
Classification Level:

Estun Bending Offline Programming Software User Manual

V1.0.0

Nanjing Estun Robotics Engineering Co., Ltd.

This document complies with ISO system requirements and will be updated according to changes in the IPD system

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Document Revision History

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1. Software Introduction and Installation

1.1 Software Overview

E-Bend Studio is a cutting-edge offline programming solution for bending robots, designed specifically for modern sheet metal manufacturing. It integrates intelligence, efficiency, and precision, revolutionizing traditional teach pendant programming by enabling complex robotic bending process planning and program generation entirely on a computer. This approach maximizes production efficiency and optimizes human resource allocation.

This software empowers enterprises to overcome production bottlenecks, minimize equipment downtime, reduce reliance on skilled programming operators, and significantly enhance processing consistency and reliability. Key features include:

- **Off-site, Efficient Programming**: Eliminates the need to occupy press brakes or robots. The entire process—from part modeling, die configuration, sequence planning, and path planning to program generation and deployment—is completed offline, enabling "non-stop" production.
- **Simulation for Safety and Reliability**: An integrated high-precision 3D simulation engine realistically replicates the entire bending process, automatically detecting potential collisions between robots, fixtures, press brakes, and dies. This proactively mitigates production risks, safeguarding equipment and personnel.
- **Intuitive 3D Interaction**: Through an intuitive 3D graphical interface and drag-and-drop operations, users only need to import workpiece drawings (e.g., DXF, IGS, STEP), define bending sequences and gripping point locations. The software automatically generates all motion points and enables point editing and management via a virtual teach pendant;
- **Process Integration, Precision Intelligence**: Leveraging an extensive built-in process knowledge base, the software automatically calculates unfolded dimensions, identifies bend angle radii, and merges fixed-link bend lines. It generates precise 3D workpiece models and automatically calculates robot poses before and after bending.
- **Open Compatibility, Seamless Integration**: Directly generates industry-standard Delem programs, supports mold imports in DLD or DXF formats, and accommodates 3D press brake model imports. Protects existing investments and effortlessly integrates into current production workflows.

This software is widely applicable for:

- Programming engineers and process engineers in sheet metal manufacturing enterprises;
- Robotic integrators and automation solution providers;
- Manufacturing plants pursuing intelligent and digital transformation.

1.2 Software Installation

Determine the version to install. For example, double-click the exe file for version 1.0.0.

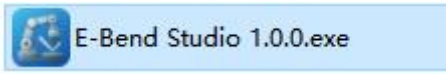


Figure1 -1 Software Installation Package

As shown in Figure 2, Installation Step 1: Select the installation path (marked as 1), then click "Next" (marked as 2) to proceed to the next step.

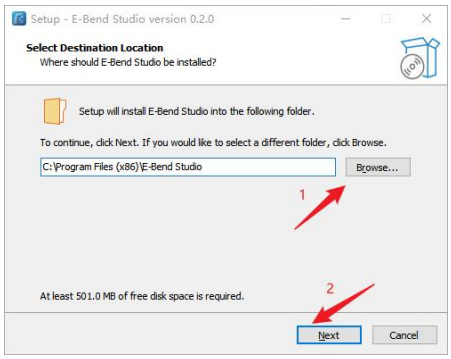


Figure 1-2 Installation Step 1

As shown in Figure 3 (Installation Step 2), check the box labeled 1 to create a desktop icon, then click the button labeled 2 "Next" to proceed to the next step.

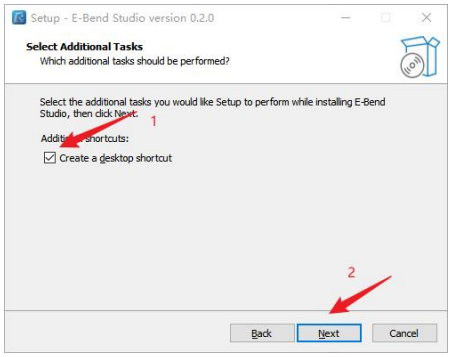


Figure 1 -3 Installation Step 2

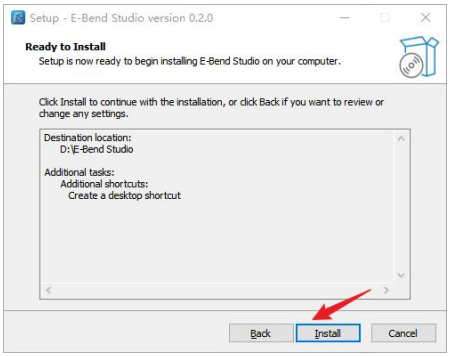


Figure 1 -4 Installation Step 3

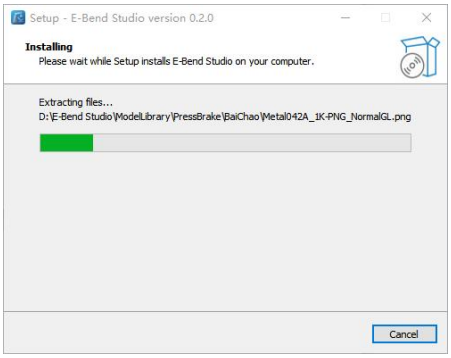


Figure 1 -5 Installation Step 4

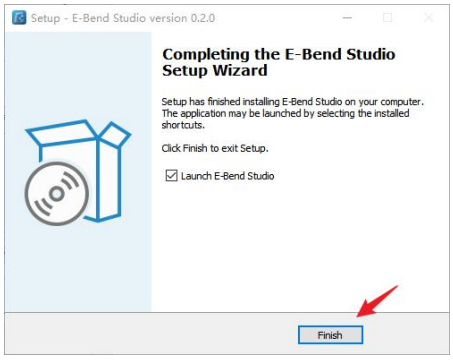


Figure 1 -6 Installation Step 5

After completing the above installation steps, the software will appear on your desktop as shown in Figure 7, indicating successful installation.



Figure 1-7 Software Icon

1.3 Software Authorization

Double-click the desktop icon. First-time users must register the software.



Figure 1-8 Software Registration Interface 1

Copy the machine code from the "Register Account" section (e.g., A683-C31B-8D29-E66D) and provide it to the administrator to obtain the software registration code.



Figure 1-9 Software Registration Interface 2

After clicking "OK," the software interface will appear if the authorization code is correct.

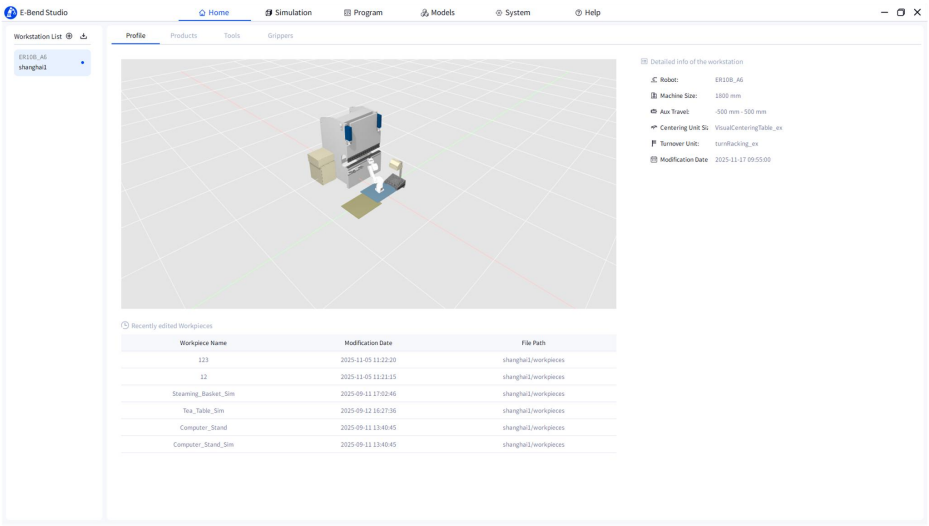


Figure 1-10 Software Homepage Interface

2. Workstation Environment Setup

2.1 Model Library

The model library currently contains 8 types of models: robots, bending machines, alignment tables, flipping racks, loading platforms, auxiliary axes, palletizers, and other types.

The model library supports creating, importing, exporting, viewing, and deleting models. Newly created and imported models are only supported in 3DS and STL formats; internally, it supports OBJ models.

Click the "Model Library" button in the function bar to switch to the Model Library page.

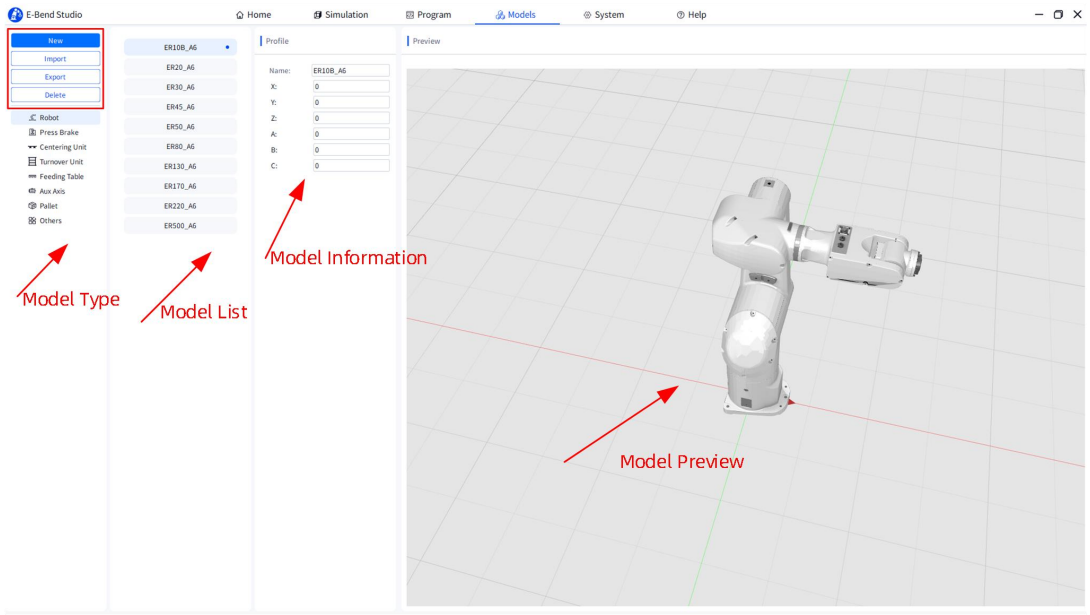


Figure 2-1 Model Library Interface

Model Viewing: As shown in Figure 2-1, after selecting a "Model Type," the "Model List" displays all models of that type (searchable by model name).Clicking a name in the "Model List" displays the model's details in the "Basic Information" area. For example, a bending machine will show its machine length and initial Y-axis position (as in Figure 11). If needed, you can directly edit and adjust the machine length and initial Y-axis value. The preview area displays the corresponding 3D model.

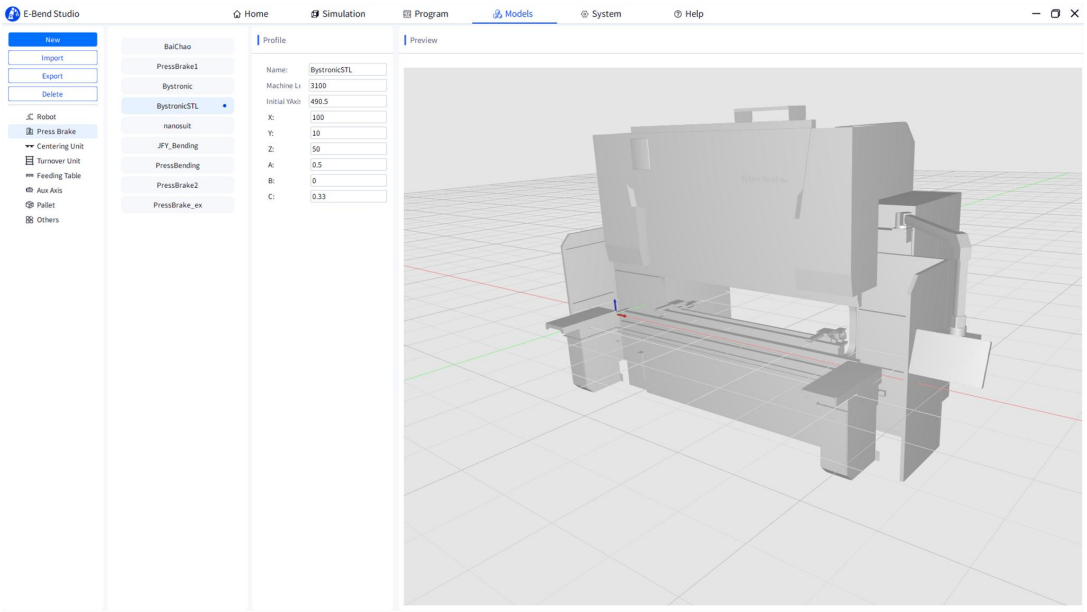


Figure 2-2 Bending Machine Model Preview Interface

Function buttons: New, Import, Export, Delete.

New (as shown in Figure 2-3): Select the model type, enter the model name, navigate to the model's path, and click "OK" to complete creation. A press brake model consists of a frame and a ram; a turret model comprises a frame and two crossbars; other model types only require adding the main body model.

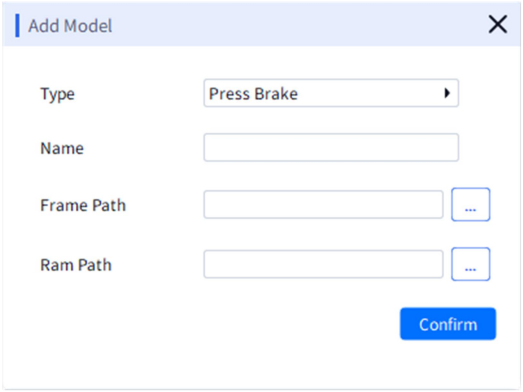


Figure 2-3 Bending Machine Model Add Interface

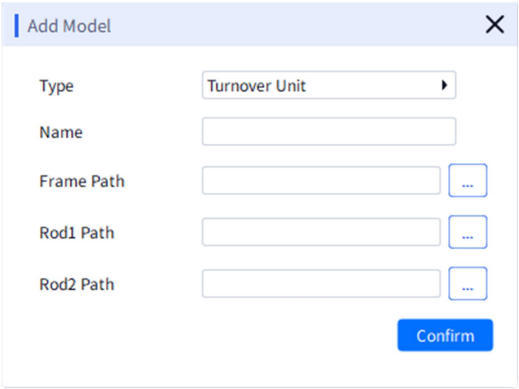


Figure 2-4: Turning Frame Model Add Interface

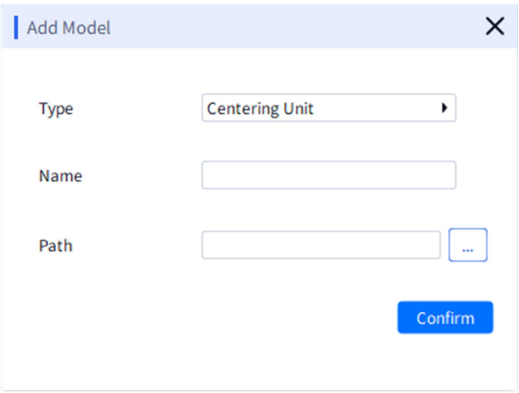


Figure 2-5: Other Model Add Interface

Import (as shown in Figure 2-6): Click the "Import" button, confirm the model type (e.g., "Bending Machine"), enter the model name, select the corresponding model folder, and click "Confirm" to complete import. (Imported model files are typically exported from E-Bend Studio or provided by professionals)

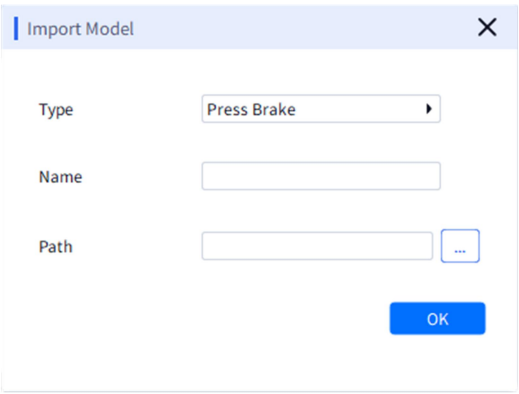


Figure 2-6 Model Import Interface

Export (as shown in Figure 2-7): Select a model from the list using the mouse, click the "Export" button, choose the export destination path, and click "OK" to complete the export.

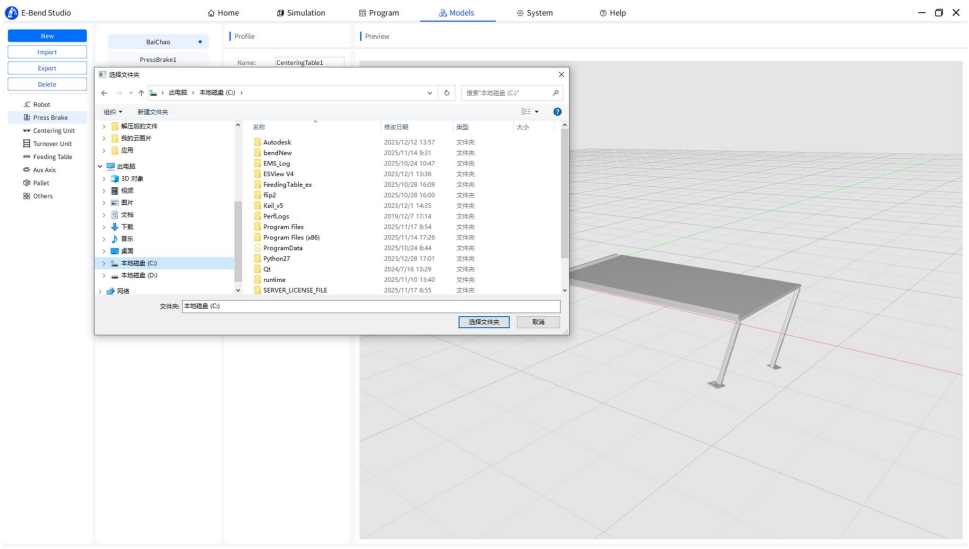


Figure 2-7: Model Export Interface

Delete: Select a model in the list, click the "Delete" button, and confirm the prompt to complete deletion.

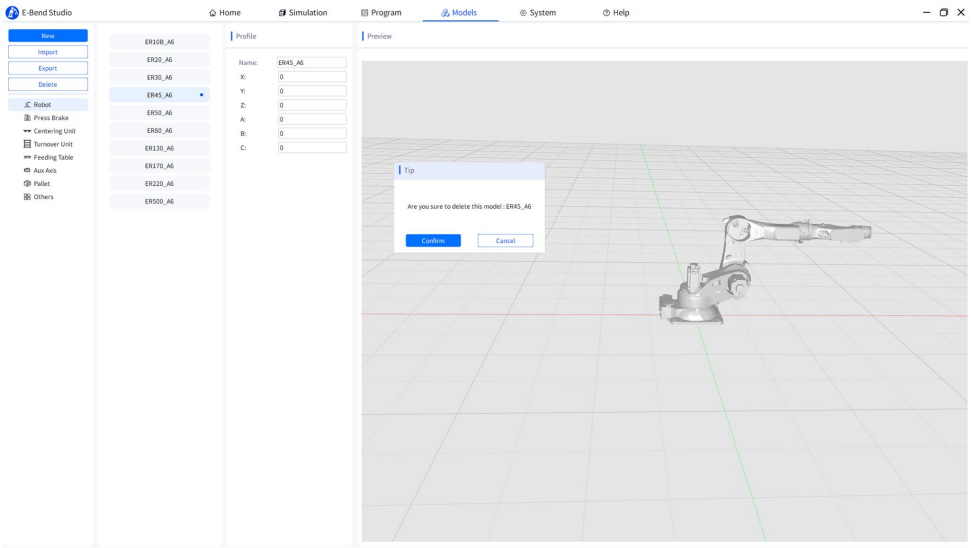


Figure 2-8 Model Deletion Interface

2.2 Creating and Editing Bending Workstations

2.2.1 Creating a Blank Bending Workstation

Click the + icon to enter the "New Workstation" interface.

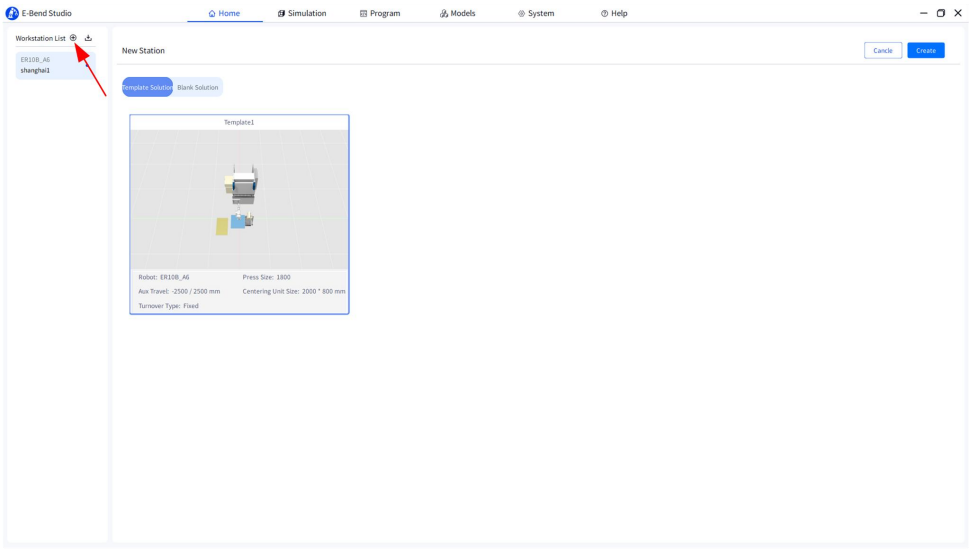


Figure 2-9 New Workstation Interface

Select "Blank Solution" to enter the blank workstation creation interface.

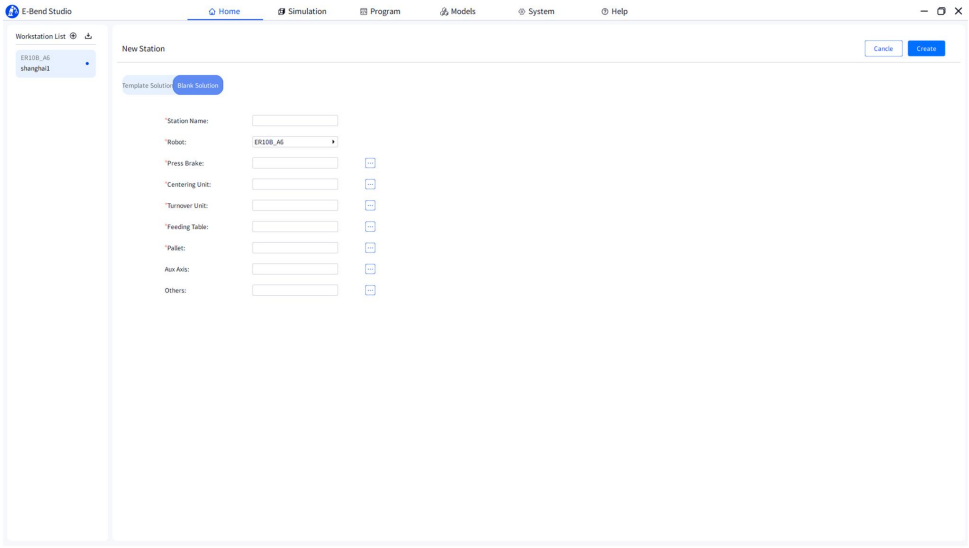


Figure 2-10 Blank Workstation Creation Interface

Fields marked with * are required. All selected models are sourced from the model library.

First, enter the name of the workstation being created;

Then, sequentially select the robot model, press brake, centering table, flipping frame, loading station, stacking area, additional axes (optional), and other (optional) models.

For robot model selection (as shown in Figure 2-11): Click the dropdown button and select the model from the dropdown list.

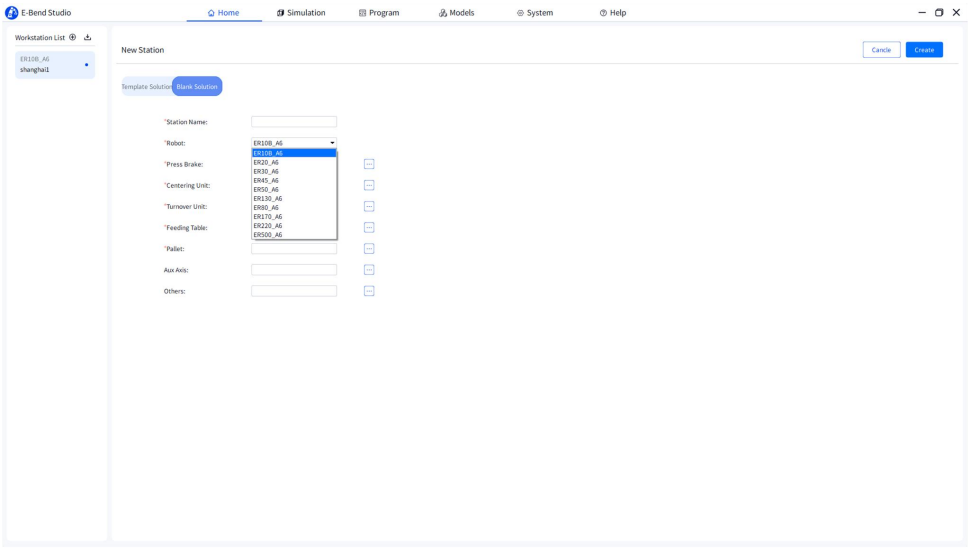


Figure 2-11 Robot Model Selection Interface

For other models like press brakes: Click the "  " button to open the "Model Selection" interface. Select any press brake model (as shown in Figure 2-11). After clicking "OK," the selected model name will automatically appear in the press brake list (as shown in Figure 2-12).

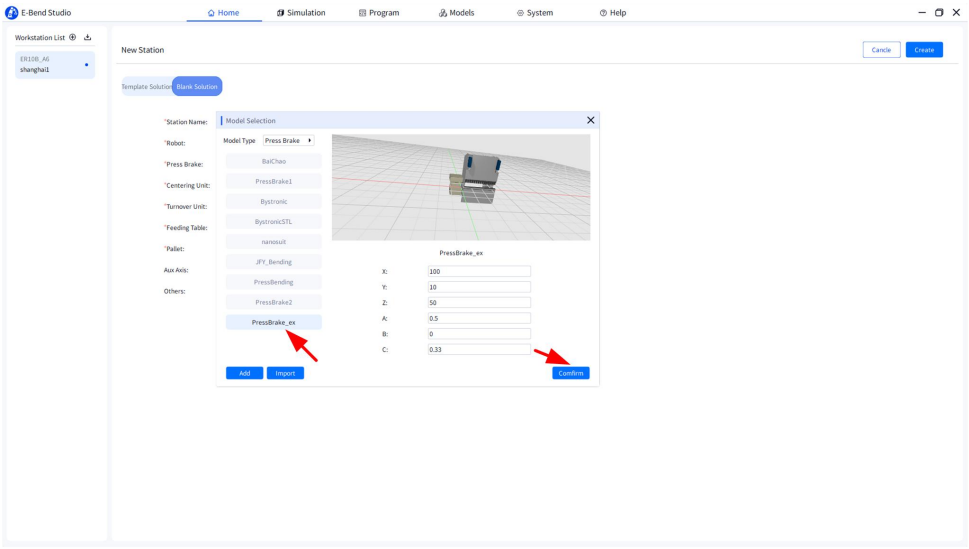


Figure 2-12 Model Selection Interface

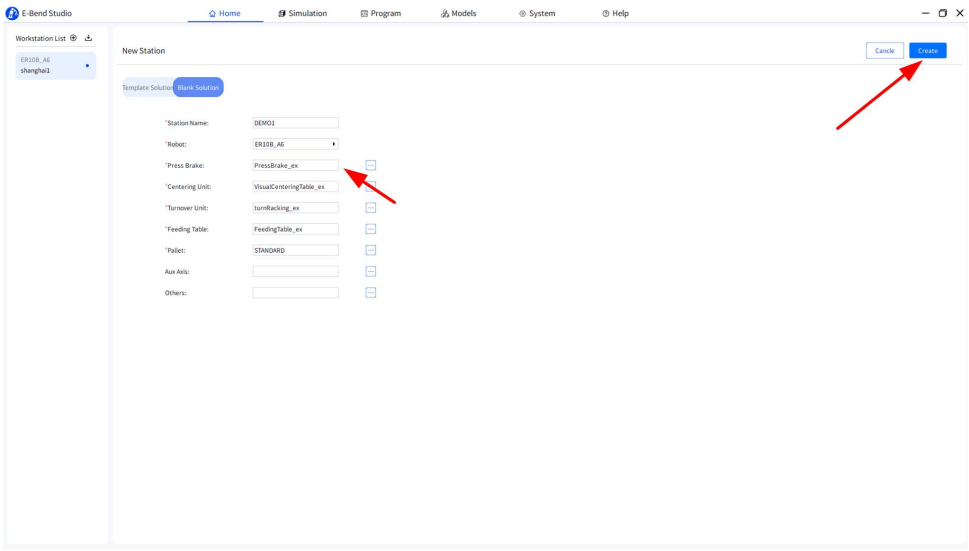


Figure 2-13 Workstation Creation Interface

After selecting all required options, click the "Create" button to enter the 3D editing interface for the workstation. At this point, the blank workstation is created (as shown in Figure 23).

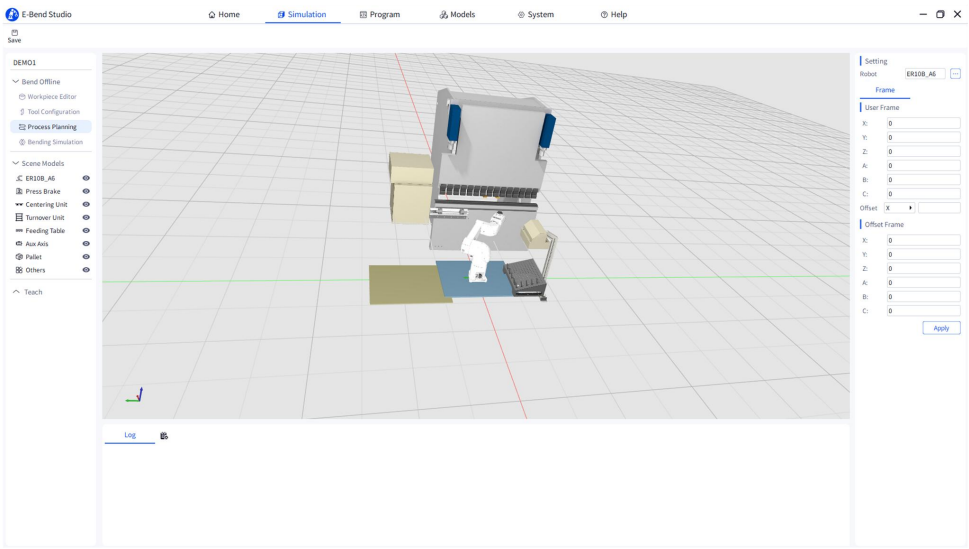


Figure 2-14 Creation Complete Interface

2.2.2 Creating a Bending Workstation Using a Template

Click the + icon to enter the "New Workstation" interface.

Select "Template Solution" to enter the template workstation selection interface (as shown in Figure 2-15).

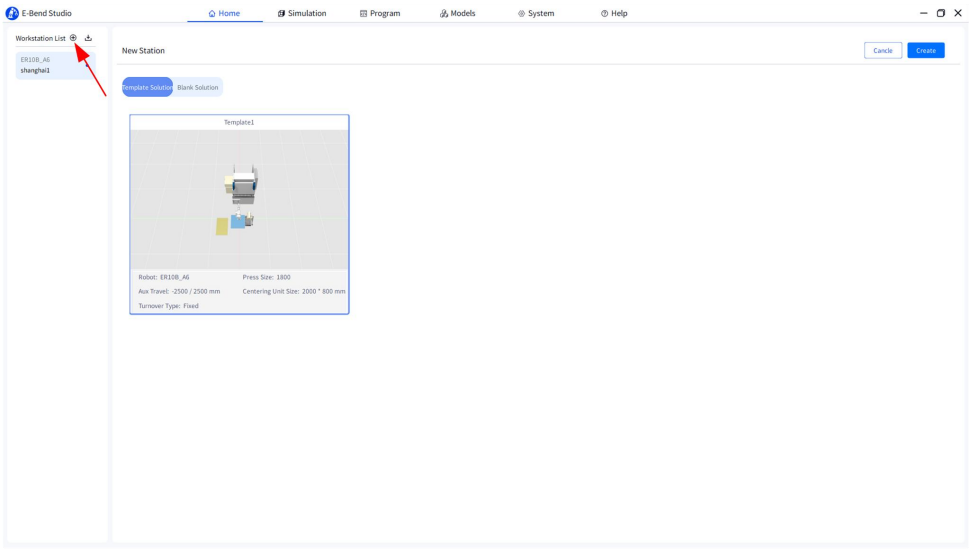


Figure 2-15 Template Workstation Interface

Select the desired workstation scenario, double-click the template to enter the 3D editing interface, and the creation via the template workstation is now complete (as shown in Figure 2-16).

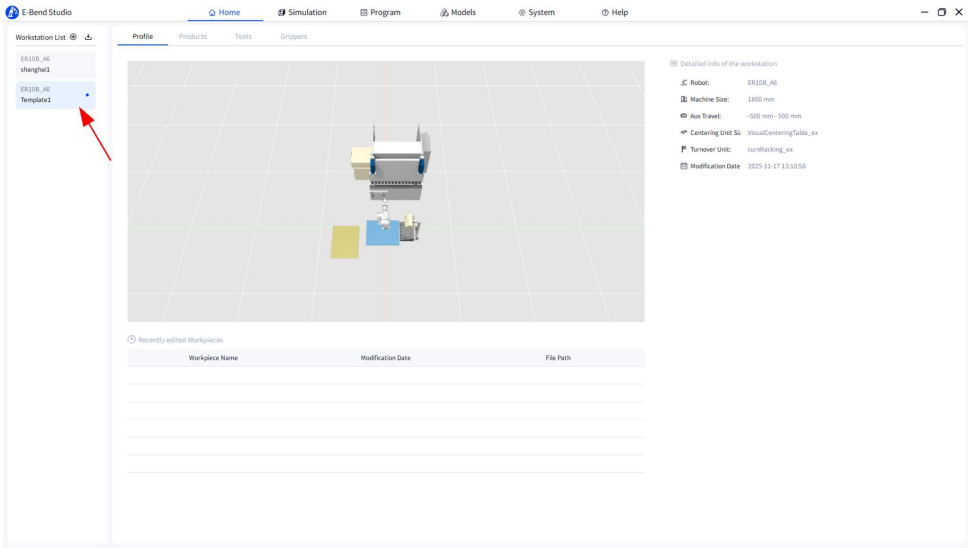


Figure 2-16 Template Workstation Creation Completion Interface

2.2.4 Workstation Scene Editing

Basic 3D Scene Operations:

View Rotation: Hover the mouse over the 3D scene interface, hold the left click to rotate up, down, left, or right;

Pan: Hover the mouse over the 3D scene interface, hold the right mouse button, and slide up, down, left, or right.

Zoom: Hover mouse over the 3D scene interface and scroll the mouse wheel forward or backward.

Model Selection: Click the desired model with the mouse. A highlighted model border indicates successful selection (as shown in Figure 2-17).

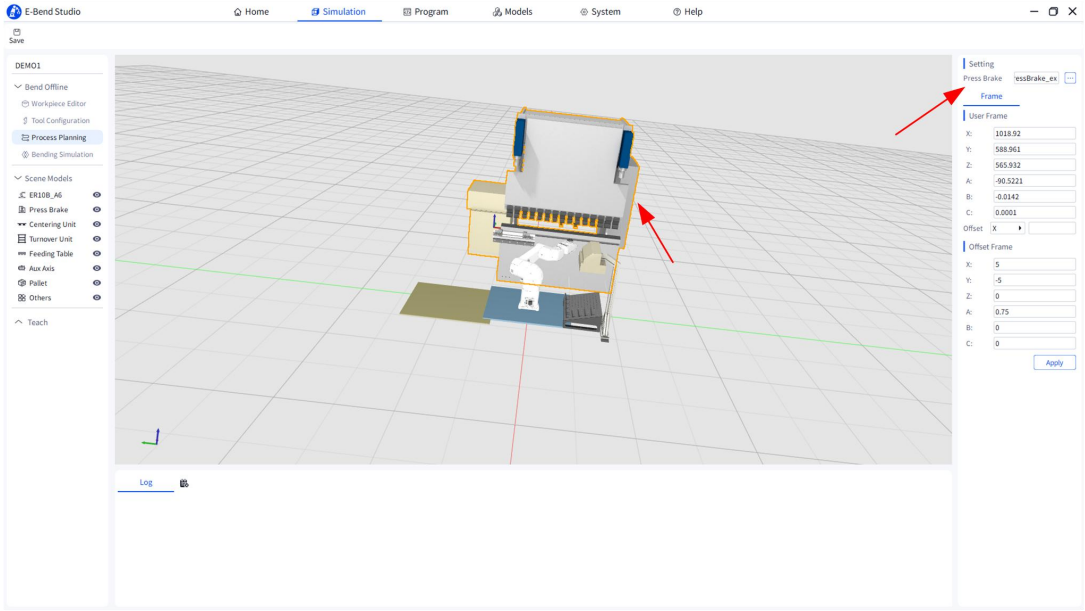


Figure 2-17 3D Scene Model Selection Interface

3D Model Operations:

Replace Model (as shown in Figure 27): Select the model type, click the " " button to enter the "Model Selection" interface

Click the model to be replaced in the list, then click the "OK" button to complete the replacement.

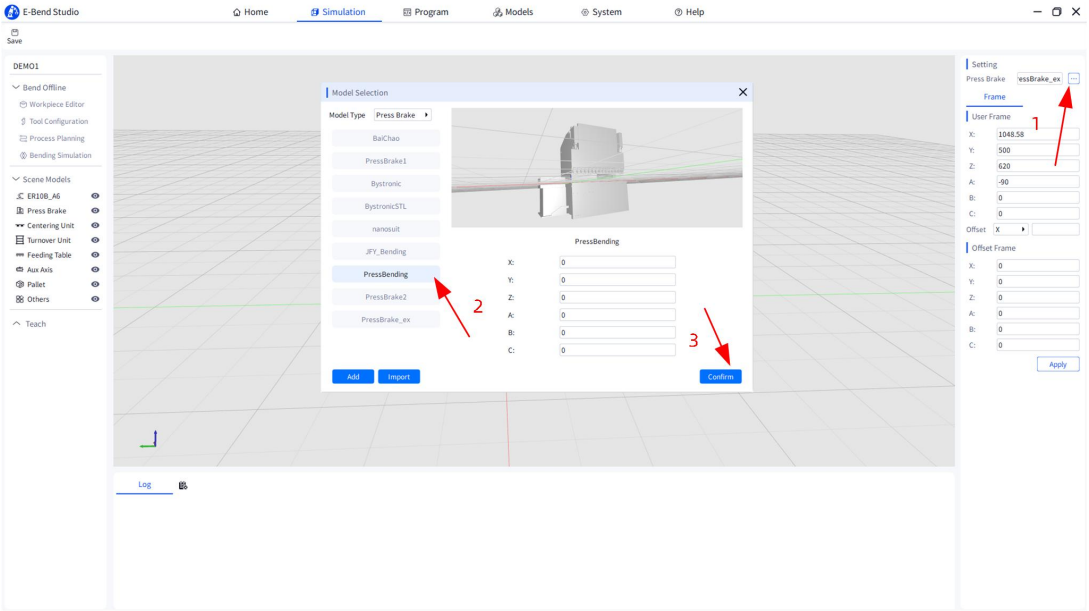


Figure 2-18 Model Replacement Steps

Update Position: Select the model, edit its user coordinate system, and click "Apply" (Enter key) to take effect (as shown in Figure 28);

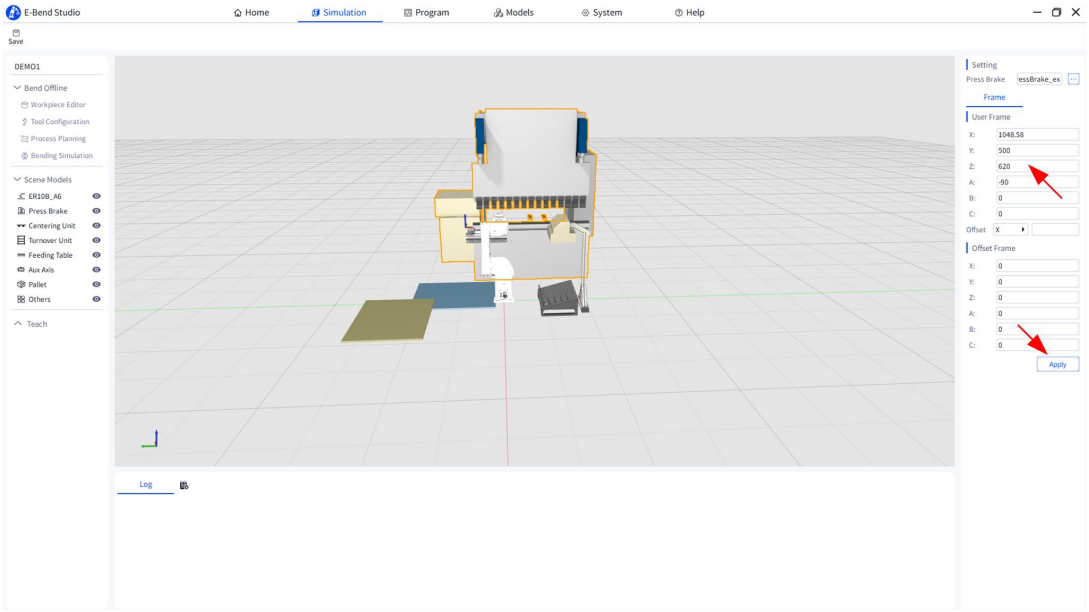


Figure 2-19 User Coordinate System Adjustment Interface

Coordinate System Offset Settings: Select the model, edit its offset coordinate system, and click "Apply" to take effect. Clicking "Undo" reverts to the previous data.

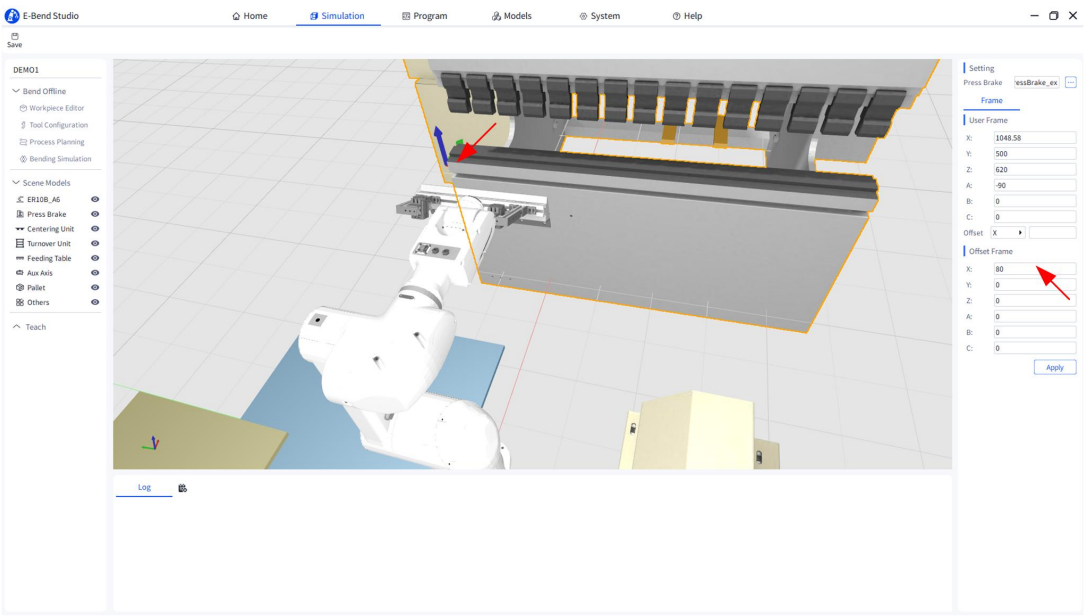


Figure 2-20 Offset Coordinate System Adjustment Interface

2.2.5 Workstation Management

Right-clicking the workstation list displays a function menu containing options to create, import, rename, copy, export, and delete workstations (as shown in Figure

30).

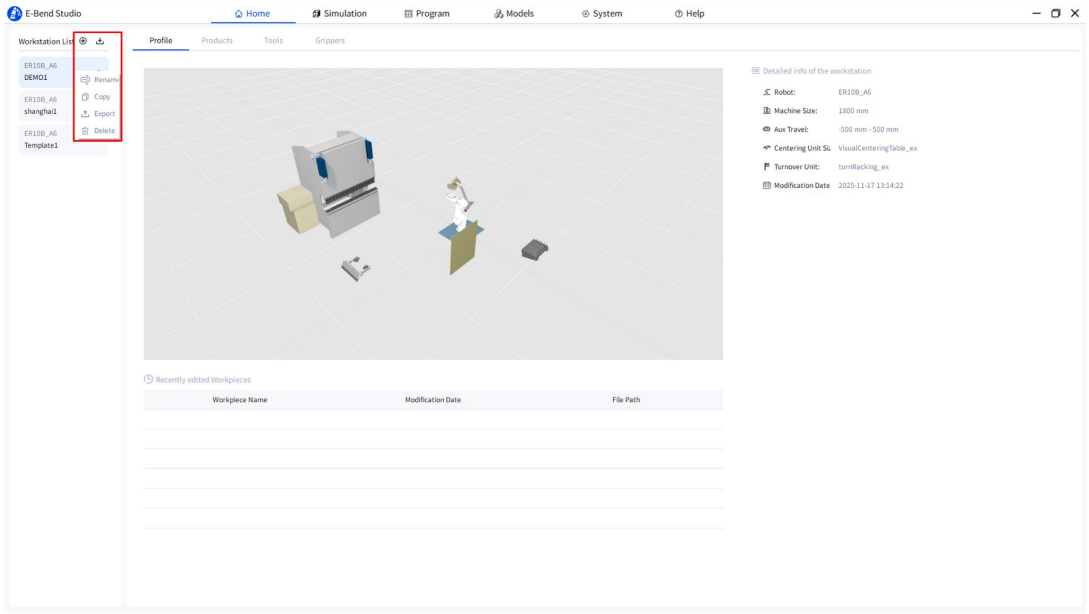


Figure 2-21 Workstation Function Interface

New: Create a new workstation. Subsequent operations follow the procedures described in sections 2.2.1 and 2.2.2.

Import: Click the "Import " button, select the workstation folder to import (workstation folders exported from E-Bend Studio can be loaded locally via import), click "Select Folder" to proceed with import; cancel to abort.

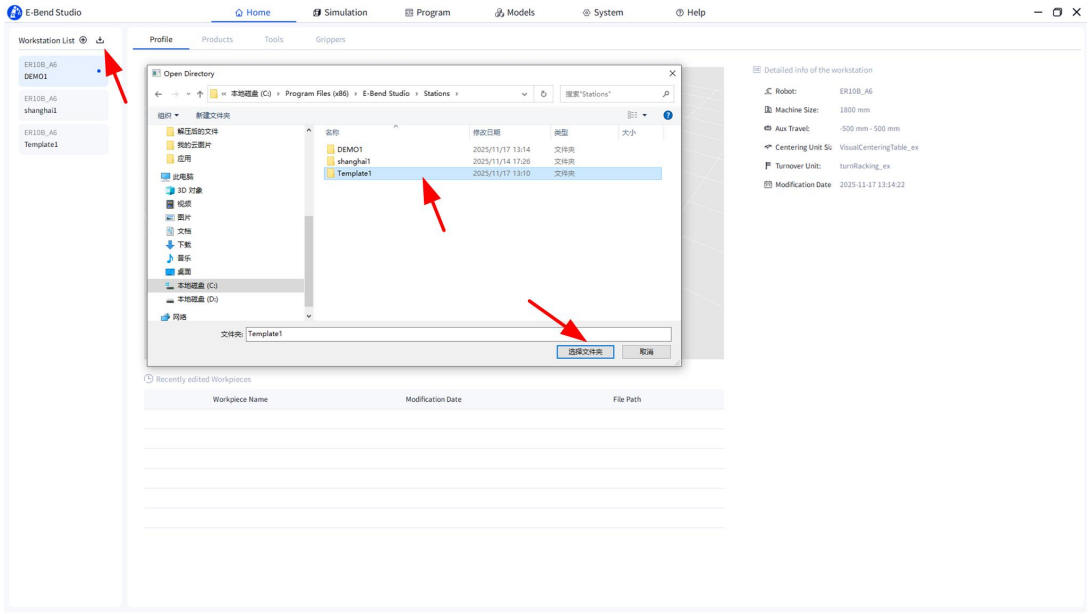


Figure 2-22 Workstation Import Interface

Renaming: Right-click the workstation to rename, enter the new name, and click "OK" to rename it. Click "Cancel" to cancel (as shown in Figure 2-23).

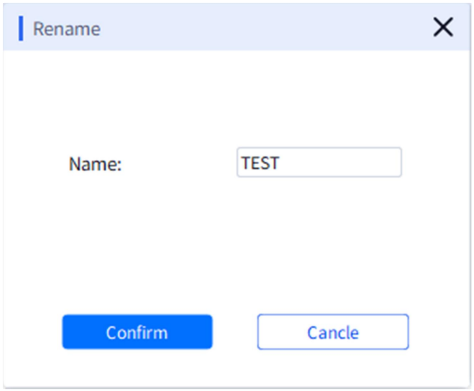


Figure 2-23 Workstation Renaming Interface

Copy: Right-click the workstation to copy, enter a new name to generate a duplicate (similar to renaming). Click "Cancel" to cancel (as shown in Figure 32).

Export: Right-click the workstation to export, select the export path, click "Select Folder" to complete the export operation. Otherwise, click "Cancel";

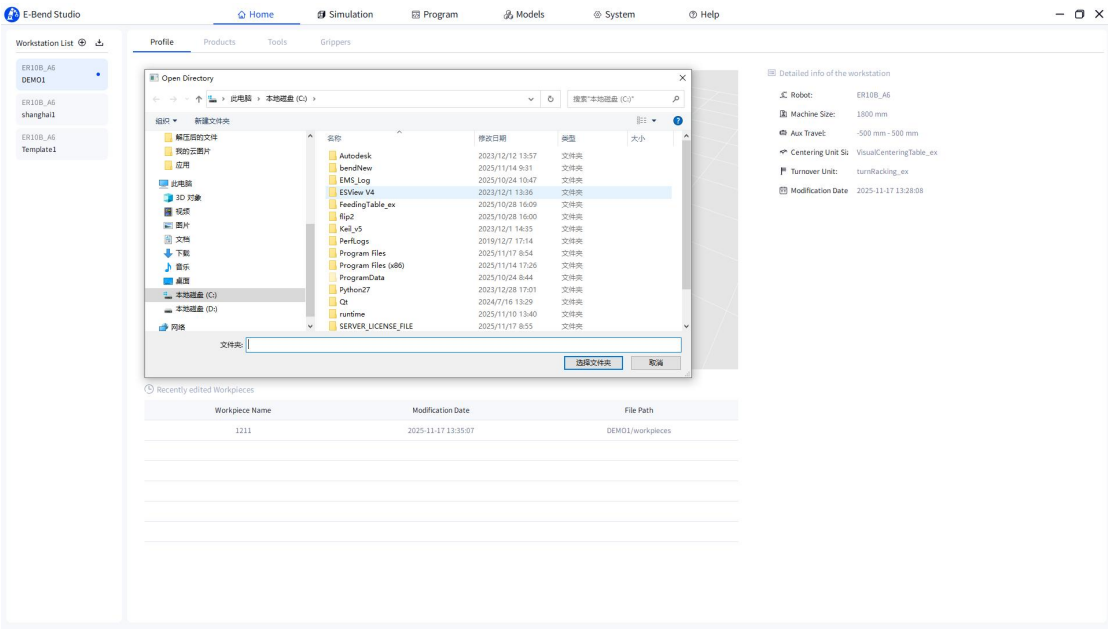


Figure 2-24 Workstation Export Interface

Delete: Right-click the workstation to be deleted. A confirmation prompt will appear. Click "OK" to delete; otherwise, click "Cancel".

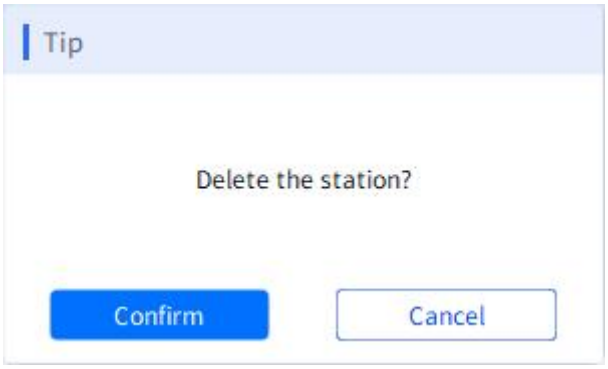


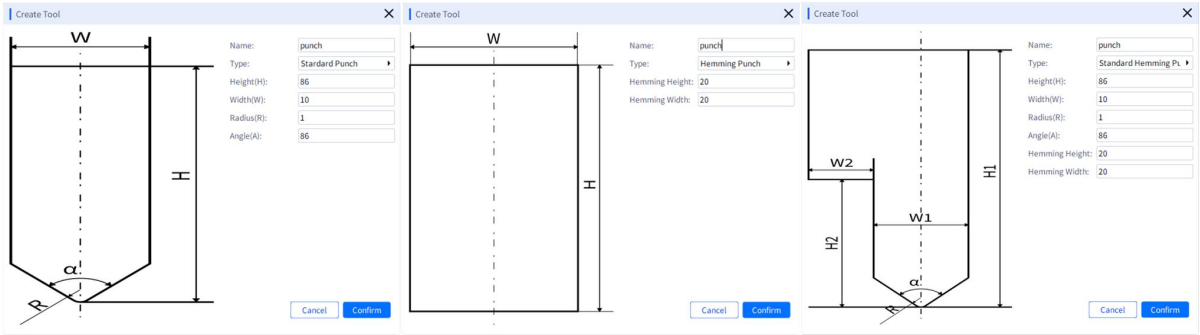
Figure 2-25 Workstation Deletion

3. Mold Library

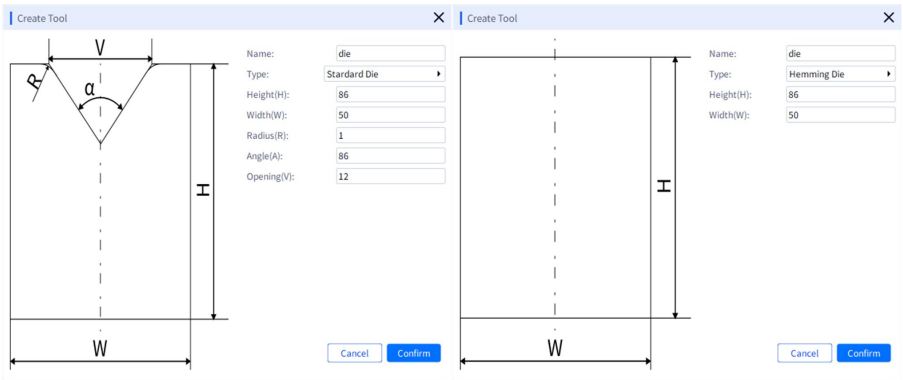
This software provides a mold library function. Users can configure upper and lower molds for different workstations, enabling unified management and visual display of molds. Through the mold library, users can conveniently perform mold drawing, importing, exporting, editing, and deletion operations, thereby enhancing the reusability and standardization of mold data.

3.1 Mold Drawing

The software supports parametric drawing of five mold types: standard upper molds, flattened upper molds, standard flattened upper molds, standard lower molds, and flattened lower molds. Users can select appropriate templates for drawing based on upper/lower mold type and application scenario in the mold preview interface.After selecting a template, users only need to input key parameters (such as height, angle, V-groove dimensions, etc.), and the system will automatically generate the basic mold outline. Specific parameters are shown in Figure 1-1.



a) Upper Die Drawing



b) Lower Die Drawing

Figure 3-1

After modifying the corresponding data, users click the "Confirm" button to enter the mold editing interface, as shown in Figure 1-2. This example uses a standard lower mold.

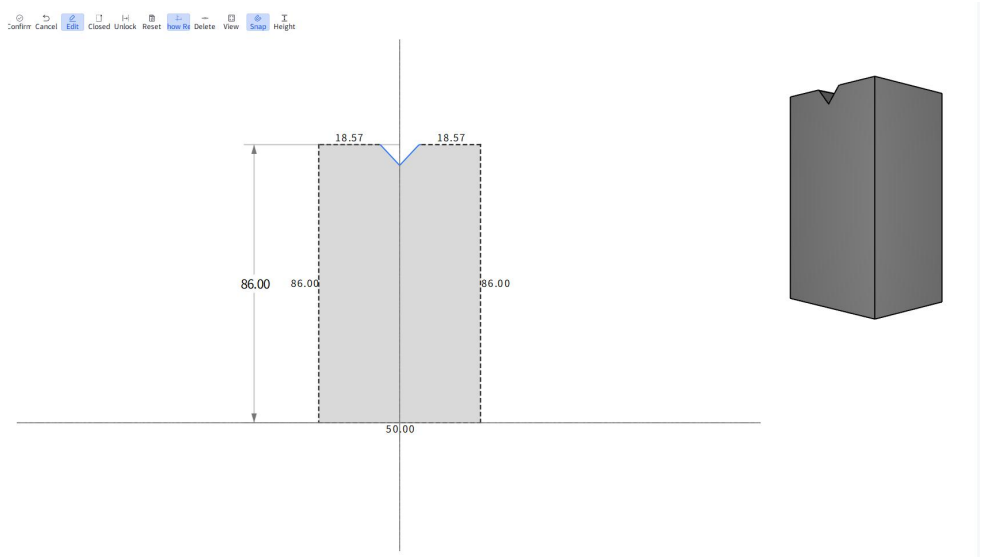


Figure 3-2

The mold is now in editing mode, allowing for secondary modifications. The left side of the page enables two-dimensional modifications to the mold, while the right side displays the current mold style in real time. The page includes the following functions:

(1) Confirm: Saves the mold displayed on the current page.

(2) Cancel: Discard changes to the currently edited mold and return to the mold list interface. If editing a new mold, cancels the new mold creation and returns to the mold list interface.

(3) Edit: Modify the mold's shape while in edit mode.

(4) Close: Convert dashed line segments to solid lines, disallowing insertion of endpoints in between.

(5) Unlock: Converts solid line segments to dashed lines. If one side of a segment has a solid endpoint, additional endpoints can be inserted beyond it.

(6) Reset: Undoes modifications, displays the initial graphic style, and centers the mold graphic in the window. Newly drawn molds revert to the style from parameter settings before entering edit mode. Edited molds revert to their pre-edit style.

(7) Show/Hide Reference Lines: When reference line mode is enabled, users can drag horizontal and vertical reference lines. Clicking an endpoint displays the distance

from the point to the reference line. Disabling reference lines hides this detailed information.

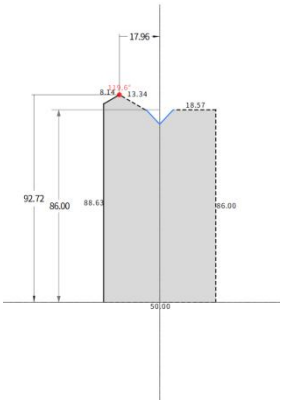


Figure 3-3

(8) Delete: Removes the selected line segment and connects the two endpoints on either side into a solid line segment.

(9) Center View: Center the mold graphic display within the window.

(10) Snap: Enable/disable snap functionality. When dragging points to the midpoint or endpoints of a line segment, the position will be highlighted and snapped into place.

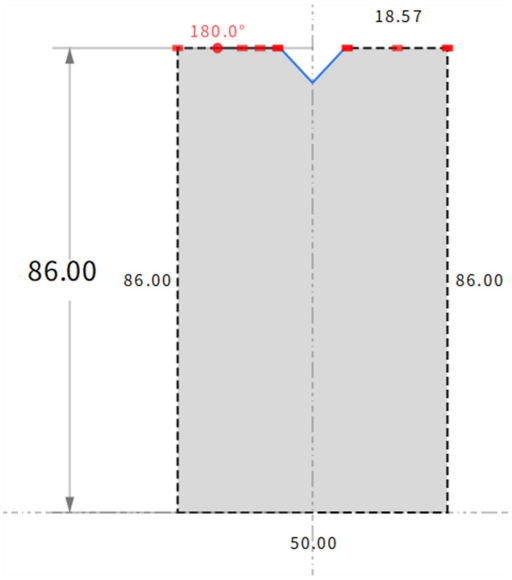


Figure 3-4

(11) Height: Set the mold's installation height. Exit edit mode, double-click the height value, and enter the desired installation height in the text box.

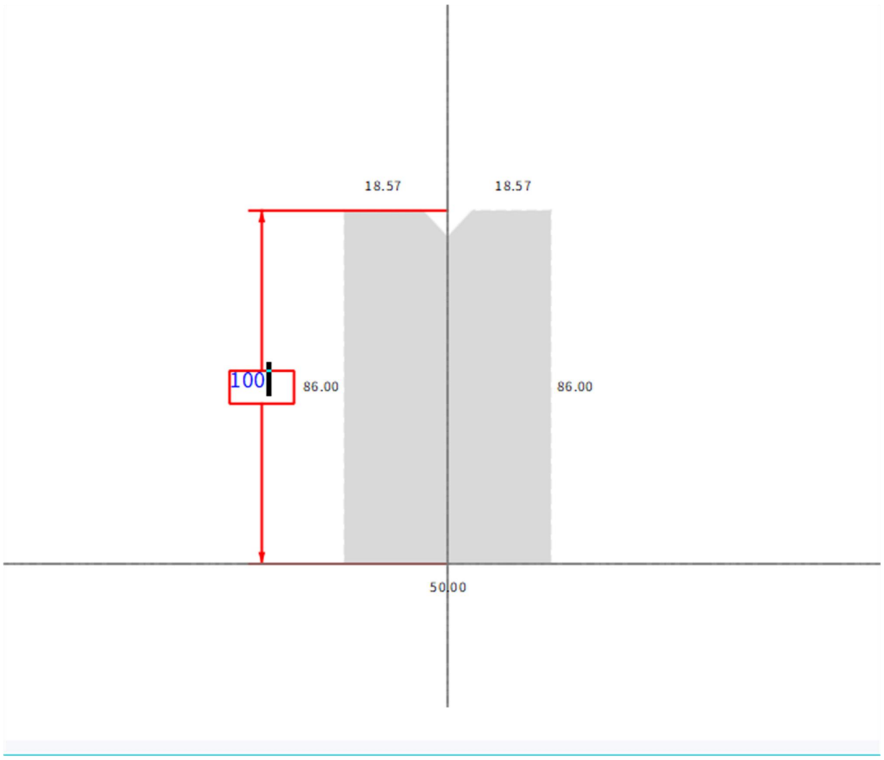


Figure 3-5 : Modifying Height

Additionally, users can click a line segment to view its length and horizontal/vertical length components in the lower-right corner, as shown in Figure 3-6.

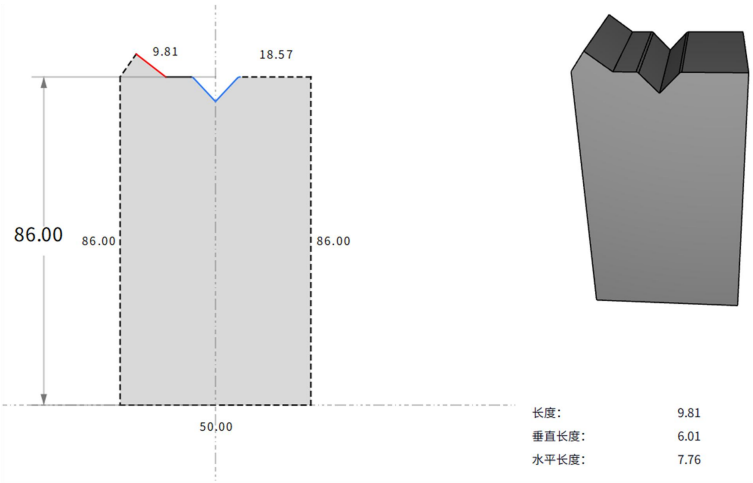


Figure 3-6 : Segment Length Display

Furthermore, if users need to modify the lower mold V-groove or upper mold cutting edge, simply double-click the corresponding blue line segment and adjust the relevant parameters in the pop-up window, as shown in Figure 3-7.

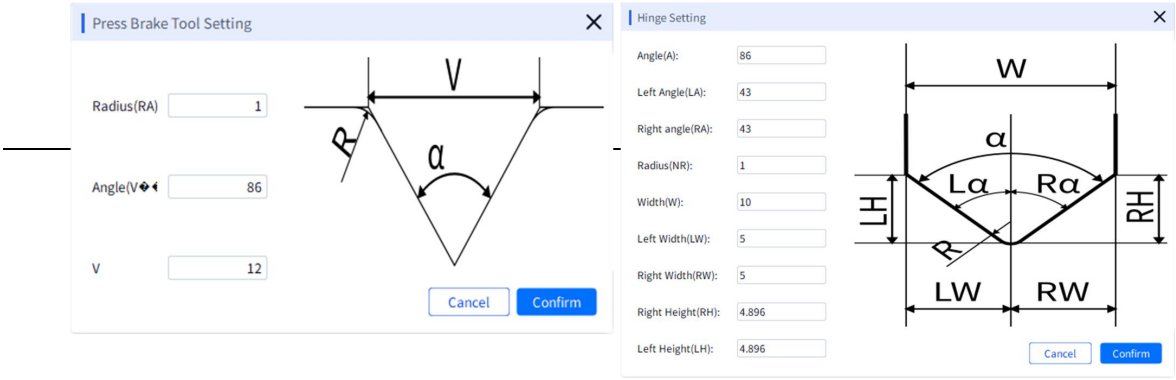


Figure 3-7 : Modifying V-groove and cutting edge values

When modifying the upper mold cutting edge, the left and right angles are equal by default. If modifying only one side, the angle value becomes the sum of both sides. The same applies to width; the heights on both sides are automatically calculated based on the width and angle.

3.2 Mold Import

To enhance mold design versatility, the software supports multiple mold import methods in addition to its parametric drawing capabilities. Beyond rapidly generating standardized molds via parameter input, the system allows direct import of existing mold data files (compatible with Estun E-series CNC mold files and Delem mold files) or loading external DXF drawings for mold modeling.

This section focuses on importing DXF drawings; file import methods are covered in the next section. First, select the mold type. If the current page displays the upper mold list, the mold is recognized as an upper mold; conversely, it is identified as a lower mold, as shown in Figure 3-8.



Figure 3-8 : Upper/Lower Mold List Selection

Next, click the Import DXF button, select the corresponding DXF file, and open it for display.

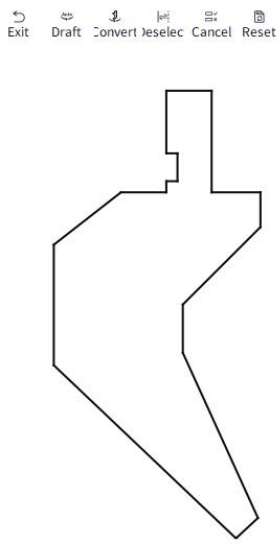


Figure 3-9 : DXF Drawing Display

Molds imported via DXF must have closed curves; otherwise, recognition may be inaccurate. The following functions assist users in identifying molds from imported DXF drawings:

(1) Exit: Aborts all editing operations, exits the imported mold, and returns to the mold list interface.

(2) Build: Automatically identifies the mold style generated from the current DXF. If recognition is difficult, it converts it to a flattened mold. Successful build proceeds to the mold editing interface, as shown in Figure 3-10.

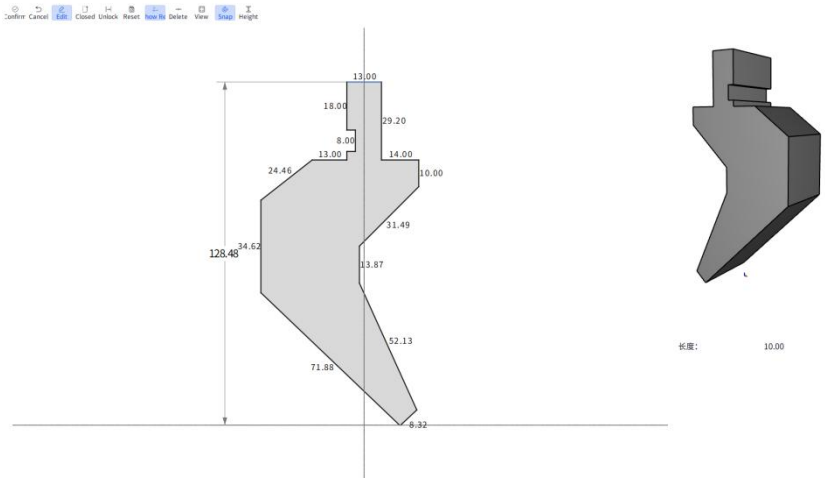


Figure 3-10

(3) Convert: Select specific line segments for conversion. Some manufacturers' DXF drawings may contain annotations or other information. Users can select segments by drawing a box around them or clicking individually. Selected segments

will be highlighted in blue, as shown. If the selected segments form a closed shape, clicking the Convert button will transform them into the corresponding mold geometry and enter the editing interface.

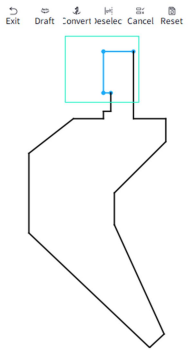


Figure 3-11 Selected Segments

(4) Invert Selection: Sets selected lines as unselected and removes blue highlighting; unselected lines become selected with blue highlighting. When interference data is minimal, users can box-select a small amount of interference data and use Invert Selection to quickly obtain the useful mold contour.

(5) Deselect: Deselects all selected lines and removes the blue highlight.

(6) Reset: Re-centers the DXF graphic display in the window.

3.3 Mold Management

To enhance mold versatility and reusability, the software provides comprehensive mold library management. Different workstations can independently configure their own mold libraries based on specific process requirements, enabling flexible management and efficient access to mold resources. The mold list is shown in Figure 3-12.

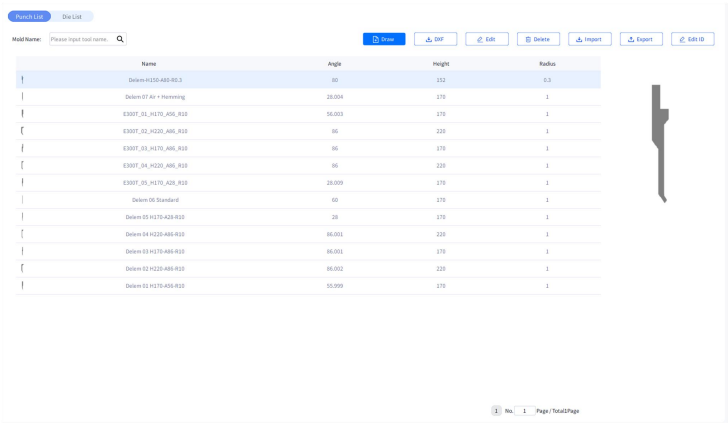


Figure 3-12

The upper section displays the mold list without the upper mold. The right side shows a preview of the currently selected mold, displaying its name, cutting edge angle, mold height, and cutting edge radius. The lower mold section displays parameters for the V-notch, notch angle, mold height, and V-notch radius.

The following functions are available for mold management:

(1) Search: Searches for corresponding upper or lower molds containing the input text and displays them in the mold list, as shown below.

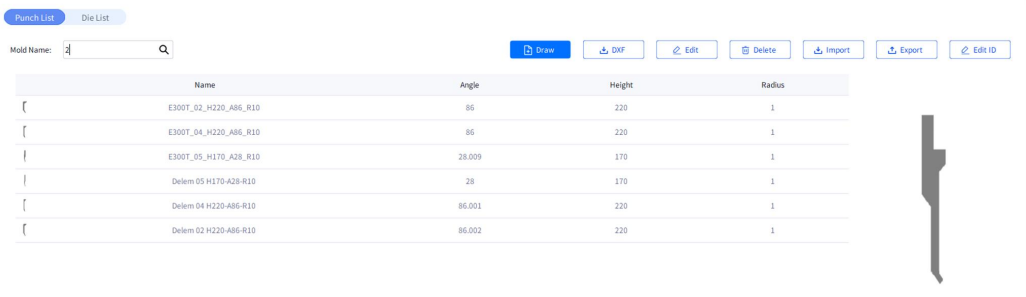


Figure 3-13 : Searching for upper molds containing "2"

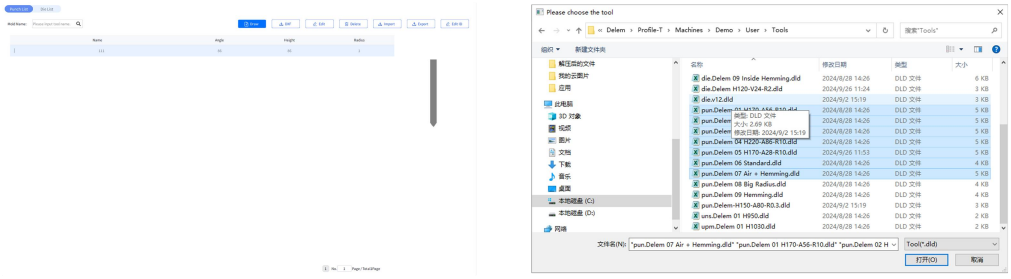
(2) Drawing: The drawing function is detailed in the "Die Drawing" section.

(3) Import DXF: This function is also detailed in the "Mold Import" section.

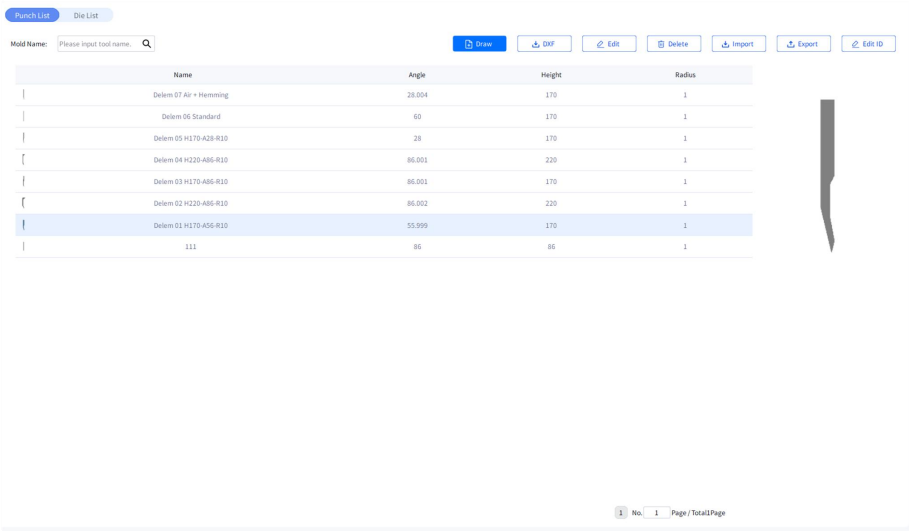
(4) Edit: Select a single mold. If multiple molds are selected, the first mold in the list is considered selected. Click the Edit button (or double-click the corresponding mold in the mold list) to enter the mold editing interface. Make modifications; specific operations are detailed in the "Mold Drawing" section.

(5) Delete: Deletes the selected mold. Multiple molds can be selected and deleted simultaneously.

(6) Import: Select the mold file path to import corresponding molds. Supports importing multiple files simultaneously, as shown in Figure 3-14.



a) Before import: **b) Select import file**



c) Selection complete

Figure 3-14 Importing Molds

Note: Upper molds must be imported on the upper mold page, and lower molds must be imported on the lower mold page.

(7) Export: Exports the selected mold file to a specified path. The implementation is equivalent to mold import.

(8) Edit ID: Modify the lower mold ID to correspond with the 15 mold sets in the teach pendant, enabling the generated program to be immediately usable. As shown below:

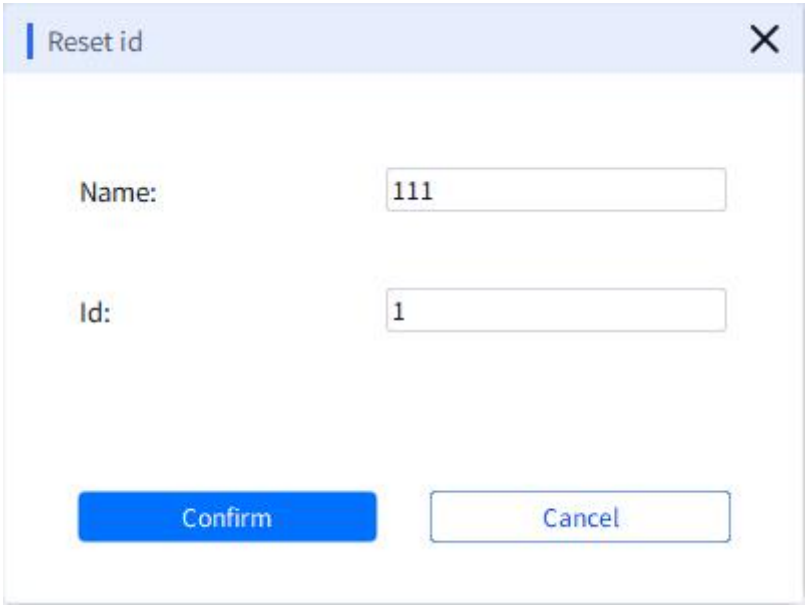


Figure 3-15 Lower Mold ID Edit

4. Robot Fixture Library

The software provides a fixture library for each workstation. Select a workstation and click the gripper list to view all fixture models and their configuration parameters.

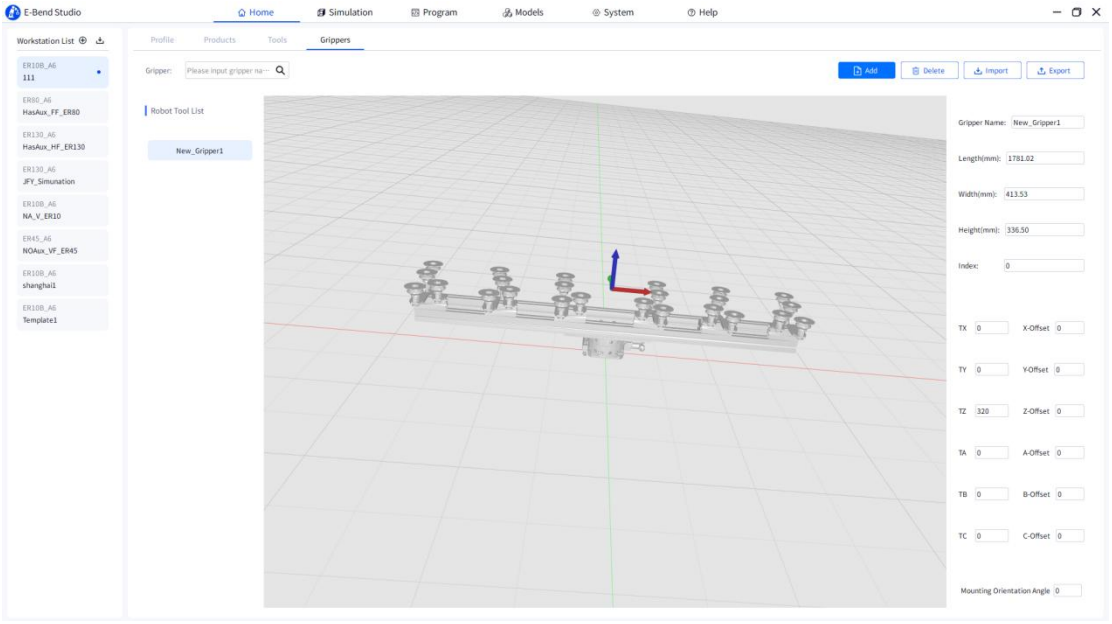


Figure 4-1 Robot Fixture Library Page

4.1 Fixture Library Management

4.1.1 Create New Gripper: To add a new gripper to the library, specify a model file (e.g., STL). Newly added grippers require configuration of parameters such as tool coordinate system and indexing. Length, width, and height are automatically recognized by the system.

Click the "Add" button in the upper-right corner. In the pop-up dialog, select the corresponding model file and click "Open" to add the gripper to the system. Newly added grippers are named with "NewGripper" as the prefix by default.

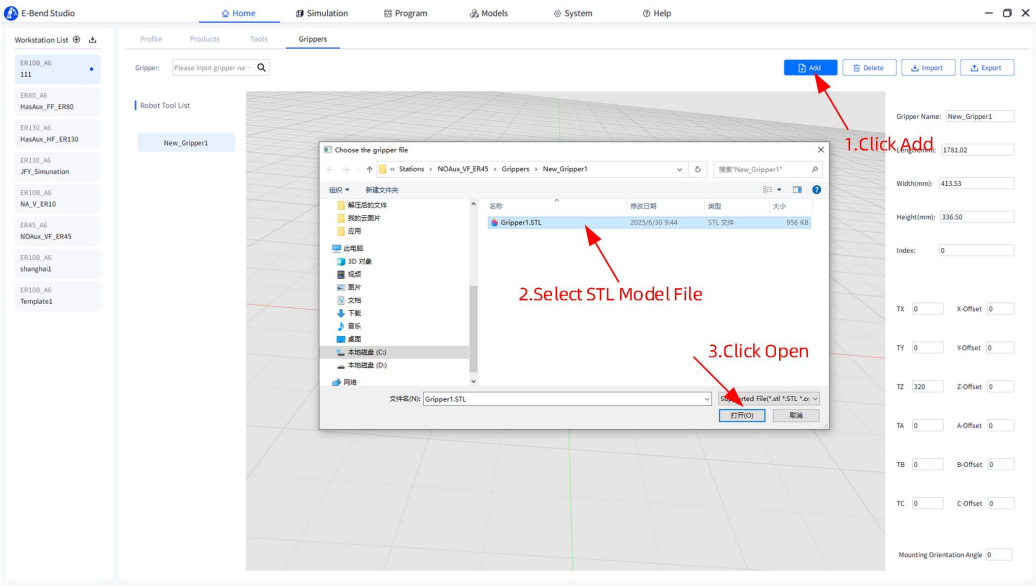


Figure 4-2 Adding a New Gripper from a 3D Model

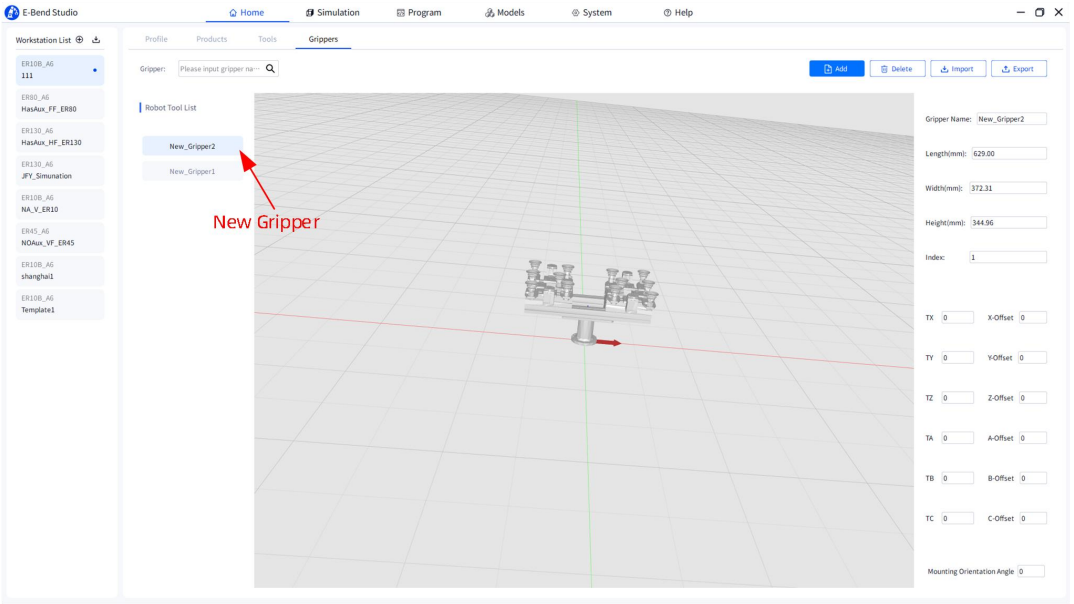


Figure 4-3: New Gripper Added from 3D Model

4.1.2 Exporting Grippers: Package the gripper model and its configuration file into a folder for export to a specified path. This allows importing into another E-Bend Studio system. The exported gripper includes configuration parameters such as the tool coordinate system. Click the "Export" button in the upper-right corner, select the export path, and click "Select Folder" to export the gripper folder to the specified location.

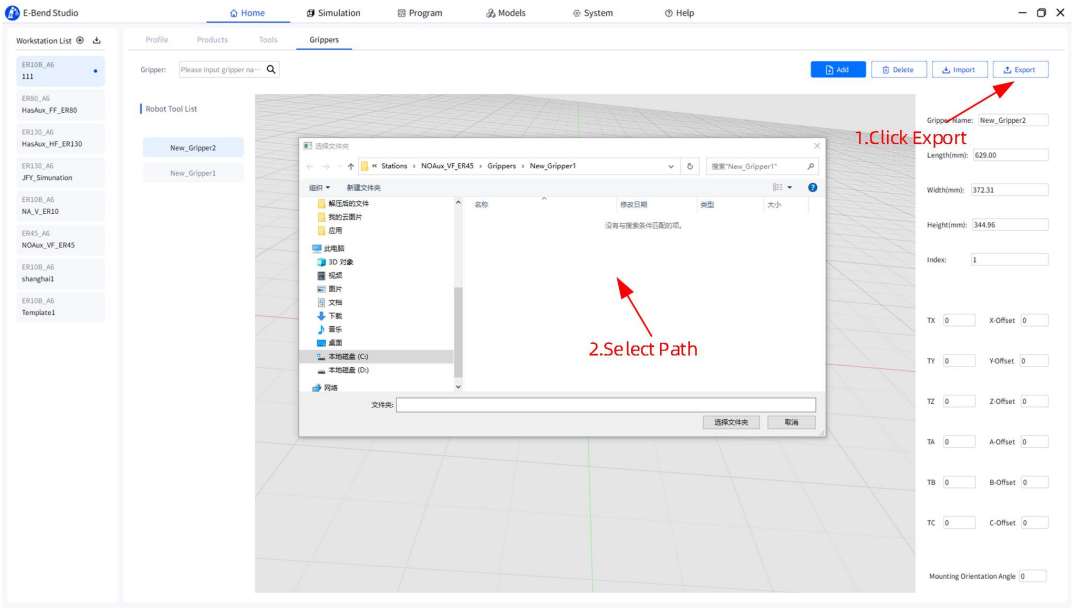


Figure 4-4 Exporting Fixtures

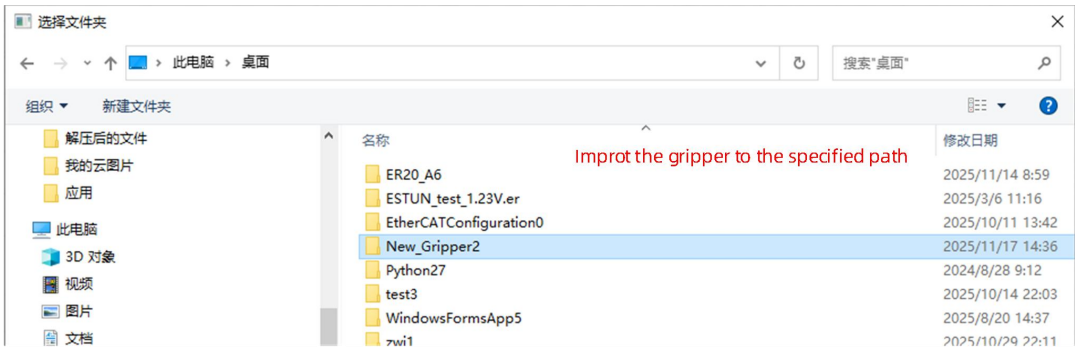


Figure 4-5 Fixture Exported to Specified Mold

4.1.3 Import Fixture: Import the fixture folder into the local fixture library. Newly added fixtures include parameters like the tool coordinate system and do not require re-specifying. Click the "Import" button in the upper-right corner, select the corresponding folder in the pop-up dialog box, and click "Open" to import the fixture into the system.

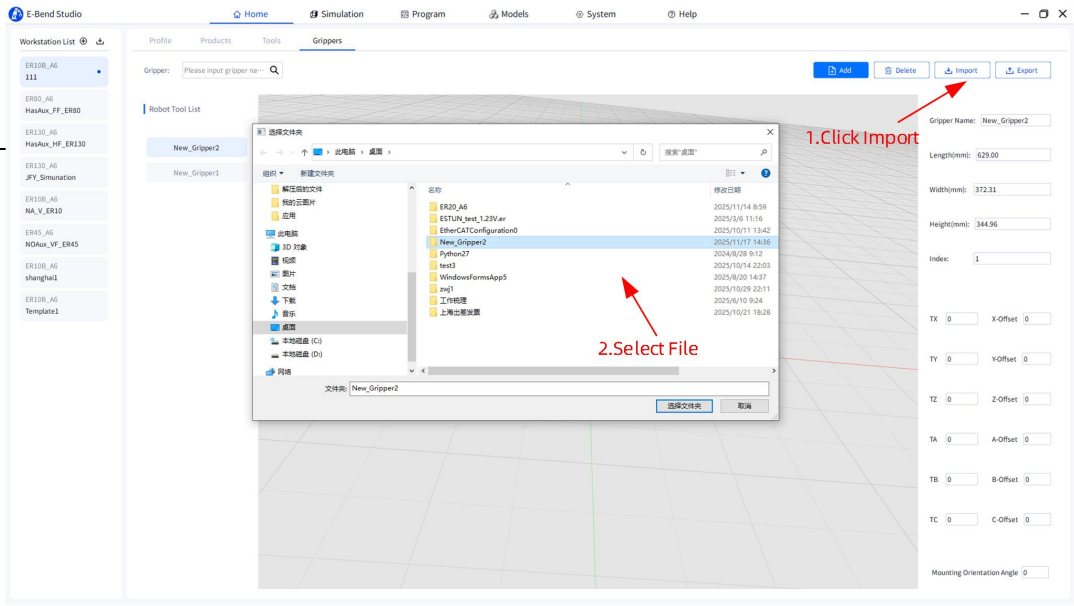


Figure 4-6 Importing Fixtures from Fixture Folder

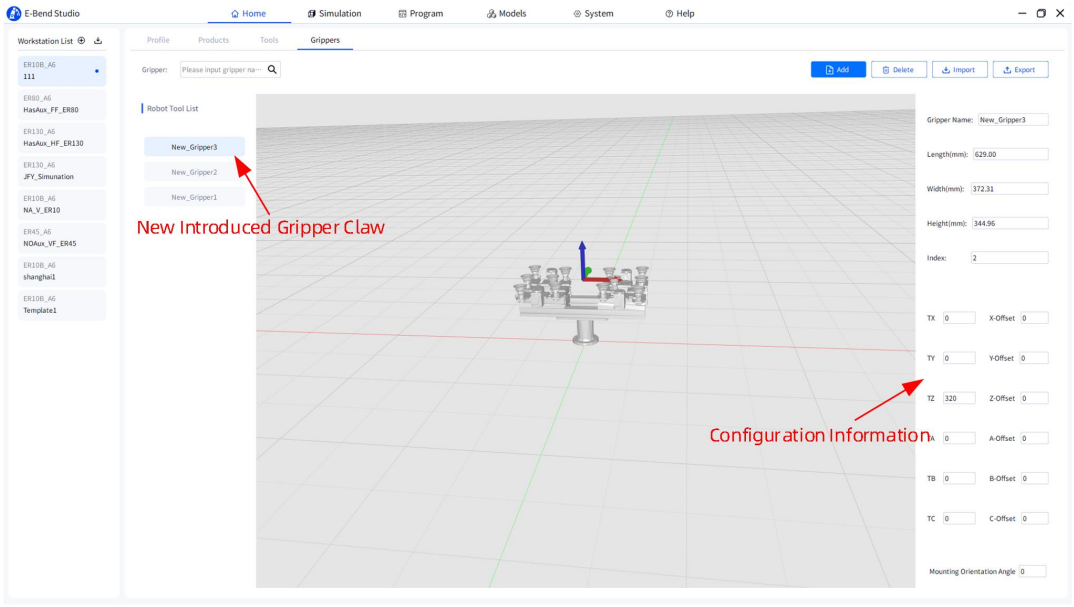


Figure 4-7 Fixture import completed

4.1.4 Delete Fixture: Remove the fixture from the fixture library of this workstation.

4.2 Fixture Parameters

4.2.1 Fixture Name: The fixture name can be directly modified in the edit box. Its name must not duplicate any existing fixtures in the current fixture library.

4.2.2 Fixture Dimensions: Fixture dimensions are automatically recognized by the system through analysis of the 3D model and do not require modification. Comparing fixture dimensions with workpiece dimensions facilitates selection of the appropriate fixture.

4.2.3 Fixture Index: Can be directly modified in the edit box. The fixture index must match the index in the robot controller.

4.2.4 Tool Coordinate System: The left TX~TC represents the suction cup's tool coordinate system. Since fixtures may carry both suction cups and clamps, the right TX~TC denotes the offset coordinate system of the clamp relative to the suction cup. This can be directly modified in the edit box, and the coordinate system indicator pose in the 3D scene will update synchronously after modification.

4.2.5 Mounting Rotation Angle: The actual mounting angle of the fixture, which requires physical measurement. This can be modified directly in the edit box.

5. Offline Programming

The offline programming module is the core functionality of the software system, providing users with a complete programming workflow from workpiece loading/importing, mold configuration, and bend position selection to bend simulation verification. Users can complete process planning and program generation in a virtual environment, ultimately outputting directly executable robot programs. This feature effectively achieves digital continuity from design to production, significantly enhancing programming efficiency and production safety.

5.1 Project Management

The Engineering Management module serves as the starting point for the offline programming workflow, primarily used to establish, maintain, and organize bending project data. Through this module, users can conveniently create new projects, manage existing project files, and perform import/export operations for project data, laying the foundation for subsequent workpiece editing, die configuration, and bending simulation. Its interface is shown in Figure 5-1.

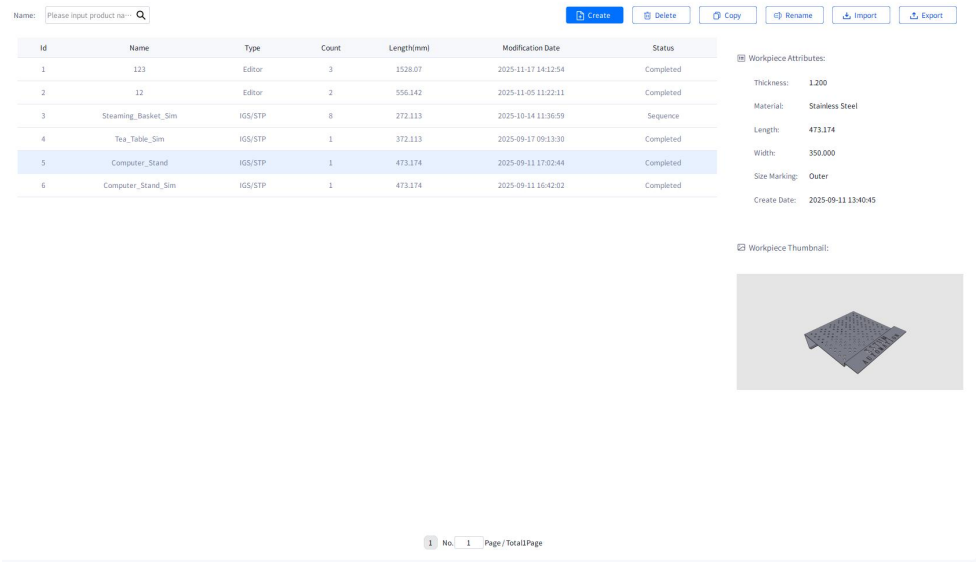


Figure 5-1

Workpieces displayed in the interface are sorted in descending order by modification date, with the most recently modified workpieces appearing first. Other key parameters shown include: number of operations, workpiece length, modification date, and completion status. The preview area on the right displays basic workpiece information and a preview image of the workpiece.

Project Management primarily provides the following functions:

(1) Search: Searches for all workpieces containing the keyword, as shown in Figure 5-2.

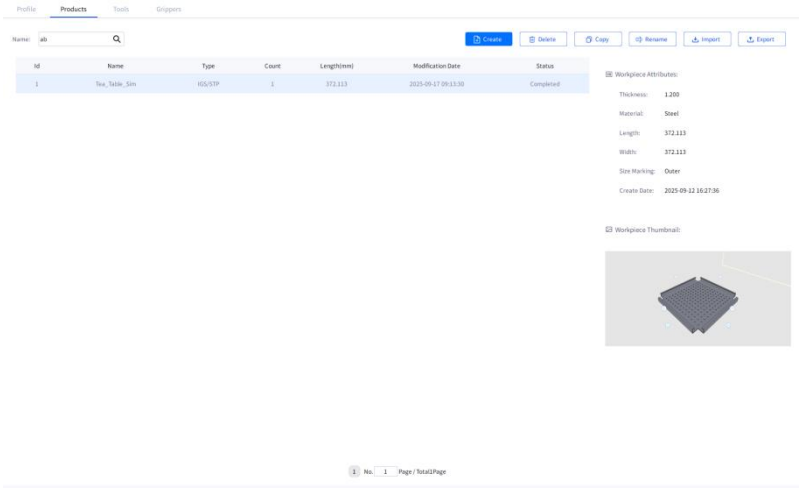


Figure 5-2 : Searching for workpieces containing "ab"

(2) New: Create a new workpiece by importing DXF, IGS, or STP files, or by drawing a new workpiece. This is not detailed here and will be covered in the next section.

(3) Delete: Remove selected workpieces, supporting batch deletion.

(4) Copy: Duplicate the currently selected unique part. The copied part name will have the suffix "_1" appended. If this naming already exists, the suffix number will increment sequentially.

(5) Rename: Modify the name of the currently selected unique workpiece. Click the Rename button to edit the workpiece name, as shown in Figure 5-3.

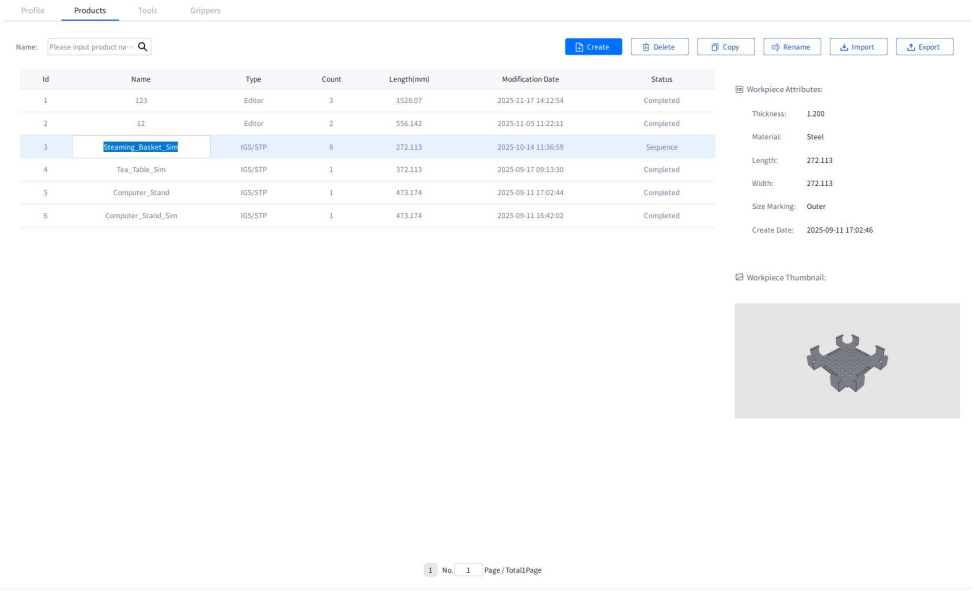


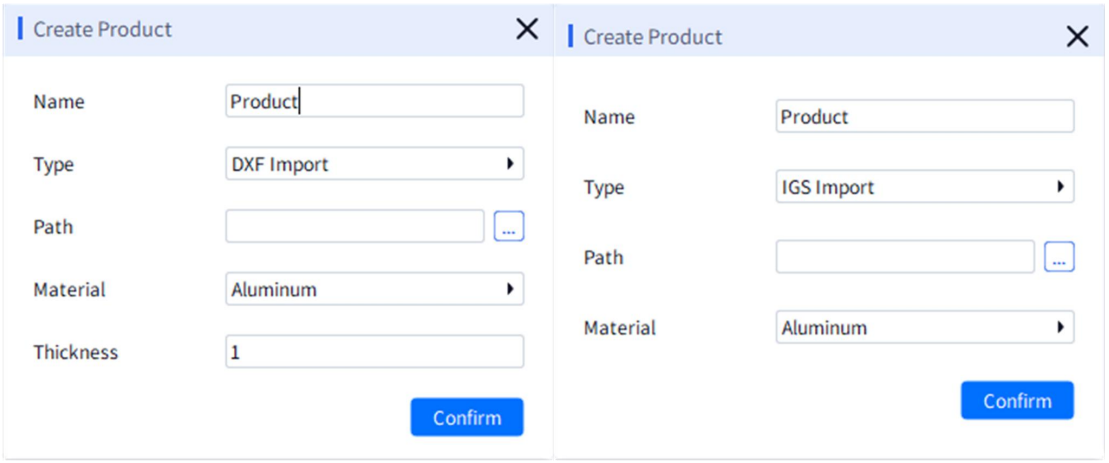
Figure 5-3

(6) Import: Select the workpiece file path and import the corresponding workpiece into the current workstation. Batch importing is supported, but workpieces with names identical to existing ones will not be imported.

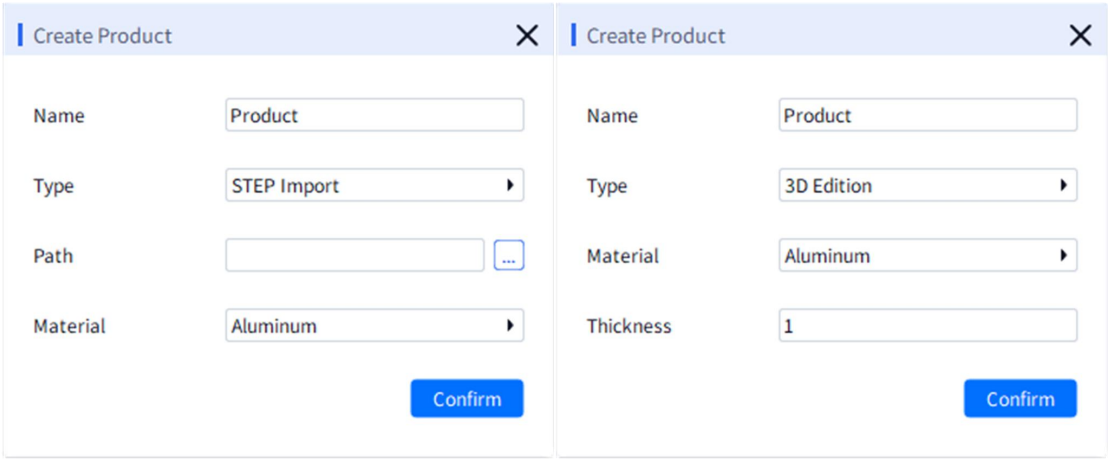
(7) Export: Output workpiece files to a specified directory. Batch export is supported.

5.2 Workpiece Creation, Editing, and Loading

There are four methods for creating workpieces: drawing 3D workpieces, importing DXF, importing STP, and importing IGS, as shown in Figure 5-4.



a) DXF Import **b) IGS Import**



c) STP Import **d) 3D Editing**

Figure 5-4 : Workpiece Creation Methods

For DXF, IGS, and STP imports, the corresponding file path must be specified, and the file extension must be verified for compliance with specifications. Only compliant files can be recognized. When creating a new workpiece, the material must be selected; the default material is aluminum plate. For DXF imports and 3D editing, the workpiece thickness can be preset, with the default thickness being 1.

After selecting all parameters, click the OK button to enter the workpiece editing interface.

5.2.1 3D Editing

When creating a workpiece using 3D editing, a 500×500 (mm) substrate is first generated. Users configure the workpiece based on this substrate.

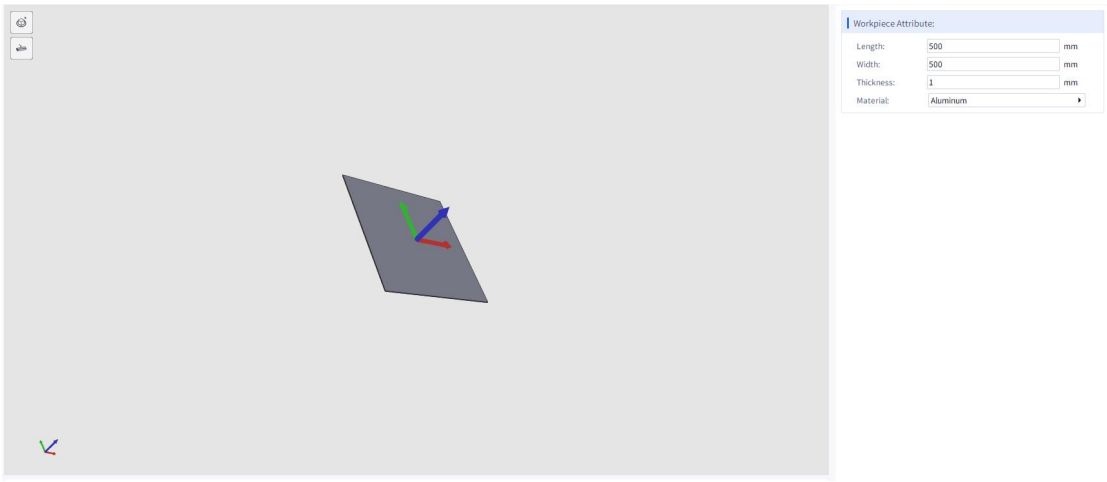


Figure 5-5

Further configuration of the workpiece can now be performed:

(1) Modify the substrate: Select the substrate to modify its length, width, and thickness, as shown in Figure 5-6.

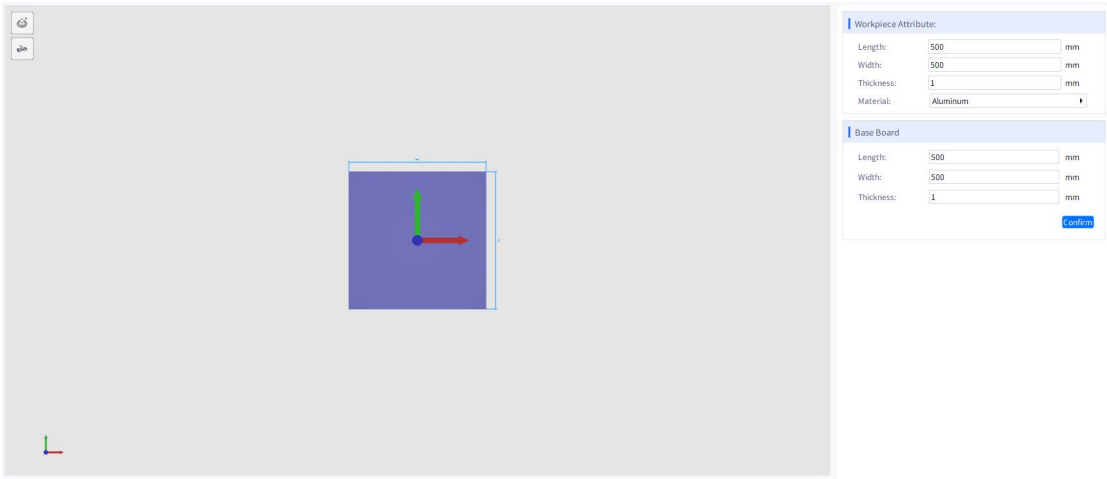


Figure 5-6 : Modifying the Base Plate

If external bend blocks have been added, they will adjust in tandem with the substrate.

(2) Add bend lines: Click the side edge of the plate to add a bend line (which simultaneously creates a bend block), as shown in Figure 5-7.

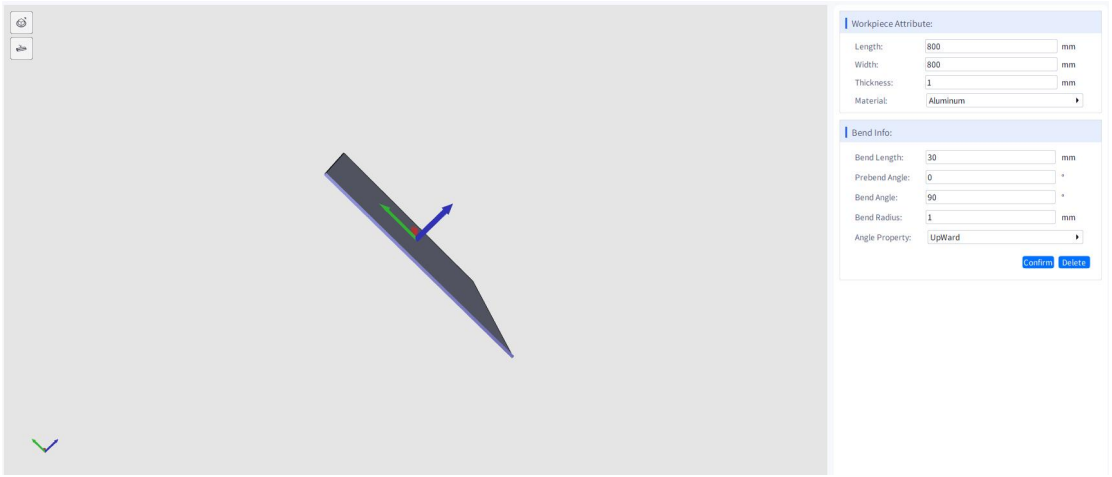


Figure 5-7

Where:

Bend Length: The height of the added bend block;

Bend angle: The angle at which the bend is formed;

Bend Radius: The inner radius of the bend, defaulting to the plate thickness value.

Bending Direction: The direction of the bending operation. Upward is the positive direction of the sheet metal coordinate system's Z-axis (blue axis in the figure, indicated by the arrow), while downward is the opposite.

Click OK to complete the new creation, as shown in Figure 5-8.

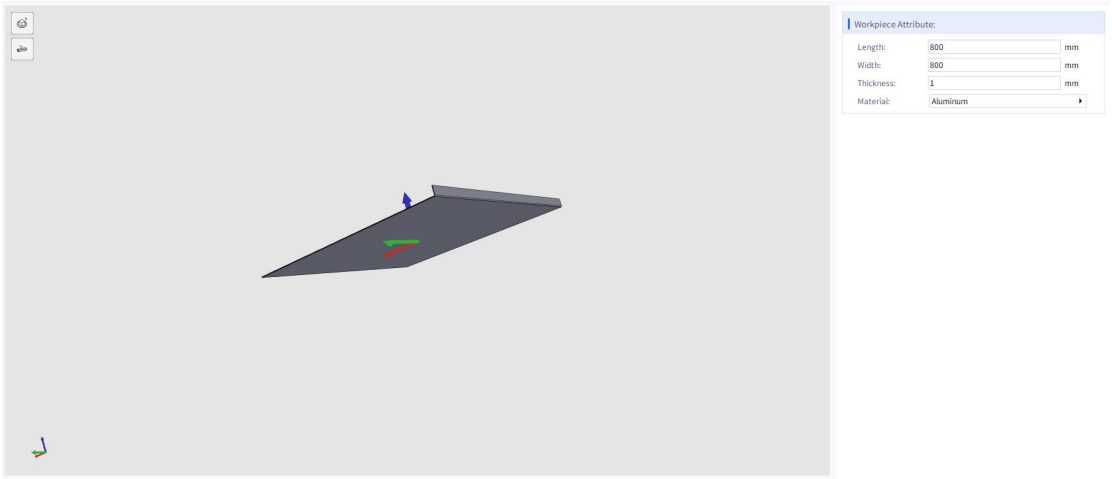


Figure 5-8

Angle Direction: The direction of the bend. Upward is the positive direction of the sheet metal coordinate system's Z-axis (blue axis in the figure, indicated by the arrow), and downward is the opposite.

Clicking the bend area (bend line) displays bend line information, as shown in Figure 5-9.

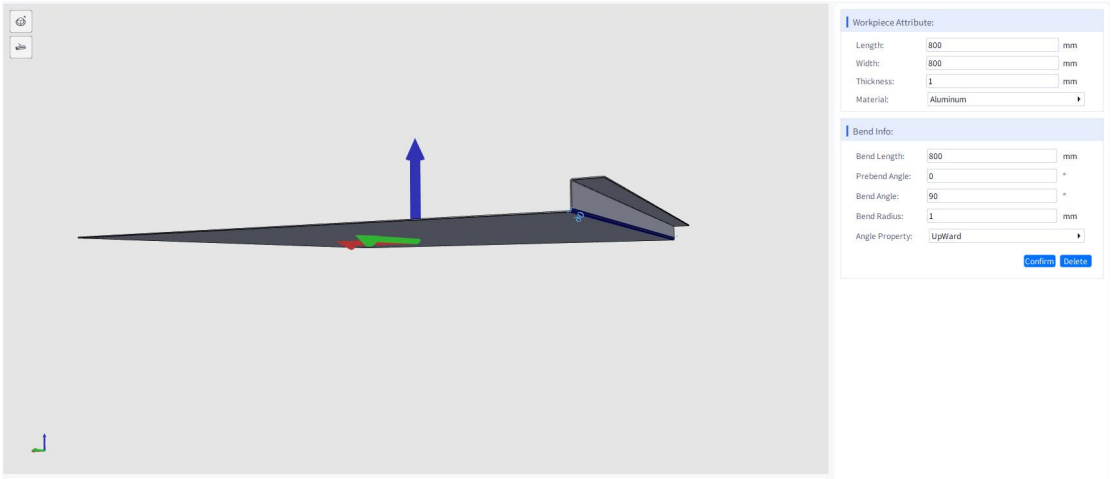


Figure 5-9 : Bend Line Information Display

Note: The bend line length cannot be modified. The bend angle, bend radius, and bend direction can all be adjusted. Changes take effect after clicking OK. Click Delete to remove the current bend line and all subordinate bend blocks extending from it, as shown in Figure 5-10 below.

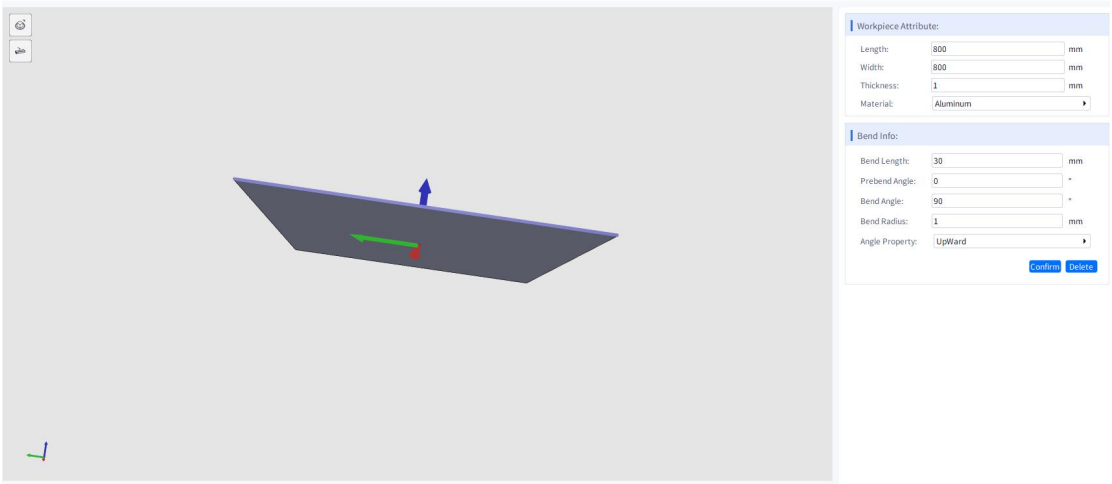


Figure 5-10 : Deleting the Current Bend Line

(3) Editing Bend Blocks: Select the corresponding bend block to display its bending information, as shown in Figure 5-11.

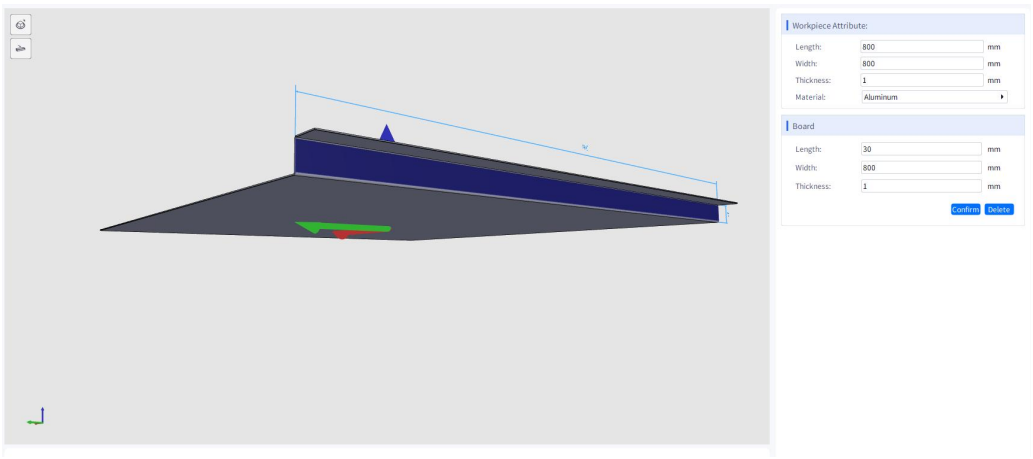


Figure 5-11 : Bend Block Parameter Display

Here, the length represents the bend block height (external dimension annotation), while the thickness value is non-editable. When the user adjusts the width value, the system extends proportionally outward from the bend line center to maintain symmetrical changes, as shown in Figure 5-12.

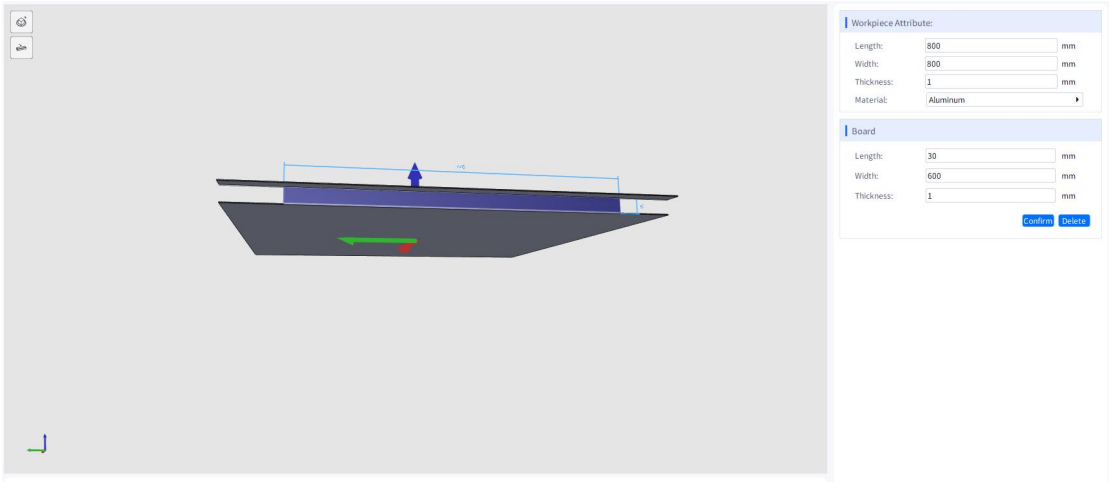


Figure 5-12 : Bend Block Parameter Display and Width Modification

Clicking "Delete" removes both the selected bend block and its associated bend lines, as shown in Figure 5-13.

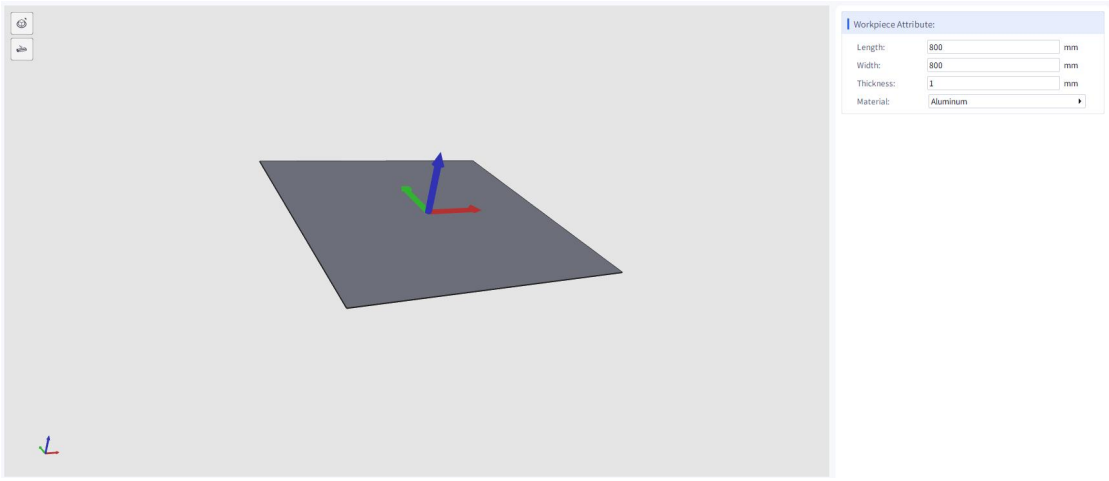


Figure 5-13 : Deleting a Bend Block

5.2.2 Importing IGS/STP

The IGS and STP import functions are largely similar and will be explained together here. After selecting the file path and verifying the file extension, a successful import is shown in Figure 5-14.

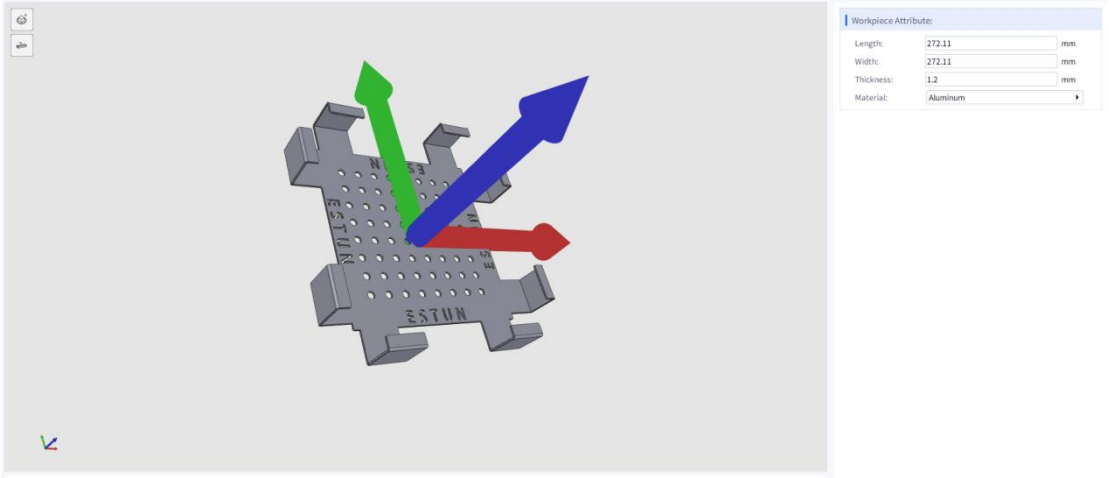


Figure 5-14 : Importing IGS

When importing 3D graphics, the internal bend radius and thickness information are inherently present, eliminating the need for additional input. Users can click on the bend line to view specific details, as shown in Figure 5-15.

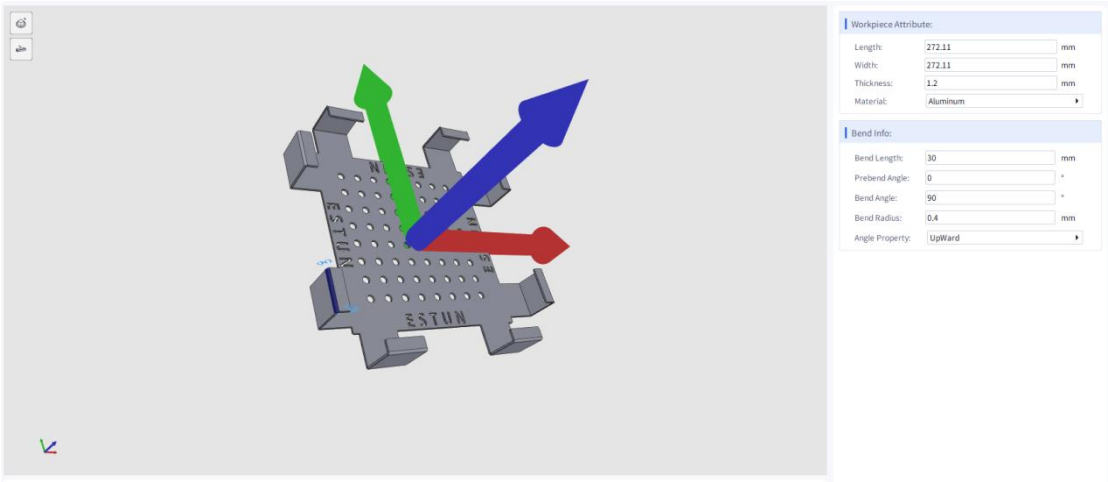


Figure 5-15 : Bend Information

5.2.3 Importing DXF

After selecting the DXF file to import, the DXF editing interface will appear, as shown in Figure 5-16.

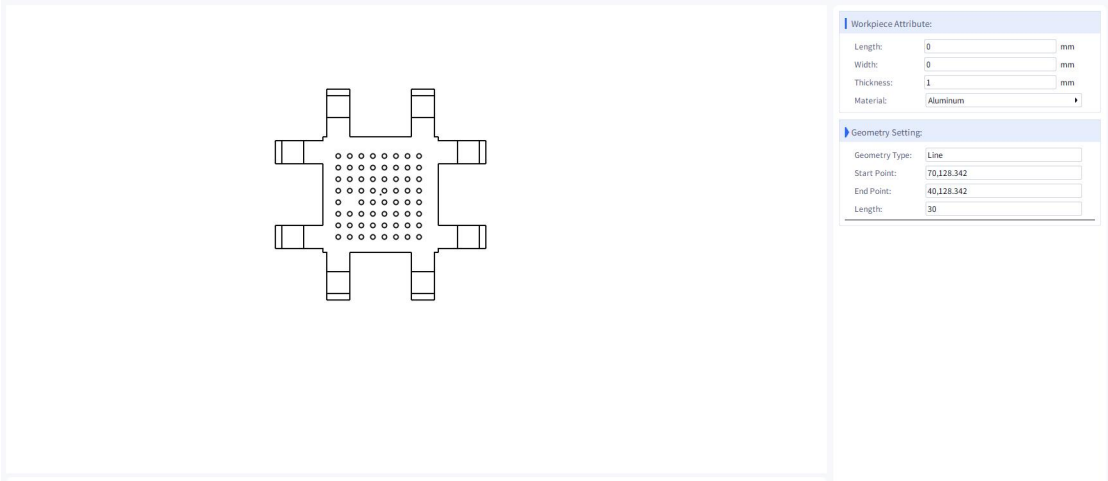


Figure 5-16 Importing DXF Drawings

To distinguish between contour lines and bend lines, contour lines are displayed as solid black lines, while bend lines appear as dashed red lines. The following functions assist users in modifying and configuring DXF drawings:

(1) Auto-Composition: Clicking Auto-Composition triggers a graphic integrity check. If errors are detected, they are annotated and flagged for the user, as shown in Figure 5-17.

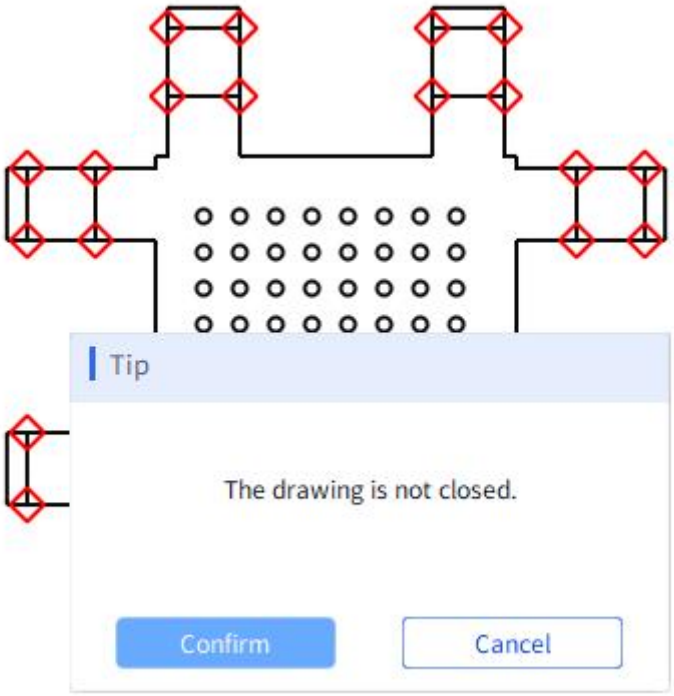


Figure 5-17 : Construction Errors and Prompts

Clicking Auto-Composition triggers a graphic integrity check. If errors are detected, they will be annotated and the user will be prompted, as shown in Figure 5-18.

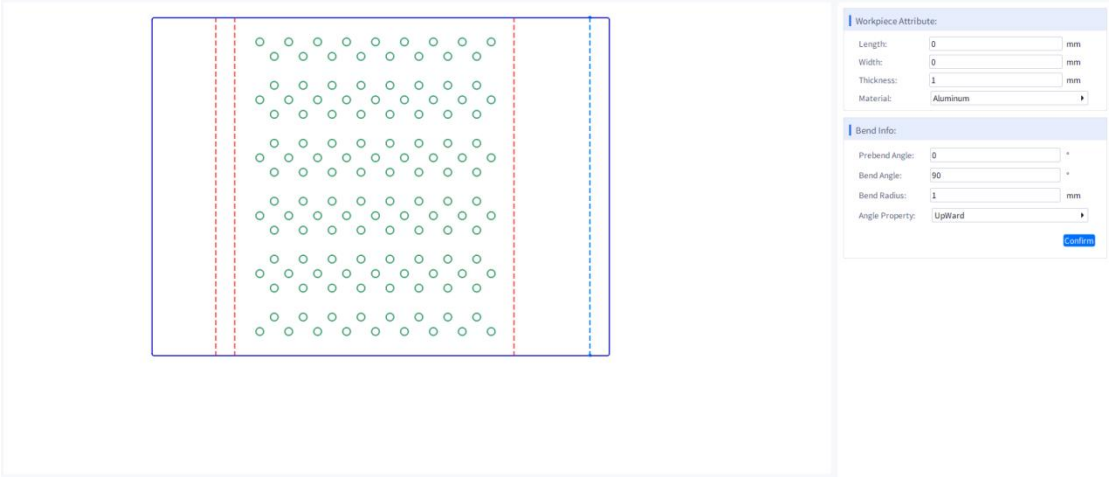


Figure 5-18 : Successful Construction

After successful construction, the contour line is highlighted in blue. At this point, the editing functions above are no longer available, and the "3D" button becomes active, allowing preview of the three-dimensional model. Users can now set the bending information for the workpiece. Select a bend line to view the bend angle,

inner bend radius, and bend direction on the right. To modify these values, adjust the corresponding data and click OK to confirm changes, as shown in Figure 5-19.

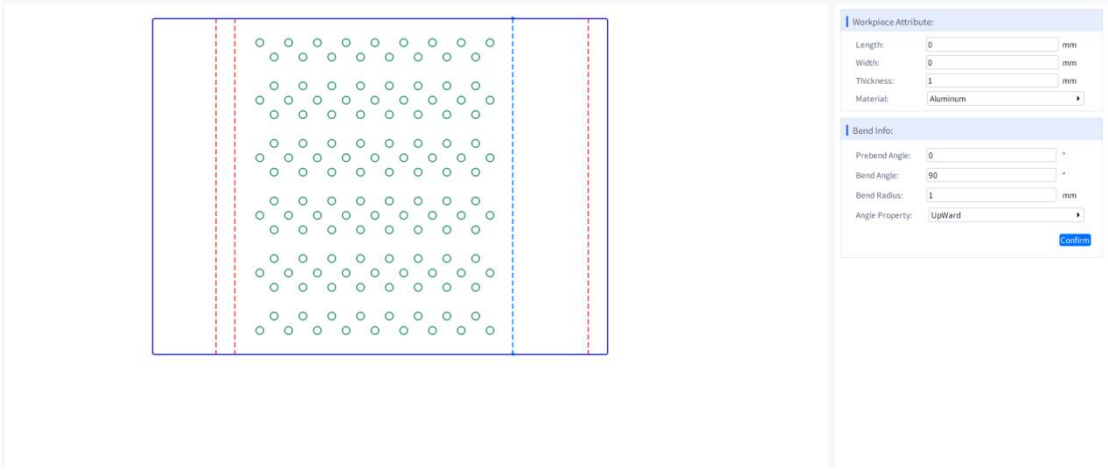


Figure 5-19 : Modifying Specific Bending Information

(2) Extension: For drawings with disconnected line segments, the extension function effectively resolves such defects.

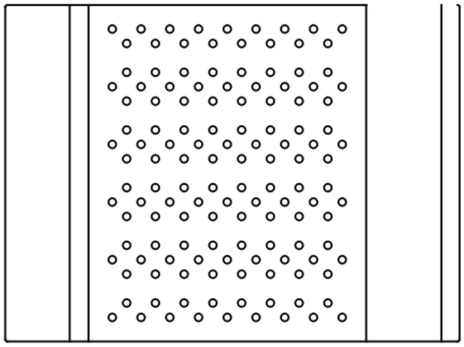


Figure 5-20 : Original Image

The specific operation involves selecting the position where the line segment should be extended, ensuring it intersects with the line segment to be extended, as shown in Figure 5-21.

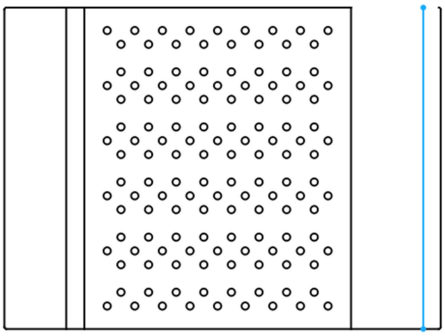


Figure 5-21 : Selecting the extension reference line

Then right-click in the blank area and click the line segment to be extended to complete the operation, as shown in Figure 5-22.

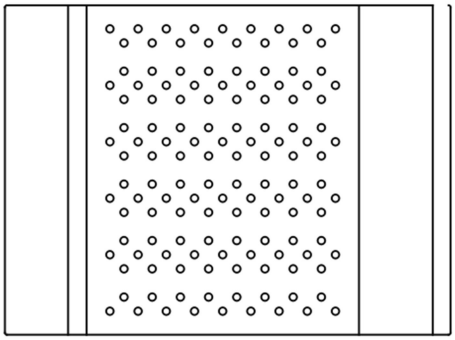


Figure 5-22 : Completing Line Segment Extension

(3) Trim: Used to cut solid line segments. Click to enter trim mode, where you can perform continuous trimming. The segment being trimmed is highlighted in green, while the segment at the mouse position is hidden, as shown in Figure 5-23.

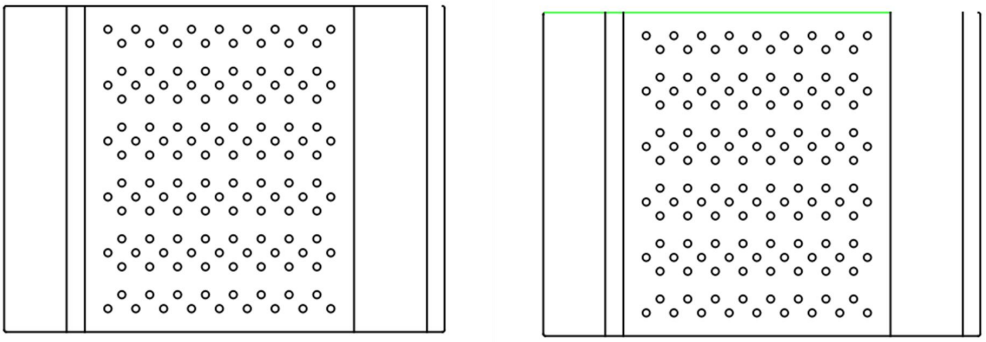


Figure 5-23

(4) Specify: Converts selected segments into bend lines;

(5) Reverse: Enters conversion mode, allowing selected bend lines to be converted to contour lines, or contour lines to be converted to bend lines.

(6) Merge: Combines multiple collinear bend lines into a single bend line. During simulation, these merged bend lines are treated as completed in a single operation.Specifically: After selecting the bend lines to merge, click the Merge button as shown below. When the merged bend line is selected, all merged bend lines are highlighted together. Additionally, when modifying bend information, they share the same set of bend information.

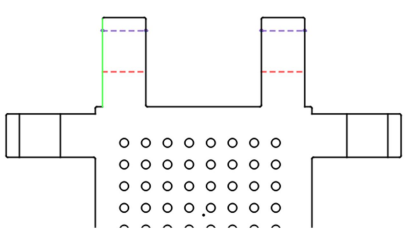


Figure 5-24

(7) Cancel: Deselects the highlighted lines and removes their highlight.

(8) 3D: After construction is complete, activate the "3D" function to preview the workpiece style, as shown in Figure 5-25. Click OK to create the new workpiece and enter the workpiece editing interface.

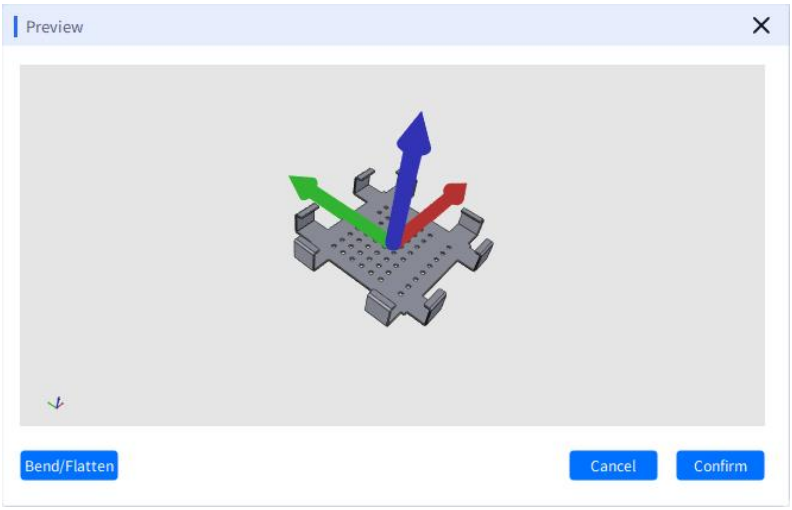


Figure 5-25 : Workpiece Preview

(9) Export: Save the edited workpiece as a new DXF file.

5.2.4 Workpiece Editing Function

Enter the 3D editing interface, as shown in Figure 5.26.

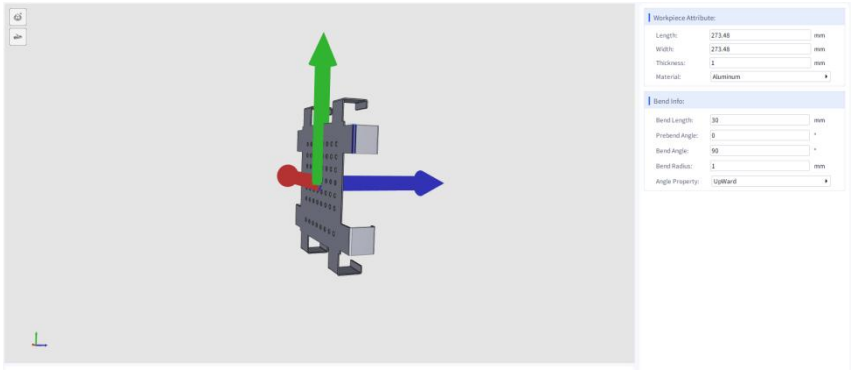


Figure 5-26 : Workpiece Editing

In addition to viewing bending information, the following functions are available:

(1) Merge: Enter merge mode, then select the bend segments to merge. Selected segments will be highlighted in green, as shown below. Click the OK button to complete the merge.

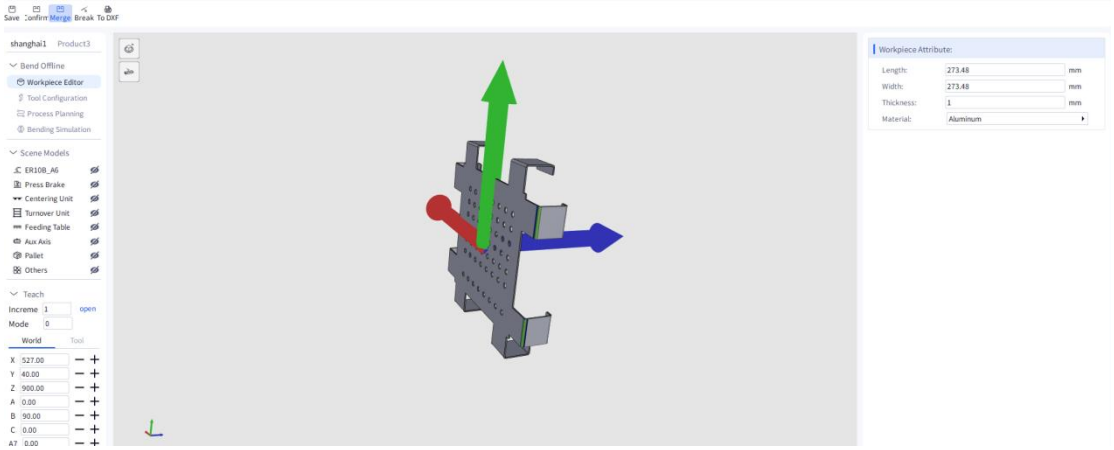


Figure 5-27 : 3D Merge Display

(2) Split: Select merged bend lines and break them apart.

(3) Export DXF: Export the current 3D workpiece as a DXF drawing.

(4)  : Reset the view to center the graphic.

(5)  : Preview the bent and unfolded geometry.

5.2.5 3D Editing

Select the target workpiece in the mold list, double-click to load it, and proceed to the corresponding page based on the workpiece's completion status: - If the graphic portion is complete, proceed to the mold configuration interface; - If mold configuration is complete, proceed to the process setup page; - If the process is complete, proceed to the path setup page.

5.3 Mold Configuration

Die configuration is a critical step in the offline programming process, used to select and arrange suitable upper and lower dies for the workpiece bending operation. Through this module, users can complete die selection, combination, and position adjustment within a virtual machine environment.Users can visually inspect mold geometry, mounting positions, and alignment methods within the configuration interface, achieving precise placement through snap-to and alignment operations. The mold configuration interface is shown below, where the mold table displays basic mold information and approximate shapes.

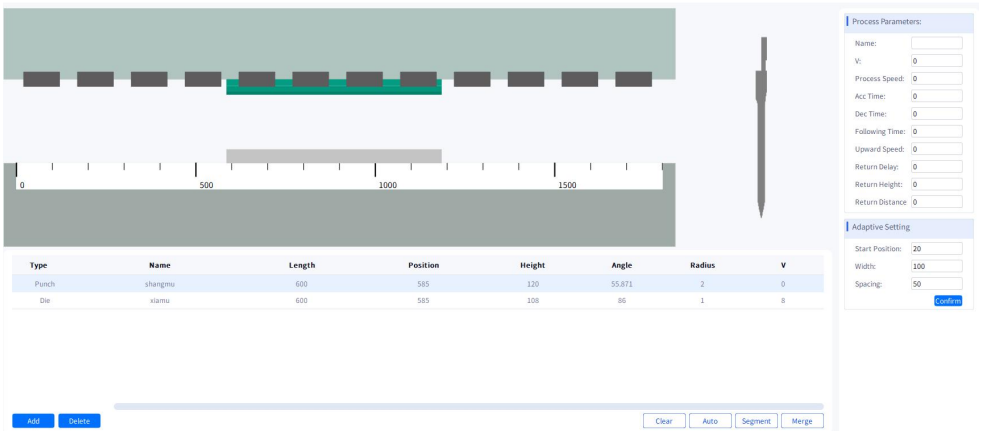


Figure 5-28

The mold interface allows you to add, delete, replace, and clear molds. Specifically:

(1) Add: Click the Add button, select either the upper or lower mold, and insert a mold segment into the largest available space, as shown in Figure 5-29.

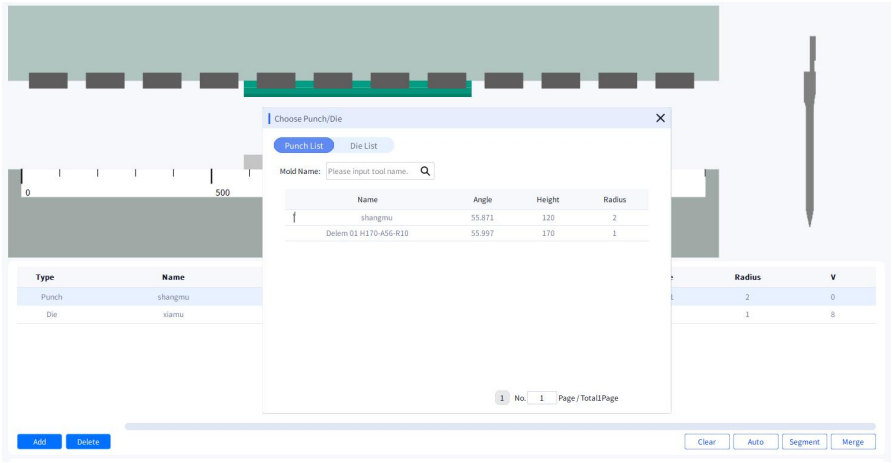
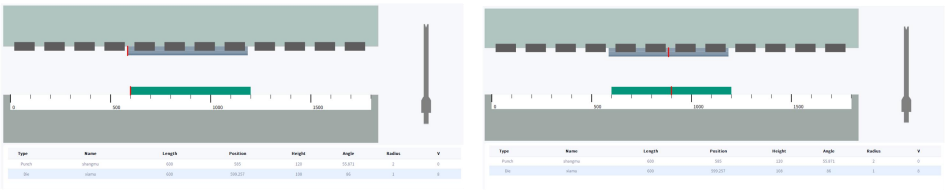


Figure 5-29 : Adding a Mold

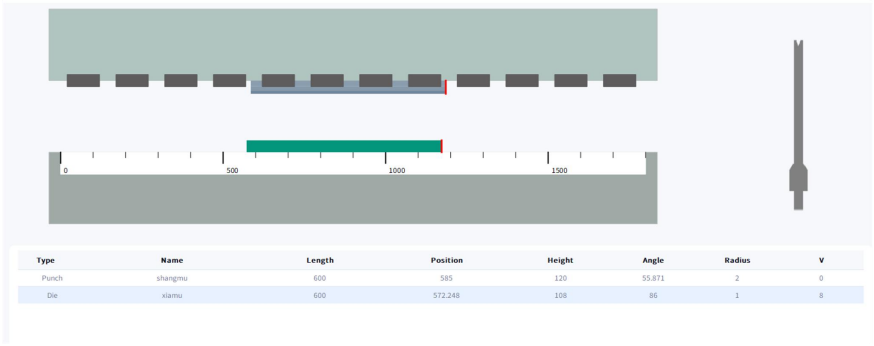
(2) Delete: Remove the selected mold section.

(3) Replace: Double-click the mold name column in the mold table to replace the mold. If the new mold is the same type (e.g., both upper or both lower), it replaces directly. If the mold types differ (e.g., selecting a lower mold), the lower mold will be converted to the corresponding upper mold if no interference exists at the upper mold position.

When placing molds, besides modifying mold length and position in the table, you can also drag molds in the configuration scene. Molds align by center, left, or right. Highlighting the corresponding upper/lower mold positions will automatically snap the mold when released, as shown in Figure 5-30.



a) Left Align b) Center Align



c) Right Align

Figure 5-30

To more accurately replicate press brake die configuration scenarios, the software also allows the upper die to be configured via the configurator. Settings are made within the red area on the right side of the interface, as shown below. After making changes, click OK to complete the modification.

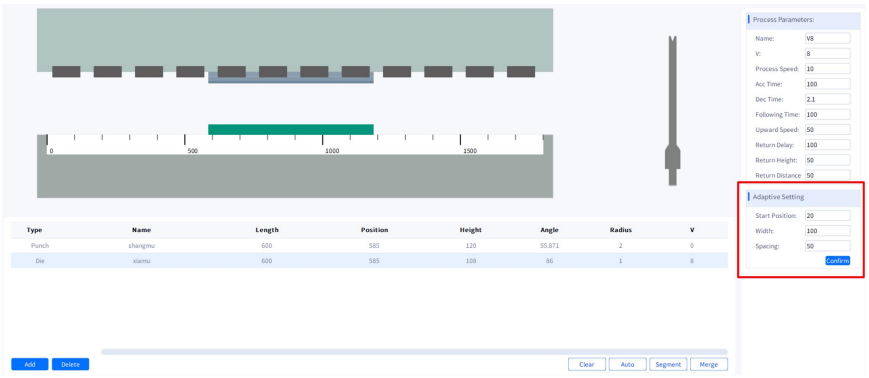


Figure 5-31 Upper Die Adapter Settings

Note: To ensure subsequent process settings proceed smoothly, configure at least one pair of upper and lower dies here.

For user convenience, the software remembers the previous die configuration settings. When creating a new workpiece, the software automatically preconfigures the dies based on the last die configuration. Users can modify these settings here if needed.

5.4 Process Specification and Editing

After importing the workpiece and configuring the mold, specify the processing sequence and verify the suitability of each bend's grasping points. If interference occurs or the robot end effector cannot reach the points, modifications must be made here. Click the "Process Planning" button in the left navigation bar to enter the process planning page.

5.4.1 Introduction

This page features two scenarios: "Process Designation" and "Process Step Editing." Switch between them using the button in the top-left corner of the scenario. In the "Process Designation" scenario, users can set the part's machining sequence. In the "Process Editing" scenario, users can modify configuration parameters for each process step (gripping points, gripping surfaces, tool types, part positions, etc.).

For projects without specified processes, the default entry point is the "Process Designation" scenario.

5.4.2 Process Assignment

Click bend lines sequentially to specify the bending sequence; bend numbers will display synchronously on the reverse side of the bend lines. If the sequence is incorrect, click the "Undo" button in the toolbar to reverse one step. Alternatively, click the "Reset" button to clear all specified operations.

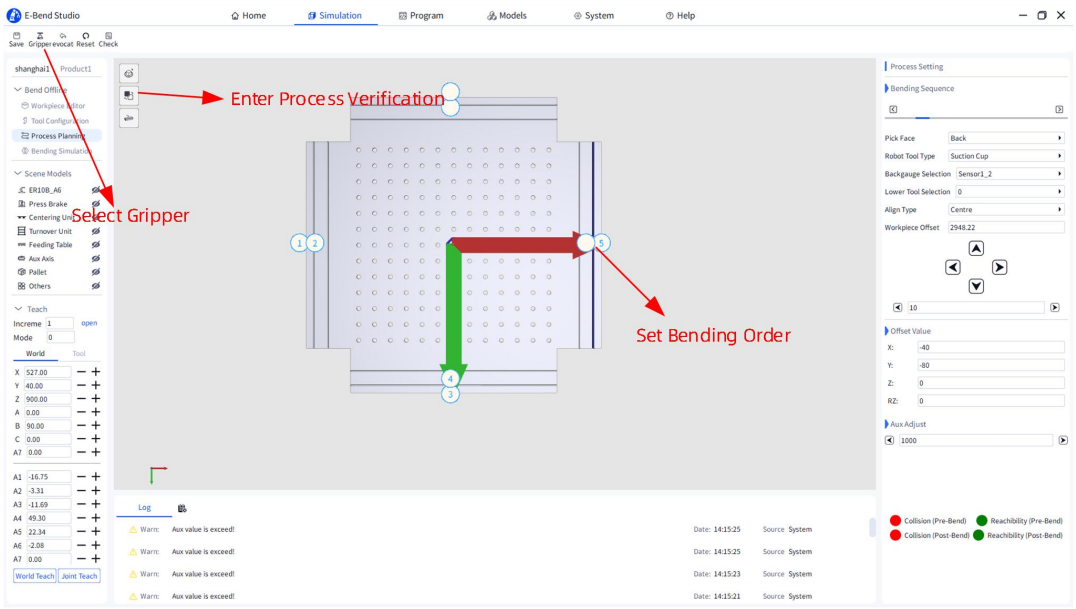


Figure 5-32: Process Designation

5.4.3 Fixture Designation

After setting the process, click the "Clamp" button in the toolbar to open the clamp library pop-up for the current workstation. Select the appropriate clamp from the list in the pop-up, then click the "OK" button in the bottom-right corner to choose this clamp for machining the workpiece. This pop-up also allows modifying clamp parameters and adding/removing clamps.

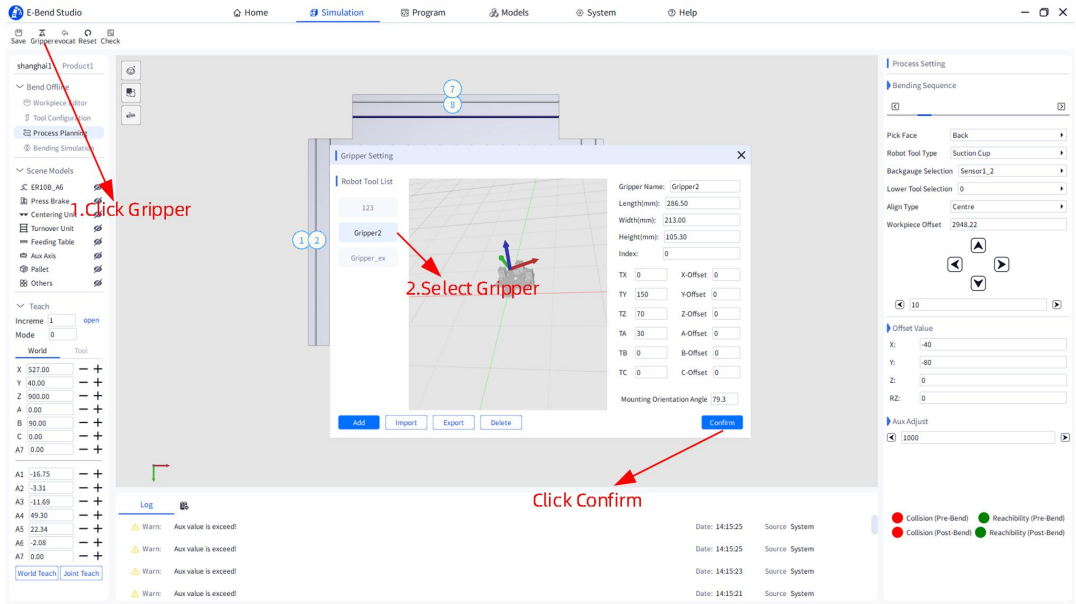


Figure 5-33 Clamp Selection

5.4.4 Generate Operation Table

Once the mold, process, and fixture are fully configured, click the toggle button  in the top-left corner of the scene to switch to "Process Editing" mode. If any of the mold, process, or fixture is not properly configured, a corresponding prompt will appear in the log bar.

The system analyzes the workpiece geometry to automatically select gripping points and surfaces, and inserts the corresponding flipping operation.

5.4.5 Operation List

Users can click the bending process button on the right or the corresponding row in the operation table to view the 3D state of that operation.

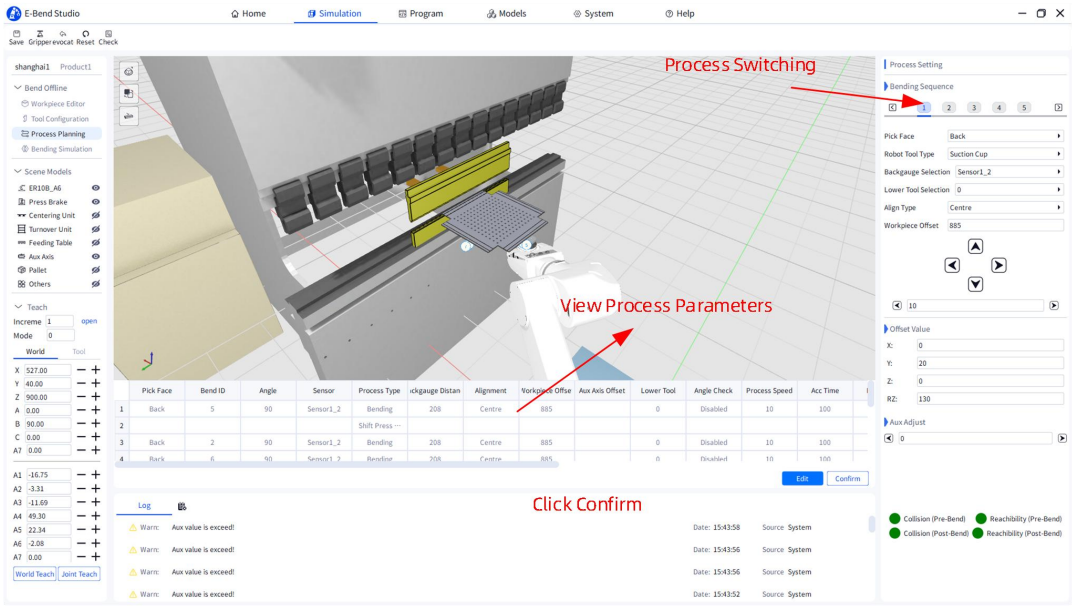
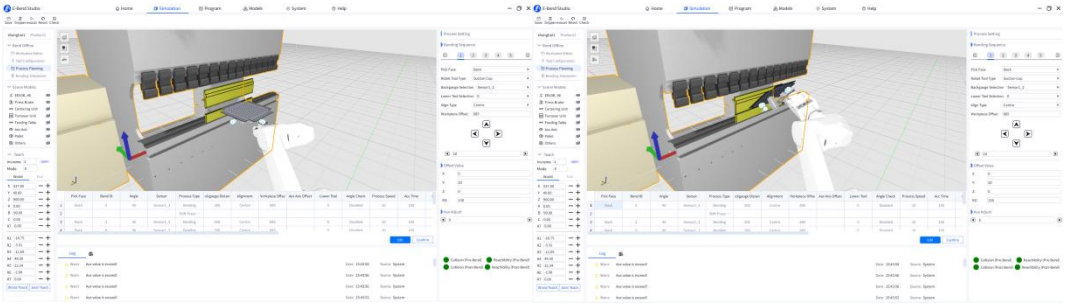
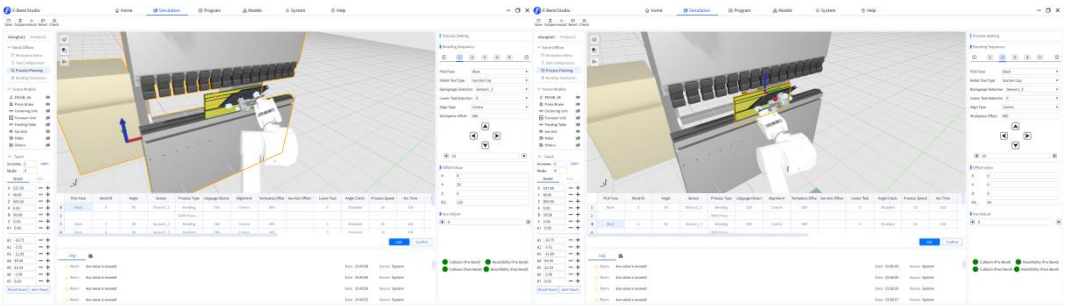


Figure 5-34 Operation Editing

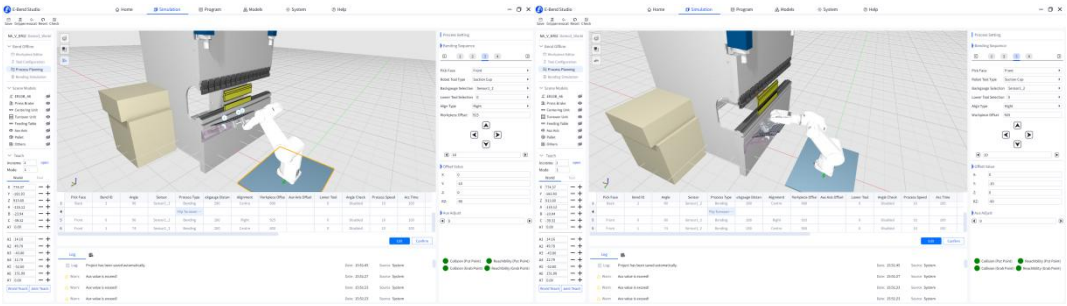
5.4.5.1 Status View: For bending operations, the system displays the relative positional relationship between pre-bend and post-bend states in the 3D scene. For gripper change operations (flip/offset), the system shows the relative positional relationship between the placement point (pre-change) and the pickup point (post-change) in the 3D scene. Click the "  " button in the upper-left corner of the scene to toggle between the two states for this operation.



(a) Pre-bending state **(b) Post-bending state**



(c) Pre-offset state of the bending machine **(d) Post-offset state of the bending machine**



(e) Flip frame pre-flip state　　(f) Flip frame post-flip state

Figure 5-35 Operation State View

The system automatically analyzes interference lines and reachability for this operation. A green indicator light in the lower right corner indicates no interference in the current state or that the robot can reach the point. A red light indicates interference in the current state or that the robot cannot reach the point.

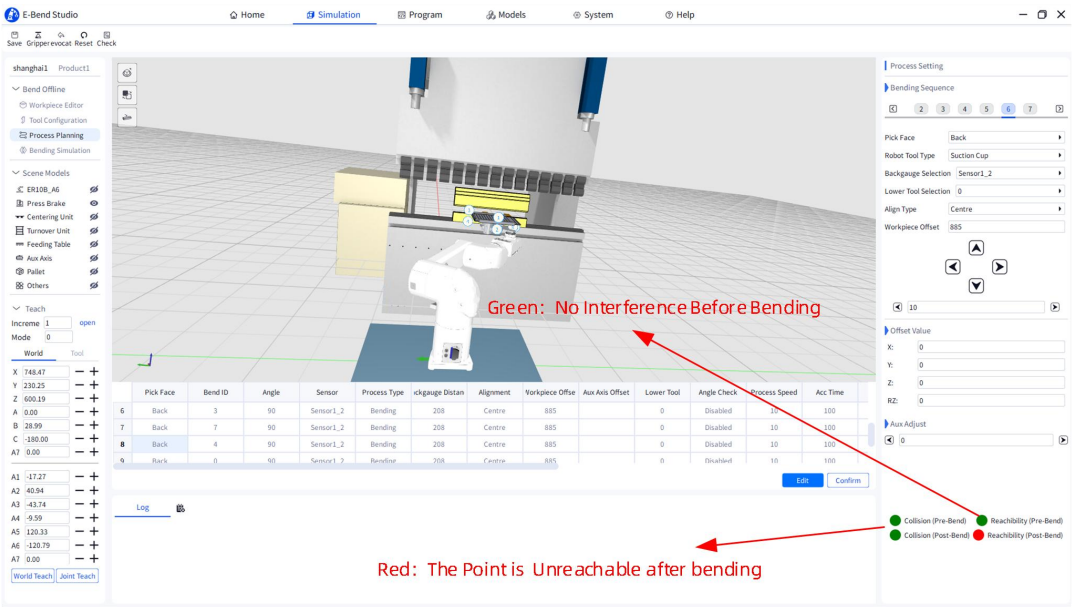


Figure 5-36 Status Accessibility and Interference Indicator

5.4.5.2 Grab Point Adjustment: If the system's default grab point causes interference or the robot cannot reach the workpiece, adjust the grab position for the corresponding operation to eliminate interference and ensure robot accessibility. Each grab point adjustment triggers automatic interference and accessibility analysis, updating the indicator light status.

1) **Indirect Adjustment**: Without altering the gripper's relative position to the workpiece, indirectly adjust the grasping point by changing the workpiece position or replacing the gripper.

- **Modify the corresponding mold**: Click the "Lower Mold Selection"

dropdown menu and choose another mold. The workpiece will be placed onto the corresponding mold.



Figure 5-37 Lower Mold Replacement

- **Modify alignment method**: Click the "Alignment Method" dropdown to select "Left Align," "Right Align," "Center Align," or "Custom" relative to the lower mold. When selecting "Custom," modify the value in the "Workpiece Offset" edit box to define the workpiece placement position.

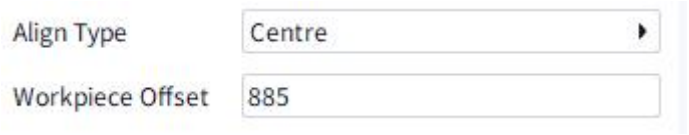


Figure 5-38 Modifying Workpiece Position

- **Replace Grippers**: Click the "Grippers" button on the toolbar to replace with other suitable grippers, which may eliminate interference.

2) **Direct Adjustment**: Modify the gripper's position relative to the workpiece without changing the workpiece's location.

- **Direct Modification**: Click the direction keys to modify the gripping point using six operations: Up, Down, Left, Right, Left Rotate, and Right Rotate. Alternatively, enter offset parameters directly into the offset value field to modify the gripping point.

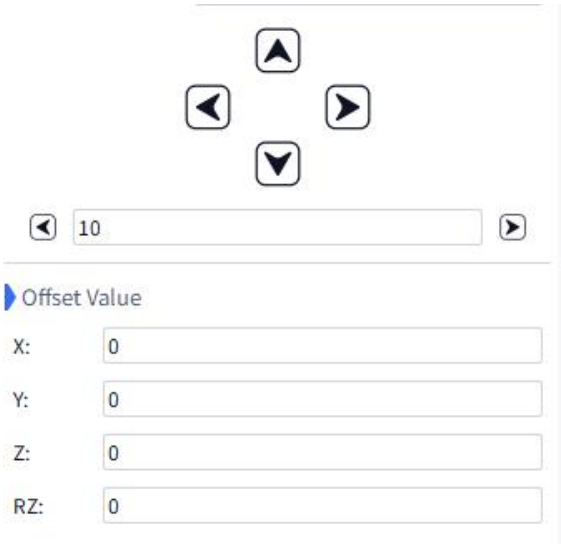


Figure 5-39 Grab Point Adjustment

- **Modify Tool Type:** Click the "Gripper Type" dropdown to select suction cups or clamps. This option is only available if the current fixture supports clamps.
- **Modifying the Grab Surface:** Generally, the system automatically selects the correct grab surface. Unless special circumstances arise, modification is not recommended.

3) **Adjusting Bending Points for Workstations with Additional Axes:** When a workstation incorporates a seventh axis, the additional axis must be positioned appropriately for bending. The software provides a jog button for the additional axis to adjust its position at the bending point. This jog function is inactive for workstations without additional axes.



Figure 5-40 Grab Point Adjustment

5.4.5.3 Suction Point Change Operation: This operation switches the gripping point. When the system detects that the robot's gripping points relative to the workpiece differ between two adjacent bends, it automatically inserts the corresponding suction point change operation.

Gripper change steps fall into two main categories: **flipping and offset**. Flipping is required when the gripping surface (front/back) differs between the preceding and subsequent bends. Offset applies when the gripping surface remains unchanged but the gripping location shifts.

The gripper change operation consists of two main steps: **placing the workpiece onto the platform** and **re-gripping the workpiece**. When clicking the corresponding row in the operation table, the 3D scene during placement and gripping can be viewed via the "" button in the top-left corner of the scene. Interference analysis and robot reachability for both steps will also be displayed in the bottom-right corner.

Resolving gripper point interference or robot inaccessibility:

- **Modify the placement and pickup points of the gripper change operation**: Use the six directional keys (Up, Down, Left, Right, Left Rotate, Right Rotate) to adjust the placement and pickup points.

(Modifying the pickup point is not recommended, as the gripper change pickup point serves as the pickup point for the next bending operation, potentially affecting subsequent bends. When the gripper change occurs off the press brake, modifying the placement point does not affect the pickup point of the preceding bend.)

- **Modify the clamping type**: For flipping, the system supports both **press brake flipping** and **flipping rack** flipping processes. For offsetting, the system supports **press brake offsetting**, **flipping rack** offsetting, and **centering table** offsetting. If directly modifying the pick-up/placement points still fails to resolve interference or inaccessibility issues, try changing the clamping type.Click the "Edit" button in the lower-right corner of the operation table area to enter edit mode. Click the process type for the corresponding gripper change operation row, select the new type from the dropdown menu, and click "Confirm" to apply the change.(FIBO flipper: forward entry, reverse exit; BIFO flipper: reverse entry, forward exit; FIFO flipper: forward entry, forward exit; BIBO flipper: reverse entry, reverse exit)

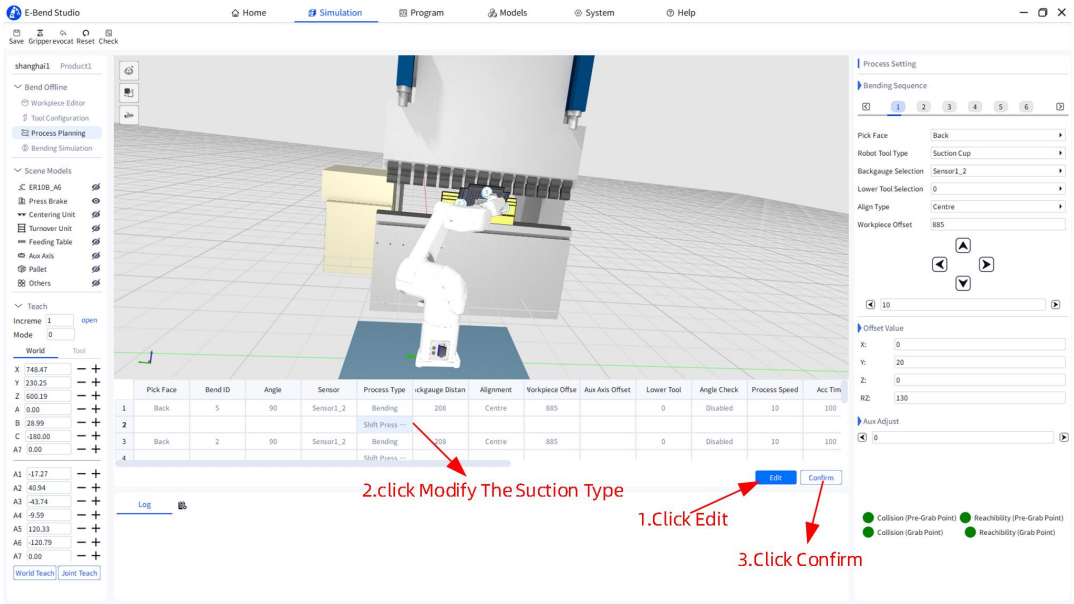


Figure 5-41 Modifying Handling Type

- **Modify Workpiece Position (for Press Brake Flip/Offset)**: When using press brake flip and offset, you can change the workpiece position by modifying the alignment method, thereby indirectly adjusting the placement and pickup points.

5.4.5.4 Operation Parameter Explanation Each bending operation carries a set of parameters that influence the robot's path during bending. Click the "Edit" button in the lower-right corner of the operation table to enter edit mode, where certain parameter values can be modified.

After making changes, click the "Confirm" button to regenerate the path using the updated parameters.

Table 5-1 Operation Parameter Reference Table

Parameter Name	Description	Unit
Grab Surface	Whether the current bending operation grips the front or back side of the workpiece	None
Bend ID	The software assigns a fixed ID to each bend as an identifier	None
Angle	Bend Angle	Degrees/°
Sensor	Finger stop sensor type	None
Process Type	Indicates current operation is bend/flip/offset	None
Backstop Distance	The distance between the stop fingers for this bend	mm
Alignment Method	Relative position of workpiece to lower die (left alignment/right alignment/center alignment/custom)	None
Workpiece offset	Workpiece position on the press brake (leftmost point of press brake is origin)	mm
Auxiliary axis offset	Displacement of the auxiliary axis from before bending to after bending	mm
Lower die index	Lower die currently used for bending (leftmost lower die is No. 0)	None
Angle detection	Whether angle detection is enabled for the current bend (On/Off)	None
Feed Speed	Feed speed during current bend (speed at which the ram moves from the clamping point to the lower stop)	mm/s
Acceleration time	Acceleration time for the robot bending follow-up motion from zero to follow-up speed	ms
Deceleration time	Deceleration time for the robot's bending follow motion from follow speed to zero.	ms
Follow time	Time from the start of following to the end of following	ms
Lifting speed	The speed ratio at which the robot lifts upward after completing	%

	the bending operation	
Return delay	Delay time between the robot completing the bend and lifting up	ms
Return stroke height	Distance the robot lifts upward after completing the bend	mm
Retraction distance	Distance the robot retracts material toward the outside of the bending machine after completing the lift	mm
Lower die travel distance	Distance traveled by the lower die to reach the clamping point in a lower-moving bending machine configuration	mm
Lower die delay time	Bending machine structure employs a lower-moving bending method; waiting time for lower die movement	ms

5.5 Bending Simulation

After ensuring no interference exists across all processes and robotic accessibility is confirmed, click "Bending Simulation" in the left navigation panel. This will generate all path points, which can be viewed in the point tree on the right.

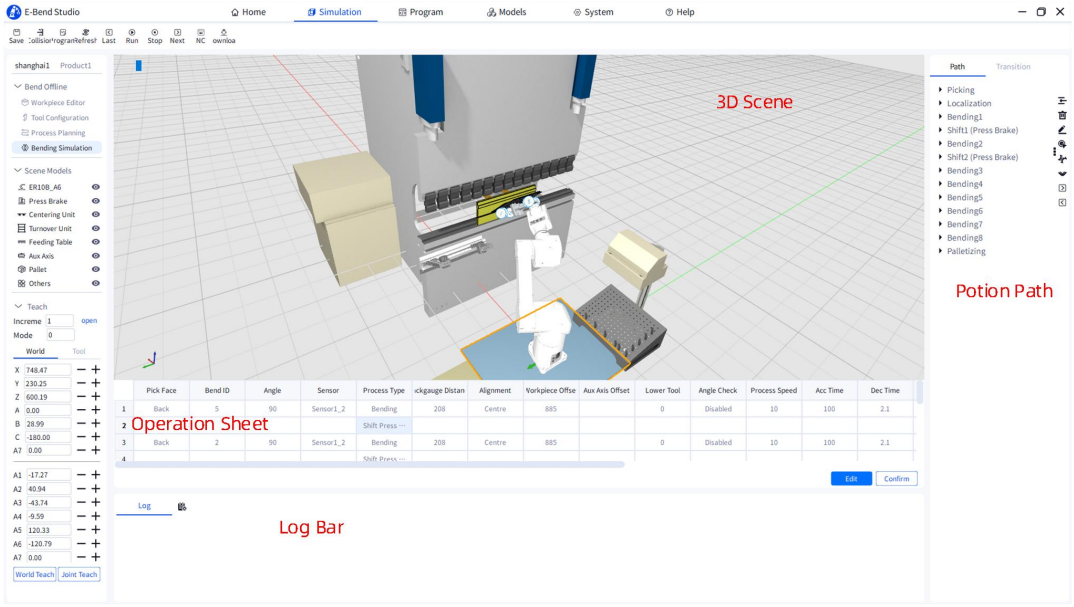


Figure 5-42 Bending Simulation Page

5.5.1 Process and Point Management

All projects contain at least four processes: "Material Pickup," "Alignment," "Bending," and "Stacking." Projects involving gripper changes also include "Flip" and "Offset" processes. Each process has corresponding key points.

Table 5-2 Process and Point Correspondence Table

Process	Process Description	Position	Point Description	Modification Method	Transition Points Can Be Inserted
Part Retrieval	First process step: Robot enters the part retrieval station, grasps the workpiece, and departs the retrieval station	Entry Point	The specific point where the robot enters the pick-up station	Parameters/Edit/Teach	Transition points can be inserted before this point
		Gripping Point	The point where the robot grasps	**Gravity centering**: Parameters/Edit/Teach; **Visual centering**:	Cannot insert

			the workpiece	Non-modifiable	
		Departure Point	Robot departure point from the pick-up station	Parameters/Edit/Teach	Cannot insert
Centering (Gravity)	Second process: Robot enters gravity centering station, releases workpiece, waits for workpiece to slide to stop, then re-grips and departs centering station	Entry point	Robot enters gravity centering station	Parameters/Edit/Teach	Transition points can be inserted before this point
		Release Point	Robot releases workpiece here; workpiece drops onto centering platform	Parameters/Edit/Teach	Cannot insert
		Wait point	Robot waits here for the workpiece to slide down to the stop position	Parameters/Edit/Teach	Cannot insert
		Grab point	Point where the robot re-grabs the workpiece	Cannot be modified	Cannot insert
		Exit point	Robot departure point from gravity centering platform	Parameters/Edit/Teach	Cannot insert
	Second process:	Entry Point	Robot enters	Parameters/Edit/Teach	Transition

Alignment (Vision)	Robot enters the visual alignment station, waits for the vision system to capture and transmit offset data, then departs the alignment station		the visual alignment station		points can be inserted before this point
		Vision Point	Robot waits here for image capture	Parameters/Edit/Teach	Cannot insert
		Exit Point	Robot leaves the vision alignment platform	Parameters/Edit/Teach	Unable to insert
Palletizing	Final Process: Robot places processed workpiece into palletizing zone before departing	Entry Point	The point where the robot enters the palletizing zone	Parameters/Edit/Teach	Transition points can be inserted before this point
		Dropping point	The robot places the workpiece at this location	Parameters/Edit/Teach	Cannot insert
		Exit point	The point where the robot leaves the palletizing area	Parameters/Edit/Teach	Unable to insert
Bending	The process where the robot enters the bending machine, aligns with the stop fingers, performs the bending operation, and	Entry point	The point where the robot enters the bending machine (this point does not exist when the previous step involves	Parameters/Edit/Teach	Transition points can be inserted before this point

then retracts the material to exit the bending machine		flipping the bending machine)		
	Bending Point	The position where the robot enters the bending area and contacts the stop finger	Cannot be edited	Cannot insert
	Bending forming point	Point position after bending	Cannot edit	Cannot insert
	Bend lift point	Point where the bend lifts after forming, preparing to exit the bend zone (this point does not exist when the subsequent operation is a press brake offset)	Parameters	Cannot insert
	Exit point	The point where the robot leaves the bending machine (this point does not exist if the next step is a bending	Parameter/Edit/Teach	Cannot insert

			machine offset)		
Flip (Flipping Frame)	The process where the robot enters the flipping frame, places the workpiece, and then re-grabs the workpiece	Placement entry point	The initial entry point of the robot into the flipping fixture	Parameters/Edit/Teach	A transition point can be inserted before this point
		Placement point	Robot places workpiece onto flipping fixture	Parameters/Edit/Teach	Unable to insert
		Place departure point	Robot first departs from flipping rack	Parameters/Edit/Teach	Unable to insert
		Grab entry point	Robot's second entry into the flipping frame	Parameters/Edit/Teach	Transition points can be inserted before this point
		Grab point	Robot re-grabs the workpiece at this location	Cannot be modified	Cannot insert
		Grab release point	Robot leaves the flipping fixture for the second time	Parameters/Edit/Teach	Unable to insert
Offset (flipping frame)	Process where the robot enters the flipping frame, places the workpiece, and then re-grabs the workpiece			Same Flip (Flip Frame)	

Flip (Bending Machine)	The process where the robot enters the bending area of the press brake, the press brake clamps the workpiece, and the robot releases the workpiece and re-grips it	Flip Placement Point	The robot places the workpiece onto the die at this location and waits for the press brake to clamp it	Not modifiable	Cannot insert
		Flip-over retraction point	After placing the workpiece, the robot retracts upward to this position	Parameters/Edit/Teach	Cannot insert
		Flip-over grasping point	The robot re-grabs the workpiece at this point	Unmodifiable	Transition points can be inserted before this point
Offset (Bending Machine)	The process where the robot releases the bent part and re-grips it	Offset clearance point	After bending, the robot retracts vertically to this point relative to the gripping surface	Parameters/Edit/Teach	Cannot insert
		Offset pre-grip point	Robot moves to this position after posture adjustment	Parameters/Edit/Teach	Transition points can be inserted before this point
		Offset Grab Point	Position where the	Cannot be modified	Cannot be inserted

		robot re-grabs the workpiece
Offset (Center Stage)	Robot releases workpiece and re-grabs after entering gravity centering platform	Same alignment (gravity)

Ensure all paths and points in this stage are interference-free and robot-accessible. First, verify that generated points themselves are interference-free and reachable.

Viewing Points: Click the triangle icon on the left side of the process to expand all points under that process. Click the triangle icon on the left side of a point to expand and view its specific coordinates.Right-click the point and select "One-Click Reach" from the menu, or click the " " button in the right toolbar to directly view the workstation status for that point. If the robot cannot reach the point, a warning will appear in the log area. Double-click the point to have the robot move from its current position to that point. If the path contains unreachable points, the robot will stop and a warning will appear in the log area.If the point uses world coordinates (X, Y, Z, A, B, C), the MOVL motion mode is used. If the point uses joint coordinates (J1, J2, J3, J4, J5, J6), the MOVJ motion mode is used.

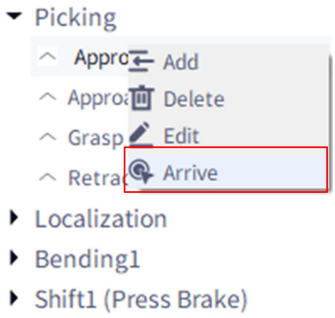


Figure 5-43 Right-Click Menu: One-Click Move

How to Resolve Robot Inability to Reach a Point When the robot cannot reach a critical point, try the following measures:

- **Modify auxiliary axes**: If auxiliary axes exist for this workstation, try adjusting them. Right-click the point, select "Auxiliary Axis Matching" from the menu, or click in the right toolbar. The system will automatically calculate suitable auxiliary axis positions.Alternatively,

right-click the point, select "Edit" from the context menu, or click in the right toolbar. This enters edit mode, allowing direct modification of the Aux value. You can also double-click the corresponding model, locate the point in the pop-up window, directly edit the Aux value, and click Apply.

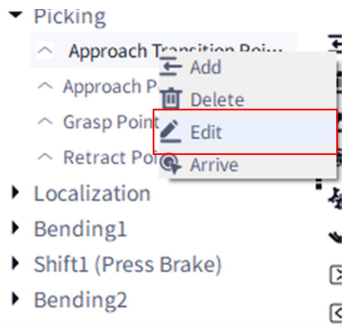


Figure 5-44: Editing Points via Right-Click Menu

- **Modifying Coordinates**: Right-click the point, select "Edit" from the context menu, or click in the right toolbar to enter edit mode and directly modify the point coordinates. Alternatively, double-click the corresponding model, locate the point in the pop-up window, modify the offset parameters, and click Apply.For teachable points, select the point, open the teach pendant in the lower-left corner, move it to the desired position, and click Teach (Joint Teach converts the point to joint coordinates; World Teach converts the point to world coordinates).
- **Modifying the mode value**: The mode value represents the robot configuration corresponding to the point. The system automatically calculates the mode value when generating path points. To modify it manually, right-click the point, select "Edit" from the pop-up menu, or click " " in the right toolbar. This enters edit mode, allowing direct modification of the mode value.Alternatively, double-click an auxiliary axis. In the pop-up window, locate the mode value for the corresponding model under the Advanced Parameters section. After modification, click Apply.

How to Add/Remove Transition Points Between Points For points where transition points can be inserted forward, right-click the point, select "Add" from the pop-up menu, or select the point and click the button in the right toolbar. This inserts a transition point before the current point. The system automatically names it,

and its initial coordinates match the selected point. Inserted transition points can be modified via teach-in or editing.Additional transition points can also be inserted before existing transition points.

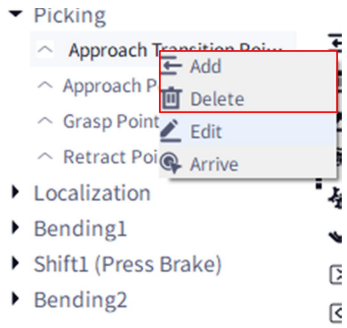


Figure 5-45: Adding/Deleting Points via Right-Click Menu

Right-click a transition point and select "Delete" from the context menu, or select the point and click the " " button in the right toolbar to remove it.

5.5.2 Transition Point Scheme

What is a Transition Point Scheme? A transition point scheme consists of pre-designed points intended to address interference or inaccessibility issues in the robot path. During point generation, the system automatically inserts these transition points at appropriate locations.

Typically, a single transition point scheme addresses only one type of workpiece (e.g., long boards). To accommodate different workpiece types, the software supports multiple transition point schemes per workstation. Users can add or remove these schemes.

How to Manage Transition Point Schemes Under a Workstation Click the "Transition" tab above the point tree on the right to view the current transition point scheme.Click the " " button on the right toolbar to open the transition point scheme management pop-up window. The left list displays all transition point schemes for the current workstation. Select an item in the list and click the "Delete" button at the bottom right to remove that scheme. Click the "Apply" button to set the selected scheme as the currently active one.

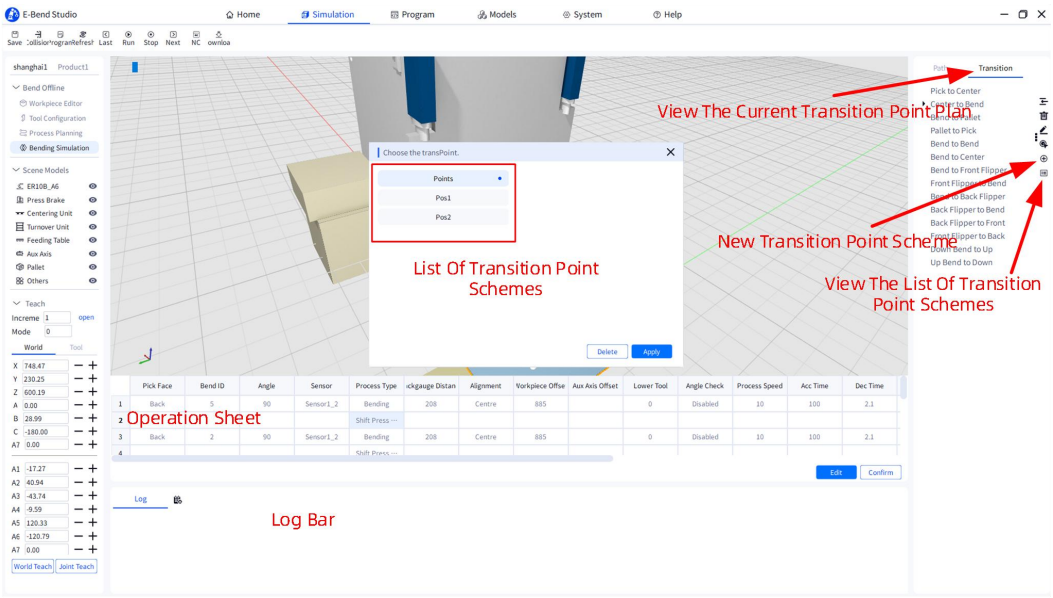


Figure 5-46 Transition Point Schemes

Close the dialog box. Click the button in the right toolbar. A blank scheme will be added under the workstation. The software automatically names it and sets it as the current scheme. Users can modify this scheme here.

Table 5-3 Transition Point Scheme Type Comparison Table

Name	Meaning	Insertion Position
Pickup to Alignment	Transition point between material pickup completion at the pickup station and arrival at the centering station	Before the entry point of the centering station
From centering to bending	Transition point from post-centering to pre-bending station	Before the first bend entry point
From bending to material discharge	Transition point from post-bending processing to pre-stacking area	Before the palletizing entry point
Unloading to Pickup	Transition point from palletizing completion back to the pick-up station	After the palletizing exit point
Bend to bend	Transition point between completion of one bend and initiation of the next	Before the subsequent bend entry point
Bend to centering	Transition point from exiting the bending machine to performing offset operations on the centering table	Before offset (centering table) entry point
Bending to the front side of the turning frame	Transition point from exiting the press brake to performing suction changeover at the front of the turret	Before the turret placement entry point

From the front of the turning frame to bending	Transition point from front of turning frame after suction change to bending machine processing	Before the subsequent bending entry point
From bending to the reverse side of the turning frame	Transition point from exiting the bending machine to the reverse side of the turning frame before performing suction change operation	Before the turning frame placement entry point
From the reverse side of the flipping frame to the bending process	Transition point from leaving the back side of the turning frame after suction change until processing on the bending machine	Before the subsequent bending entry point
From the reverse side of the flipping frame to the front side	Transition point from placing the workpiece on the reverse side of the flipping frame to picking up on the front side	Before the turning frame gripping entry point
From the front side to the back side of the flipping frame	Transition point from placing the workpiece on the front side of the flipping frame to retrieving it from the back side	Before the flipping frame's grasping entry point

Similar to path points, you can insert points under a specific type by right-clicking the point or type, selecting "Add," or selecting the point and clicking the button in the right toolbar. To delete a point, right-click and select "Delete," or select the point and click the button in the right toolbar.Right-click and select "Edit," or select the point and click the button in the right toolbar to enter edit mode. Here you can modify point coordinates, attach axis positions, adjust mode values, or teach a point using the teach pendant. Right-click and select "One-Click Move" or select the point and click the button in the right toolbar to view the robot pose at the current point.

How to replace transition points from a transition point scheme into a path / How to overwrite path transition points with those from a transition point scheme Click the "Path" tab in the right-side point tree. Click the "  " button in the right-side toolbar to overwrite the current path's transition points onto the current transition point scheme based on classification. Click the "  " button to overwrite

the current path's points with transition points from the current transition point scheme.

5.5.3 Simulation Run

Simulation Run is the core functional module of the software. Based on data created in previous steps (such as workpiece import, die configuration, and process planning), it performs high-fidelity simulation of the entire bending automation cell's workflow within a 3D simulation environment.

The core purpose of the simulation module is to visually validate and optimize the robot's motion path in a 3D environment, confirming whether the trajectory for moving sheet metal is efficient, safe, and collision-free. Close attention must be paid to the robot's posture when approaching the press brake, loading/unloading positions, and during workpiece flipping. Ensure safe distances are maintained between the robot and the press brake, dies, and safety fencing.

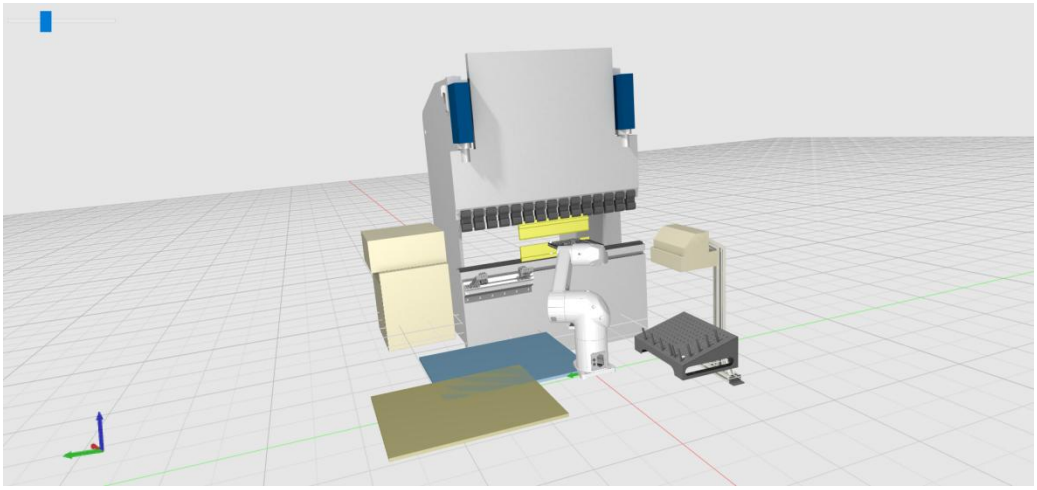


Figure 5-47 3D Simulation Interface

5.5.3 Function Buttons

Table 5-4 Simulation Function Button Description Table

Icon	Core Function	Details: Detailed Explanation: and Usage Scenarios
Save	Save Current Simulation Progress	After confirming simulation results are accurate, immediately save the project to fully record all successful simulation parameters and path data into the project file.

Collisior	Real-time collision detection during simulation	Collision detection is a real-time safety verification feature. When enabled, the software continuously calculates for geometric interference between the robot, gripper, workpiece, and surrounding equipment (e.g., press brakes, molds) throughout the simulation.
rogra	Generate Robot Operation Programs	Convert the robot motion trajectory from simulation into a robot program.
Refresl	Reset path points to initial state	When dissatisfied with the current debugged path points, click this button to restart path point debugging.
Last	Single-step simulation from current point to previous point	\
Run	Enable simulation	After debugging path points, press the Run button to verify the path's feasibility and identify potential optimization needs.
Stop	Simulation stopped	\
Next	Step-by-step simulation from current point to next point	\
NC	Generate press brake program and download to press brake CNC system	\
ownloa	Download robot program to robot controller	\

5.5.4 Model Parameters

5.5.4.1 Loading Table Settings

The loading platform settings interface consists of two sections: first, basic information parameters, primarily including the configuration of key point poses on the workbench and the placement orientation of sheet metal; second, coordinate system parameters, primarily involving adjustments to the loading platform's user coordinate system.

1） Basic Information

The basic information interface is shown in Figure 5-48.

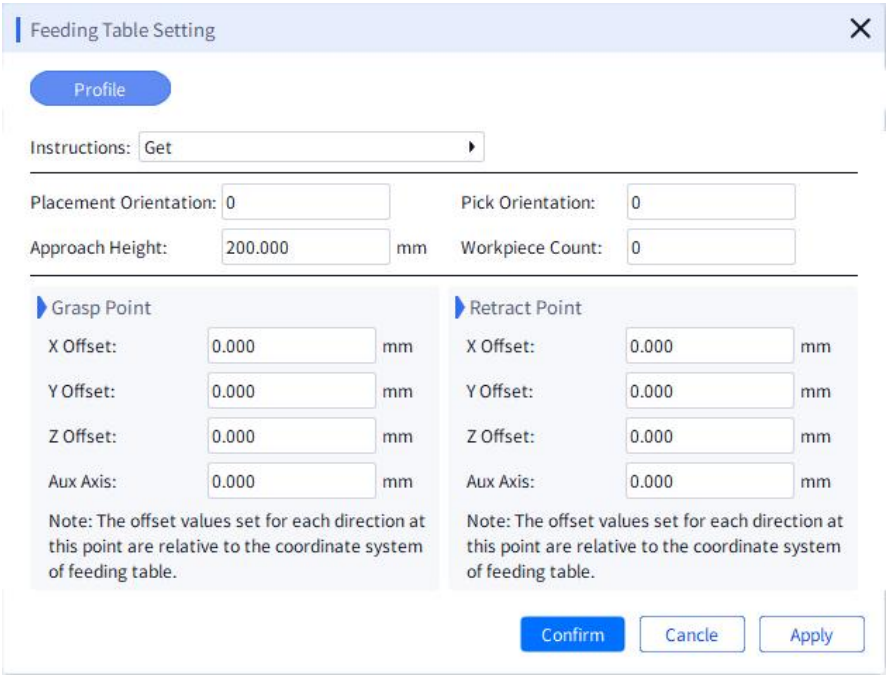


Figure 5-48 Loading Table Settings Interface

The parameters in the Basic Information interface are described in Table 5-5.

Table 5-5: Parameter Description Table for the Loading Table Settings Interface

Parameter Name	Parameter Description
Command	The default selection is Get; this value does not need to be changed.
Placement Orientation	**Function:** This parameter defines the initial placement angle of the workpiece on the loading table. **Reference:** The 0° position is defined where the X-axis of the workpiece coordinate system (typically aligned with the workpiece's long edge) coincides with the X-axis of the loading platform coordinate system. **Direction:** The positive direction of the angle is defined as clockwise rotation around the workpiece's own Z-axis. **Adjustment Constraint:** Currently, this parameter only supports adjustment in 90° increments (e.g., 0°, 90°, 180°, 270°).
Gripping Pose	**Function:** The rotation angle of the robot end-effector flange around the Z-axis of the workpiece coordinate system during part gripping. **Reference:** The 0° position is defined where the X-axis of the flange coordinate system aligns with the X-axis of the sheet metal coordinate system. **Direction:** The positive direction of the angle is defined as clockwise rotation around the workpiece's own Z-axis. **Adjustment Constraint:** Currently, this parameter only supports adjustment in 90° increments (e.g., 0°, 90°, 180°, 270°).
Entry Point	**Function:** This parameter sets the height of the entry point. Located directly above the

	pick-up point (in the positive direction of the Z-axis in the loading platform coordinate system), the height difference between the entry point and the pick-up point is defined by this parameter to ensure safe robot movement during approach.
Number of Workpieces	**Function:** Specifies the number of workpieces to be processed, affecting the calculation of the Z value for the pick point.
Grab Point	**Function:** Sets the position of the pick-up point. (Note: Its offset is based on the origin of the user coordinate system, with the offset coordinate system being the loading platform coordinate system)
Exit Point	**Function:** Sets the exit point position. (Note: Its offset is relative to the pick-up point, with the offset coordinate system being the loading platform coordinate system)

2) Coordinate System Parameters

The coordinate system parameters interface is shown in Figure 5-49.

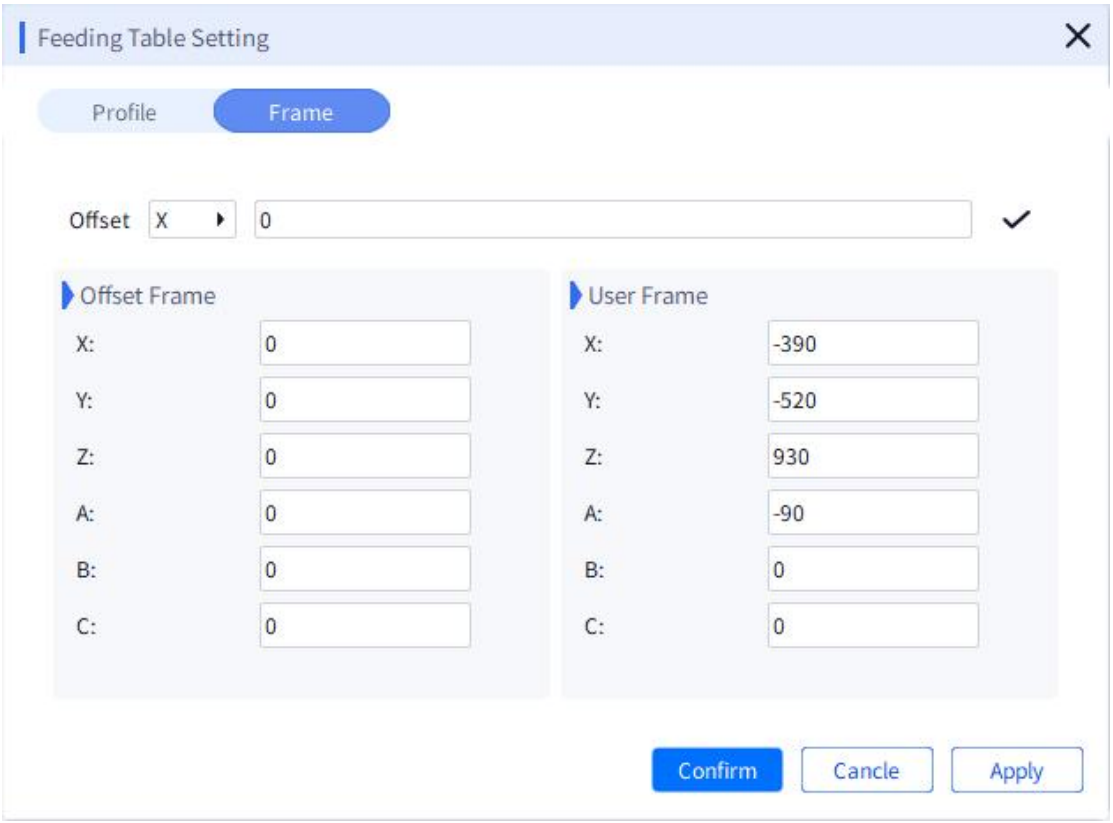


Figure 5-49 Coordinate System Parameters Interface

The coordinate system parameters are described in the following table:

Table 5-6: Coordinate System Parameter Description Table

Parameter Name	Parameter Description
Offset	**Function:** Rotates and offsets along the X, Y, and Z axes of the user coordinate system on the loading platform to adjust the pose of the model's user coordinate system; Note: Values within the text box represent incremental offsets and must be

	distinguished from the offset parameter values;
Offset Coordinate System	**Function:** Rotate and offset along the X, Y, and Z axes of the loading platform's user coordinate system to adjust the model's user coordinate system pose; Note: Values in the text box represent total offsets and should be distinguished from the offset parameter values;
User Coordinate System	**Function:** Adjust the coordinate position and orientation of the model within the 3D scene;

5.5.4.2 Alignment Platform Settings

The alignment platform settings interface consists of two sections: First, basic information parameters, primarily including the setup of key point poses on the workbench and the placement orientation of sheet metal; Second, coordinate system parameters, primarily involving adjustments to the alignment platform's user coordinate system.

1） **Basic Information**

The Basic Information interface is shown in Figure 5-50.

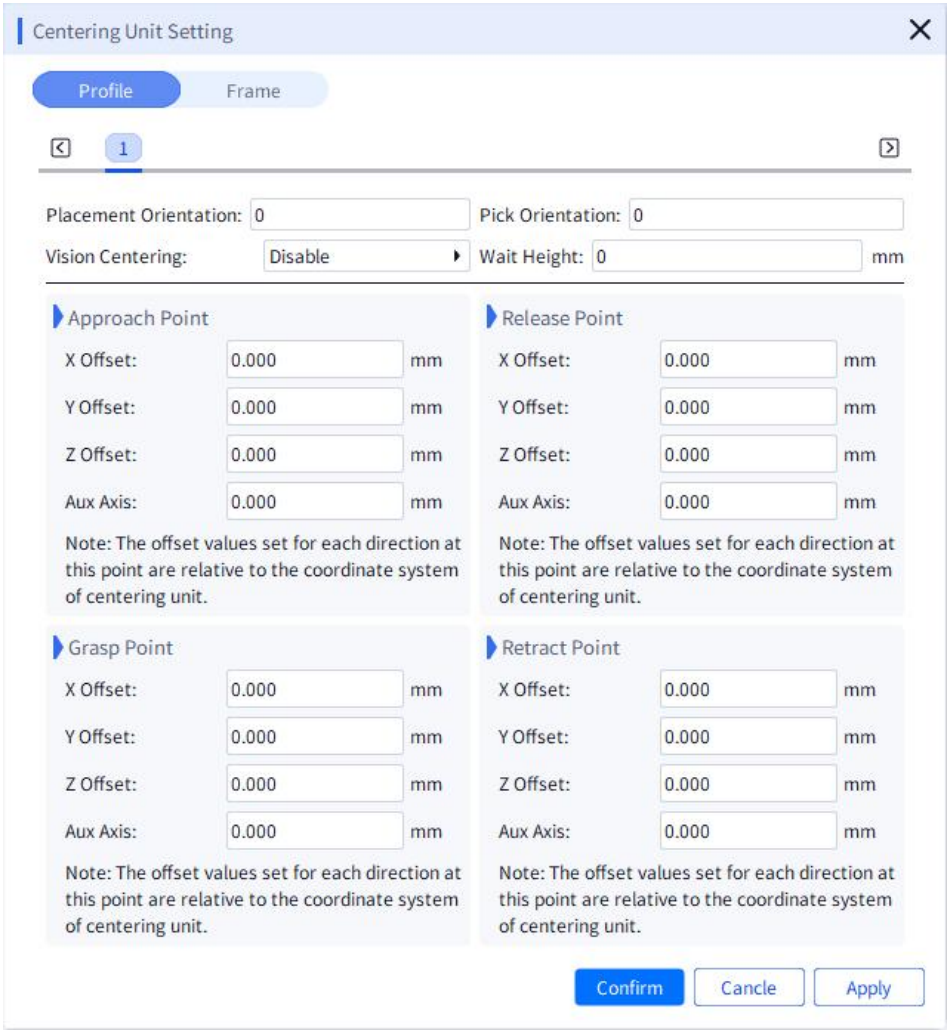


Figure 5-50 Basic Information Interface

The parameters in the Basic Information interface are described in Table 5-7.

Table 5-7: Parameter Function Description Table for Basic Information Interface

Parameter Name	Parameter Description
Placement Orientation	**Function:** This parameter defines the initial placement angle of the workpiece on the centering table. **Reference:** The 0° position is defined where the X-axis of the workpiece coordinate system (typically aligned with the workpiece's long edge) coincides with the X-axis of the centering table coordinate system. **Direction:** The positive direction of the angle is defined as clockwise rotation around the workpiece's own Z-axis. **Adjustment Constraints:** Currently, this parameter only supports adjustment in 90° increments (e.g., 0°, 90°, 180°, 270°).
Grab Pose	Cannot be modified; must be set in the process planning section.
Visual Alignment	**Function:** Sets whether this alignment station is a vision-based alignment station;

Wait Height	**Function:** Offset the value of this parameter along the negative Z-axis direction of the grasping point, using the grasping point as the reference. The resulting point is the wait point;
Entry Point	**Function:** Set the entry point position. (Note: Its offset is based on the venting point, with the coordinate system being the centering platform coordinate system) Calculate the positions of the entry point, vent point, and exit point on the centering platform based on the following offsets:
Discharge Point	**Function:** Set the vent point position. (Note: Its offset is based on the origin of the user coordinate system, with the coordinate system being the centering platform coordinate system)
Exit Point	**Function:** Set the exit point position. (Note: Its offset is based on the pickup point, with the coordinate system being the centering platform coordinate system)

2) Coordinate System Parameters

The interface parameters for the centering platform coordinate system are the same as those for the feeding platform coordinate system.

5.5.4.3 Bending Machine Settings

The press brake settings interface is primarily divided into three sections: First, basic information settings, mainly for adjusting the working points on the press brake; Second, advanced parameter settings, mainly for configuring the press brake machine tool information; Third, coordinate system settings, mainly for adjusting the press brake user coordinate system.

1) Basic Information

The Basic Information interface is shown in Figure 5-51.

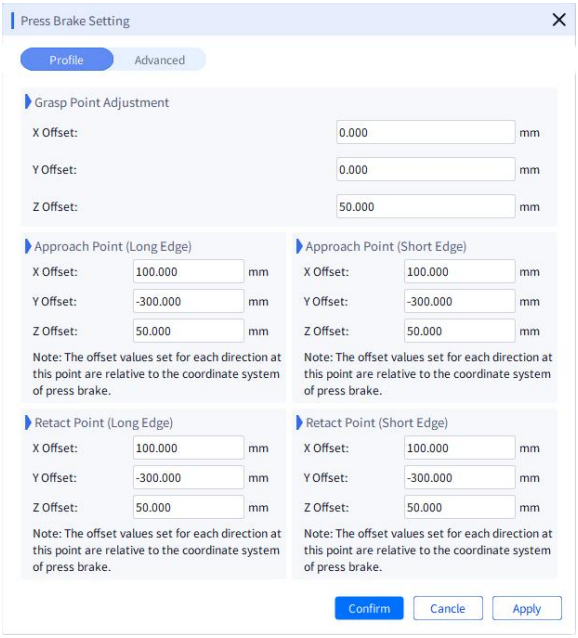


Figure 5-51 Basic Information Settings Interface

Parameter descriptions for the Basic Information interface are listed in Table 5-8.

Table 5-8: Basic Information Interface Parameter Reference Table

Parameter Name	Parameter Description
Grab Point Adjustment	**Function:** Adjust the pose of the gripper when picking up the workpiece after changing the suction point ( ) and the pose when releasing the workpiece ( ). (Note: This value cannot be modified here; it should be modified in the process planning section).
Entry Point (Long Edge)	**Function:** Sets the entry point position. (Note: Its offset is based on the bending point, using the press brake coordinate system.)
Exit Point (Long Edge)	**Function:** Sets the exit point position. (Note: The offset is based on the bending point, with the coordinate system being the press brake coordinate system)
Entry Point (Short Edge)	No setting required.
Exit Point (Short Edge)	No setting required.

2) Advanced Parameter Settings

The advanced parameter interface is shown in Figure 5-52.

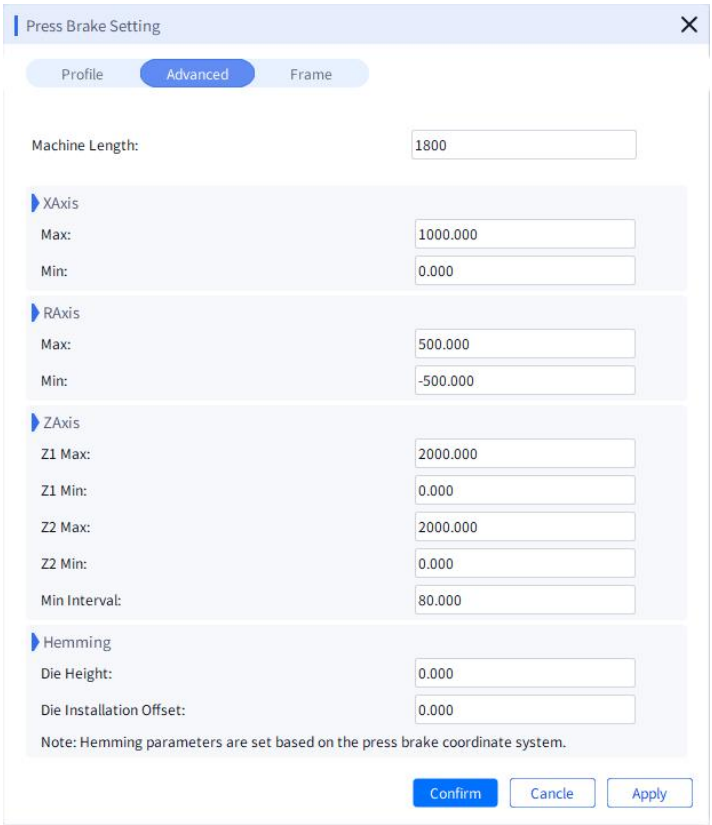


Figure 5-52 Advanced Parameter Interface for Bending Machine

The parameters for advanced settings are described in Table 5-9 below.

Table 5-9 Introduction to Press Brake Advanced Parameters

Parameter Name	Parameter Description
Machine Length	**Function:** Adjusts the length of the lower die support .
X-axis	**Function: Sets** the X-axis movement limit for the stop finger.
R-axis	**Function:** Limit the movement of the stop finger on the R-axis.
Z-axis	**Function:** Limits the movement of stop fingers 1 and 2 along the Z-axis.
Flattening	**Lower Die Height:** Z-value of the flattening groove in the press brake coordinate system. **Lower Die Installation Offset:** Absolute value of the Y coordinate of the flattening groove in the press brake coordinate system. (Note: Flattening function is not currently supported)

3) Coordinate System Settings

The parameters for the centering table coordinate system interface are the same as those for the loading table coordinate system interface.

5.5.4.4 Flip Stand Settings

Flip frame settings are primarily divided into three sections: First, basic information, which mainly involves setting the working points for each flip frame operation and the movement positions of the moving axes on flip frames equipped with moving axes; Second, advanced settings, which primarily involve parameter settings related to the movement of moving axes for flip frames equipped with moving axes; Third, coordinate system settings, which mainly involve adjusting the user coordinate system of the flip frame model.

1) Basic Information

The Flip Frame Basic Information interface is shown in Figure 5-53.

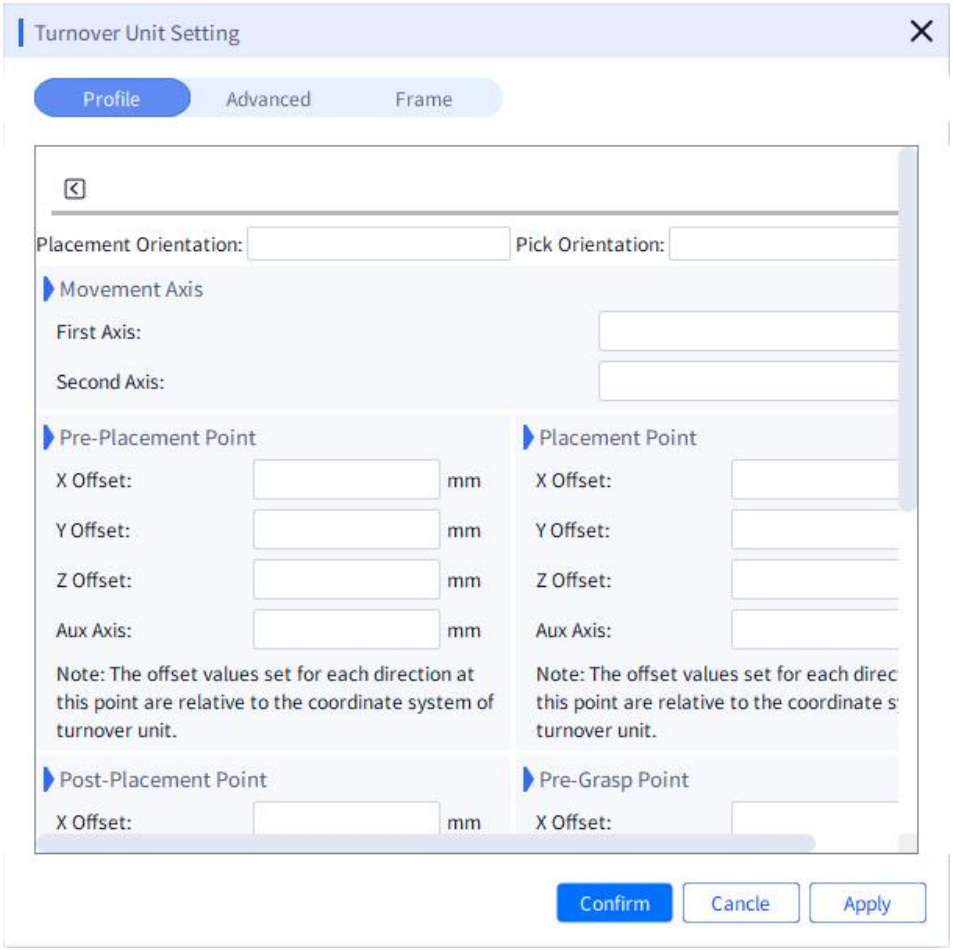


Figure 5-53 Flip Frame Basic Information Interface

The parameters in the Flip Frame Basic Information interface are described in Table 5-10.

Table 5-10: Basic Information Interface Parameter Description Table

Parameter Name	Parameter Description
Placement Orientation	**Function:** This parameter defines the placement angle of the workpiece on the flipping fixture. **Reference:** The 0° position is defined where the X-axis of the workpiece coordinate system (typically aligned with the workpiece's long edge) coincides with the X-axis of the flipping frame coordinate system. **Direction:** The positive direction of the angle is defined as clockwise rotation around the workpiece's own Z-axis. **Adjustment Constraints:** Currently, this parameter only supports adjustment in 90° increments (e.g., 0°, 90°, 180°, 270°).
Grab Pose	Cannot be modified; must be configured in the process planning section.
Movement Axes	**Function:** Used to adjust the positions of the axes on the moving axis **when** placing the workpiece on a turning frame with moving axes (from left to right: Axis 1, Axis 2);

	Axis 1: Adjusts the position of Axis 1; **Axis 2:** Axis 2 position adjustment;
Placement Entry Point	**Function:** Sets the placement entry point position. (Note: Its offset is based on the placement point, using the turret coordinate system)
Placement Point	**Function:** Set the placement entry point position. (Note: The offset is based on the origin of the flipper user coordinate system, with the coordinate system being the flipper coordinate system)
Placement Exit Point	**Function:** Set the placement exit point position. (Note: The offset is based on the placement point, using the flipping frame coordinate system)
Grab Entry Point	**Function:** Set the grab entry point position. (Note: The offset is based on the grab point, using the flipper coordinate system)
Grab Point	Cannot be set here; must be configured in the process planning section.
Grab Exit Point	**Function:** Set the grab exit point position. (Note: Its offset is based on the grab point, using the flipping frame coordinate system)

2) Advanced Parameter Settings

The advanced parameter settings interface for the turning frame is shown below:

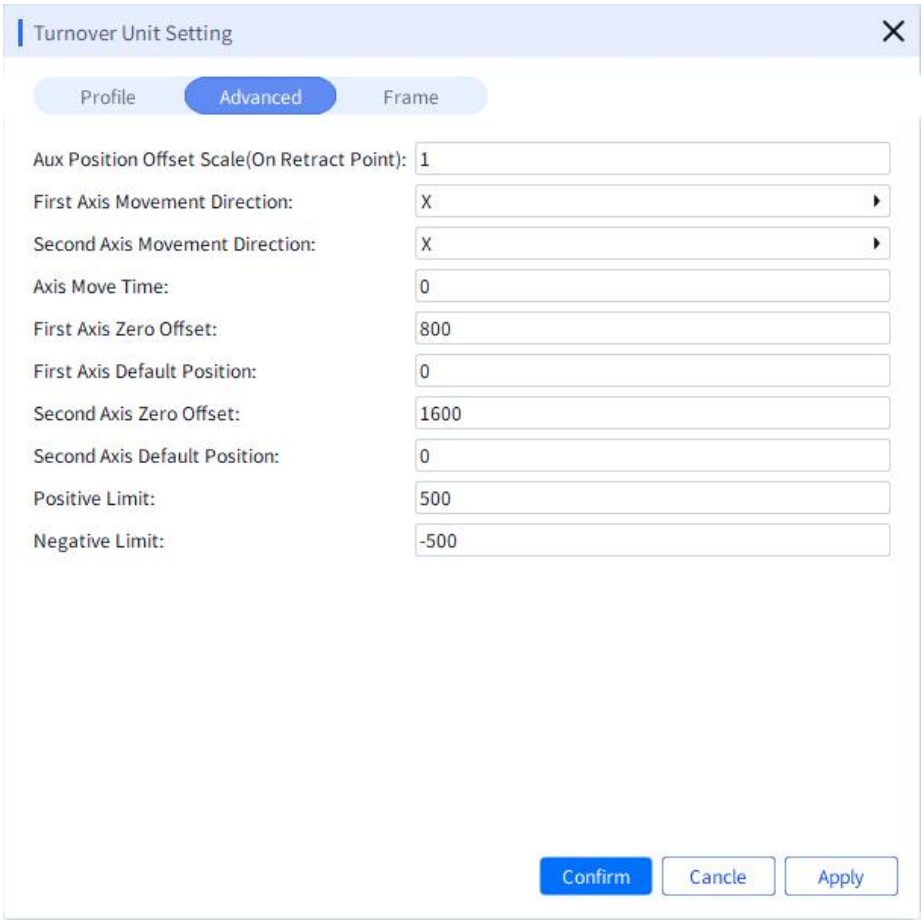


Figure 5-54 Flip Frame Advanced Parameters Interface

The advanced parameters of the flipping frame are introduced in the table below:

Table 5-11 Flip Frame Advanced Parameter Introduction Table

Parameter	Parameter Description

Name	
Additional Axis Position Shift Ratio (at Exit Point)	**Function Function :** This parameter automatically calculates the auxiliary axis position at the exit point within the flipping frame. Auxiliary axis at exit point = Auxiliary axis value at key point-gripping point on the flipping frame × this parameter value.
Axis 1 Movement Direction	**Function:** Sets the movement direction of Axis 1 in the flipping frame along the X, Y, or Z axis of the flipping frame's user coordinate system. (Typically configured for flipping frames with non-parallel axes.)
Axis 2 Movement Direction	**Function:** Sets the movement direction of the flipping frame's second axis along the X, Y, or Z axis of the flipping frame's user coordinate system. (Typically configured for flipping frames with non-coaxial movement.)
Axis Movement Time	**Function:** Sets the movement speed of the axis.
Axis 1 Zero Point Offset	**Function:** Adjusts the zero point position of Axis 1 based on actual conditions. All calculations of Axis 1 movement distance use this position as the zero point.
Axis 1 Default Position	**Function:** Sets the initial position of Axis 1.
Axis 2 Zero Offset	**Function:** Adjust the zero point position of Axis 2 based on actual conditions. All distance calculations for Axis 2 movement use this position as the zero point.
Axis 2 Default Position	**Function:** Sets the initial position for Axis 2.
Positive Limit	**Function:** Positive limit value for axis movement.
Negative Limit	**Function:** Adjust the negative limit value for axis movement.

3) Coordinate System Settings

The parameters for the centering platform coordinate system interface are the same as those for the loading platform coordinate system interface.

5.5.4.5 Additional Axis Settings

The auxiliary axis parameter settings interface is primarily divided into two sections: the basic settings interface, which mainly configures the limit values for auxiliary axes and displays dimensional information for auxiliary axis models; and the advanced interface, which primarily configures the robot's joint configuration mode values and auxiliary axis positions when the robot operates on the centering platform, flipping frame, and bending machine.

1) Settings

The auxiliary axis settings interface is shown below:

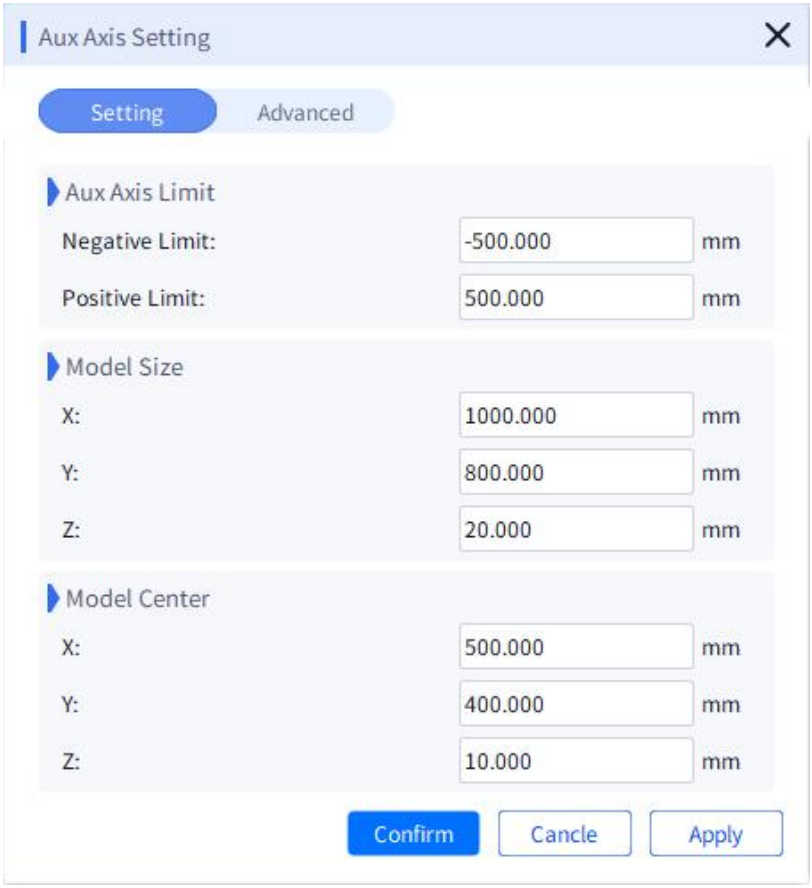


Figure 5-55 Additional Axis Settings Interface

Parameter descriptions for the additional axis settings interface are provided in Table 5-12.

Table 5-12 Parameters in the Additional Axis Settings Interface

Parameter Name	Parameter Description
Auxiliary Axis Limit	**Function:** Sets the positive and negative limits for the auxiliary axis.
Model Dimensions	**Function:** Automatically calculated data based on the imported auxiliary axis model.
Model Center	**Function:** Data automatically calculated based on imported additional axis models.

2) Advanced Interface

The advanced interface of the auxiliary axis settings dialog box is shown in

Figure 5-56.

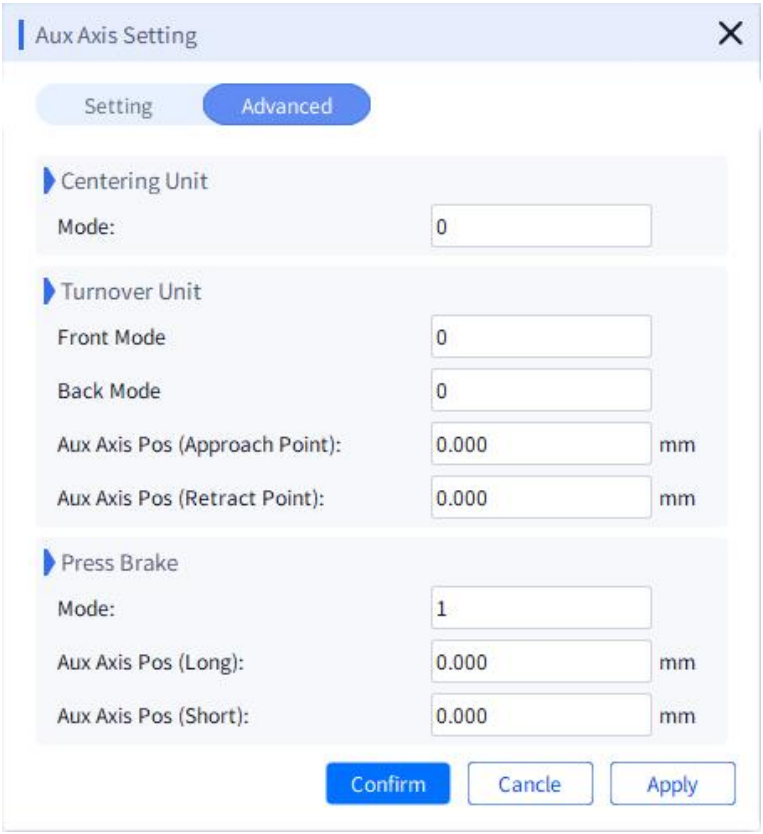


Figure 5-56 Advanced Interface for Additional Axes

Parameters in the Advanced Interface are described in Table 5-13.

Table 5-13 Parameters in the Advanced Interface for Additional Axes

Parameter Name	Parameter Description
Alignment Platform	**Function:** Sets the values for the robot's operation on the centering platform (m od e). Primarily affects the values for the key points on the centering platform (mode).
Flip Frame	**Function:** Sets the robot's mode value and auxiliary axis position during flip frame operations, primarily affecting the key point mode value and auxiliary axis value on the flip frame. **Front Mode:** Keypoint mode value when the robot enters the work area from the front direction of the flipping frame. **Back Mode:** The mode value of the key point when the robot enters the work area from the reverse direction of the flipping frame. **Auxiliary Axis Position (Entry Point):** Default position of the auxiliary axis at the flipping frame entry point. **Auxiliary Axis Position (Exit Point):** Default position of the auxiliary axis at the exit point of the flipping frame.
Bending Machine	**Function:** Sets the mode value and default auxiliary axis positions for the robot when operating on the bending machine. Primarily affects the mode value of key

points and default auxiliary axis values on the bending machine.

5.5.4.6 Uncoiler Settings

The Unloader Settings dialog box functions are divided into two main sections: First, basic information settings, which primarily configure the key points for the robot when working on the unloader and the placement pose of the workpiece within this processing area; Second, adjustments to the user coordinate system of the unloader model.

1) Basic Information

The basic information interface of the unloading table settings pop-up window is shown in Figure 5-57.

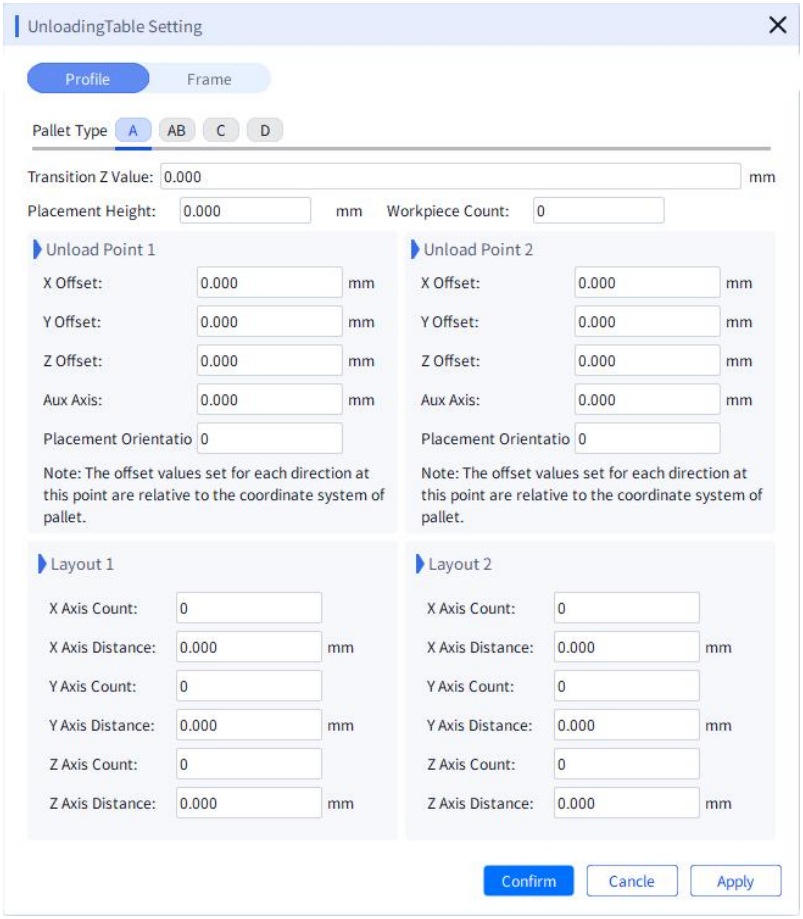


Figure 5-57 Unloading Table Basic Information Interface

The parameters in the unloading station basic information interface are described in Table 5-14.

Table 5-14 Parameter Description Table for Basic Information Interface

Parameter Name	Parameter Description
Palletizing	**Function:** Specifies the palletizing type . Four palletizing methods are supported: A,

Type	AB, C, and D.
Z Offset Value	**Function:** Specifies the Z-axis height of the entry and exit points in the feeding area. The offset is calculated based on the drop point and applied within the user coordinate system of the feeding platform.
Placement Height	**Function:** None.
Workpiece Count	**Function:** Displays the number of simulated workpieces.
Nesting Point 1	**Function:** Sets the position of Blanking Point 1. (Note: Its offset is based on the blanking point origin, using the blanking table coordinate system)
Unloading Point 2	**Function:** Sets the position of blanking point 2. (Note: Its offset is based on the blanking point origin, using the blanking table coordinate system. This point is only valid for AB palletizing types.)
Layout 1	**Function:** Not currently supported
Layout 2	**Function:** Not currently supported

5.6 Program Generation and Download

This section primarily describes how to generate robot programs and press brake CNC system programs, and how to deploy these programs to the robot controller and press brake CNC system.

5.6.1 Robot Program Generation

Click the "Program" button in the function bar to open the program generation pop-up window (as shown in Figure 5-58).

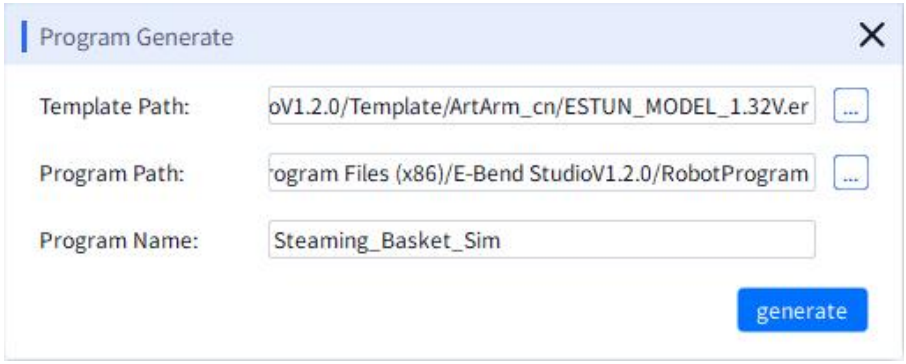


Figure 5-58 Program Generation Dialog

The Template Path parameter selects the appropriate program template for generating the robot program. Currently, two templates are available: 1.24V and 1.32V, supporting different controller versions respectively. Templates must be selected under manufacturer guidance. The Program Path specifies the storage

location for the generated robot program, defaulting to the RobotProgram folder within the installation directory. The Program Name designates the folder name for storing the generated robot program file.

After configuring the above parameters, click the Generate button to create the robot program.

5.6.2 CNC System Program Generation

CNC system programs do not require a generation process and can be directly downloaded to the CNC system. See Section 5.6.4.

5.6.3 Robot Program Download

Click the "Deploy" button in the function bar to open the robot program deployment pop-up window, as shown in Figure 5-59.

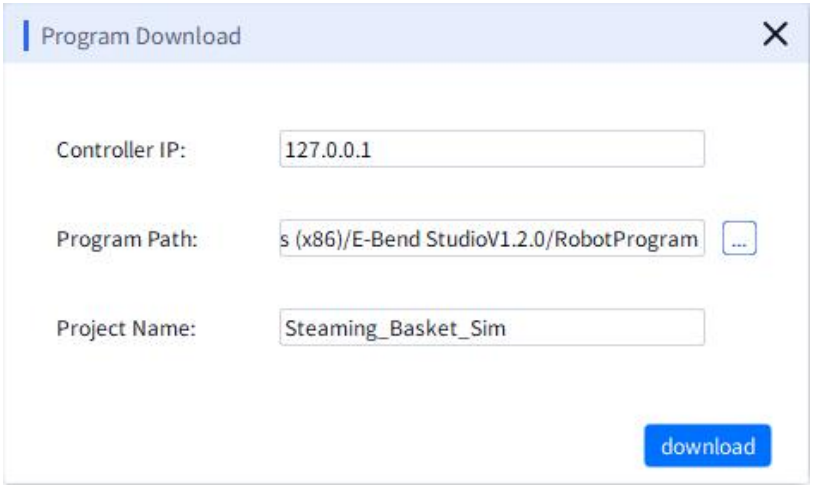


Figure 5-59 Program Download Dialog Interface

Here, the Controller IP is the IP address of the controller communicating with the device running this software; the Program Path is the directory where the robot program is stored; and the Project Name is the name of the project to be uploaded to the controller.

After configuring the above parameters, click the Download button. If communication fails, an alarm prompt will appear.

5.6.4 CNC System Program Download

Click the "NC Button" in the function bar to open the NC program pop-up window, as shown in Figure 5-60.

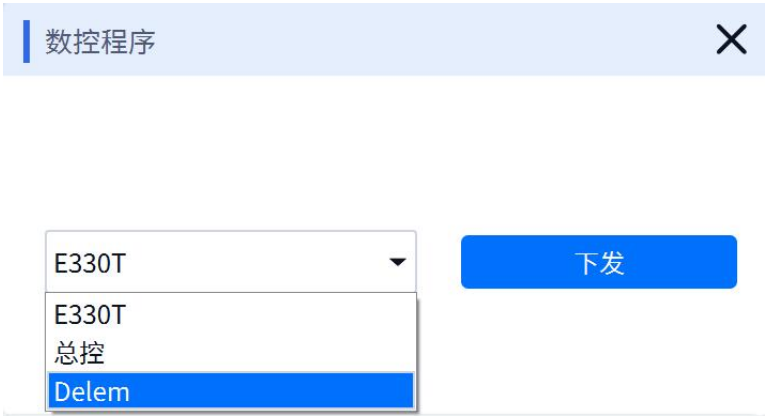


Figure 5-60 NC Program Pop-up Window Interface

Users can select the bending machine's CNC system brand from the dropdown menu, then click the Download button to complete the download of the CNC system program.

Note: Before downloading the NC system program, configure the press brake's IP address and port number in the software's "System" interface. The system interface is shown in Figure 5-61.

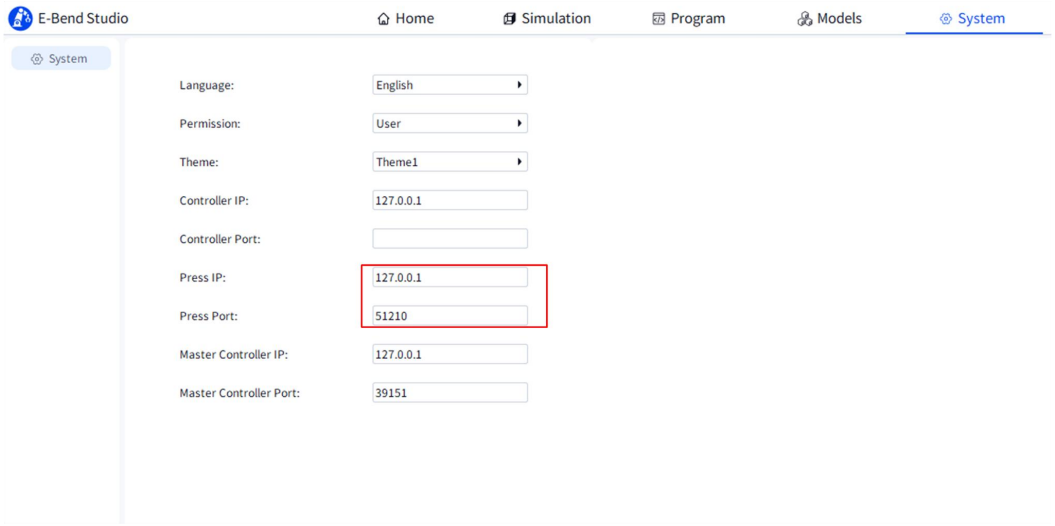


Figure 5-61 System Interface