



Software Manual TMstudio

Original Instruction

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Revision History Table

Revision	Date	Revised Content
1.00	2020-07-29	Original release

1. General

1.1 Overview

TMstudio is an offline simulation application software for users to create simulated projects for TM Robots. Through simulations, users can accelerate their process in developments of robot operating environments and applications, and detect potential faults.

TMstudio comes with three modules: **Workstation**, **TCP generate**, and **Palletizing Wizard**.

Workstation allows users to import robot model, tool, workpieces and robot application devices to create a scene for the simulation before actually building the workstation and developing the robot project, **TCP generate** helps users set the TCP information based on the end tool in CAD file, and **Palletizing Wizard** simulates and exports the layout file of the TM Palletizing Operator.

Click the icon of TMstudio to launch the TMstudio user interface as shown below to start using TMstudio.

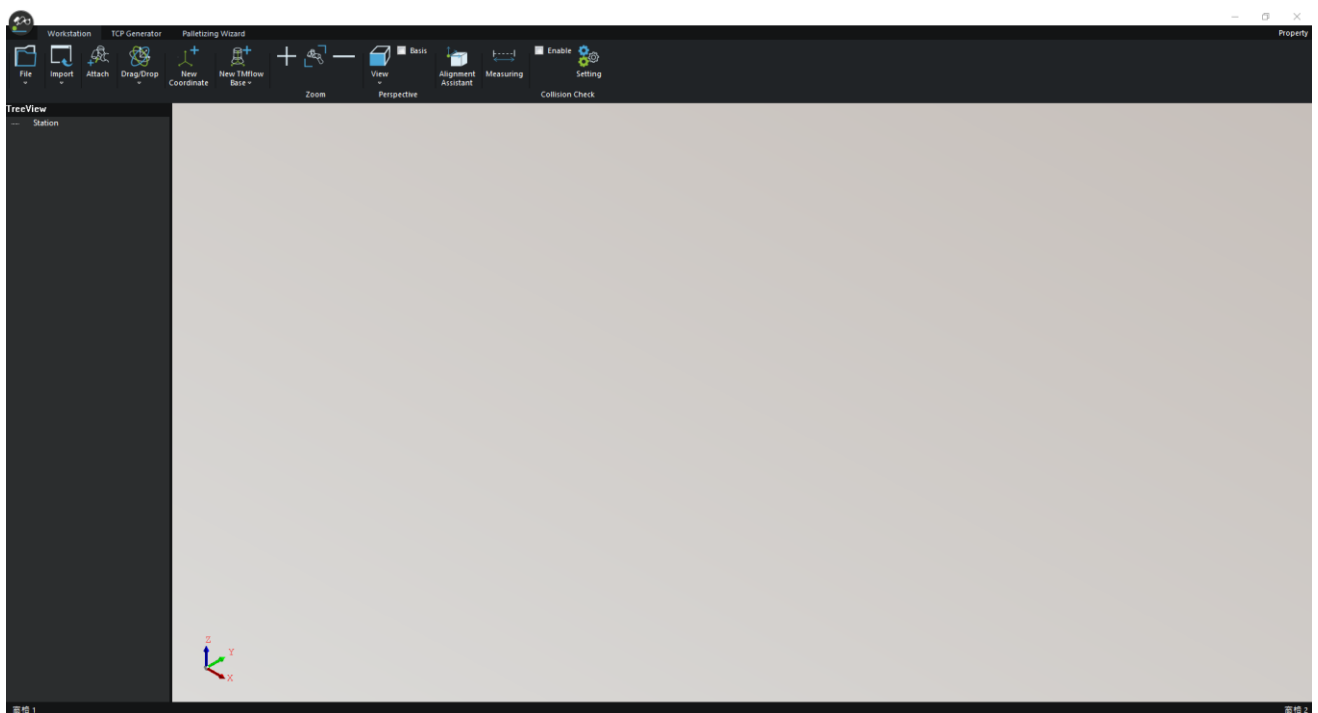


Figure 1: TMstudio User Interface

NOTE:

1. For details about **Palletizing Wizard**, refer to **TM Palletizing Operator User's Manual**
2. The default TMstudio allows users to conduct palletizing simulation. However, it requires specific USB dongle to export the simulation file. For details, contact Techman Robot representatives.

Note

Click **Property** at the top right to change the language to display, adjust the arrow size of the coordinate system, or check the software version.

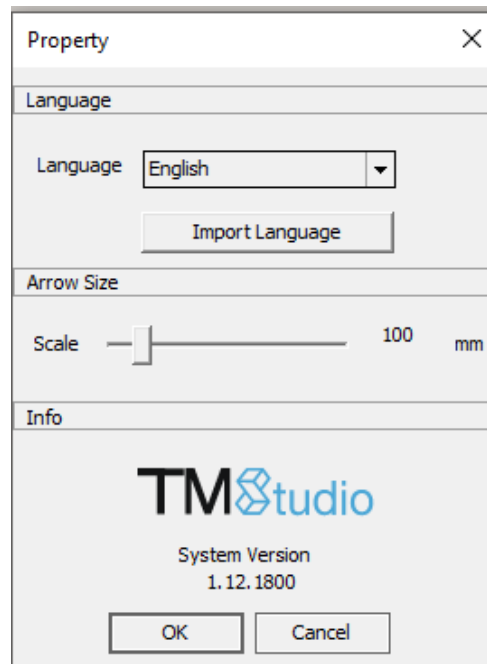

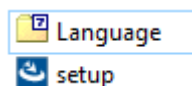


Figure 2: Property

User may use **Import Language** function to add their preferred language versions into TMstudio. To enable language options in Import Language, users may download **Language** pack when downloading TMstudio software (the **setup**  execution file), and they may unzip language pack and select the unzipped folder when importing language options in TMstudio.




Languages available by default:

- English
- Chinese (Traditional)
- Chinese (Simplified)
- Japanese
- German
- Spanish
- French
- Italian

Language options by **Import Language**:

- Korean
- Vietnamese
- Thai
- Polish
- Portuguese
- Hungarian

Some of the functions described in this manual are related to operations in TMflow 1.80 or later version. There may be functional compatibility concerns among different versions. Confirm the software version before importing your TMstudio outputs to TMflow. To confirm TMflow version, click  at the top right corner of TMflow for details.

1.2 System Requirements

Operating System	Microsoft Windows 7 (with service pack 1 or above)
CPU	Intel® Core i5™ series processor or equivalent/higher
Memory	4GB or above
Storage	More than 1GB of available space
Display Resolution	1,366 x 768 recommended
Pre-installed Software	<ol style="list-style-type: none"> 1. 2010Redistributable_vcrist (x64/x86) 2. 2017Redistributable_vcrist (x64/x86) 3. Microsoft.Net 4.52 or above

2. TCP Generator

TCP Generator helps users load the user-designed tool end to mount on the virtual robot with the process setting and save the configured TCP parameters as a TCP.zip file loaded by the TM Robot. The passages below describe the method of using TCP generate.

2.1 TCP Setting Wizard

Click **TCP Generator** > **Wizard** as shown below to pop up the dialog box for further settings.

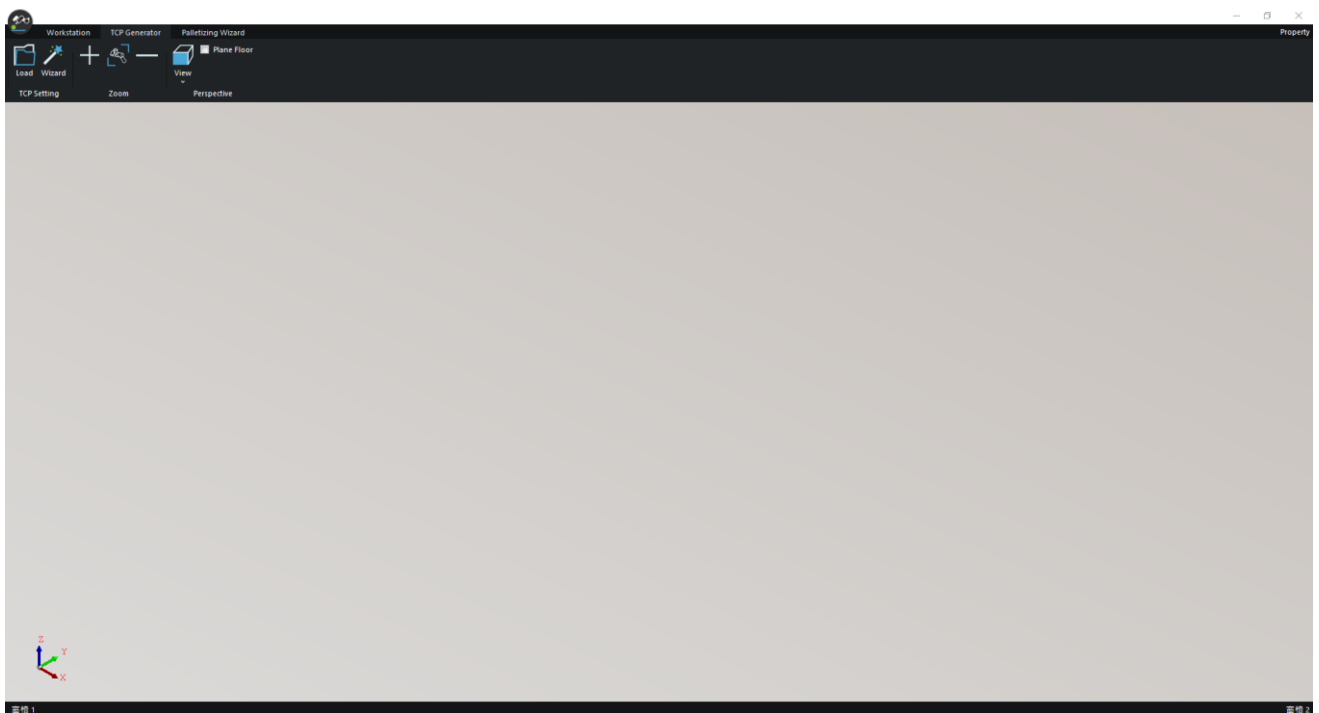


Figure 3:TCP Setting Wizard

As the dialog box pops up, various settings, such as **Robot Module** for robot selection, **Import Tool** for loading the end tool, robot link setting, TCP settings, and **Advanced Function**, are shown as below.

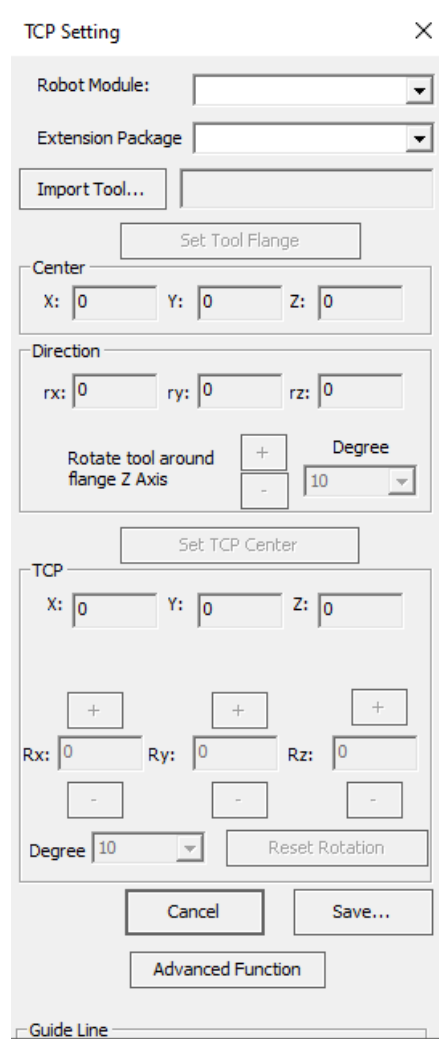


Figure 4: TCP Setting Dialog Box

2.2 Robot Module, Extension Package and Import Tool

Select the item in the dropdown next to **Robot Module** for the robot module to be loaded later and use the drop-down menu to select **Extension Package**. Then, click **Import Tool** to load the end tool as shown below.

The robot flange is equipped with official hardware package, for example, TM Compact 3D Camera Package, and you can pre-load the official hardware package when setting up TCP in TMstudio, without the need to merge tool and official hardware model in other 3D CAD software in advance.

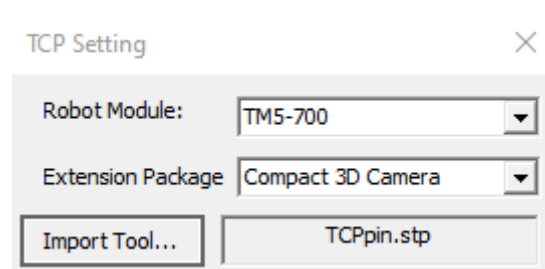


Figure 5: Robot Module, Extension Package and Import Tool

The interface shows the tool model at this point and loads the robot in the next stage.

2.3 Tool Flange Setting

Once the end tool is loaded, click **Set Tool Flange** for the connection with the robot.

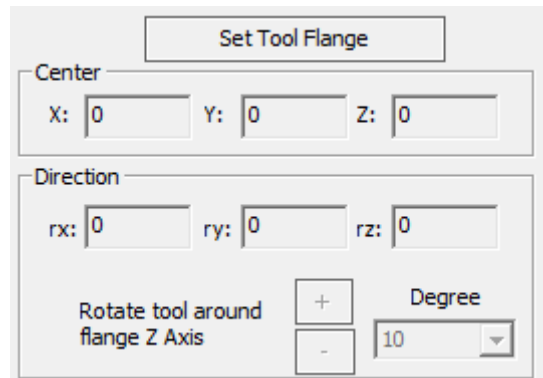
The image shows a 'Set Tool Flange' dialog box. It has a title bar with the text 'Set Tool Flange'. Below the title bar, there are two main sections: 'Center' and 'Direction'. The 'Center' section contains three input fields for X, Y, and Z coordinates, all of which are currently set to '0'. The 'Direction' section contains three input fields for rx, ry, and rz, also all set to '0'. Below these, there is a label 'Rotate tool around flange Z Axis' followed by two buttons, '+' and '-', and a dropdown menu currently showing '10' with the word 'Degree' to its right.

Figure 6: Set Tool Flange

The dialog box of **Tool Flange Center** pops up as shown below for users to select the center feature of the end tool and the flange of the robot between **Middle of Two Point** and **Arc Center**.

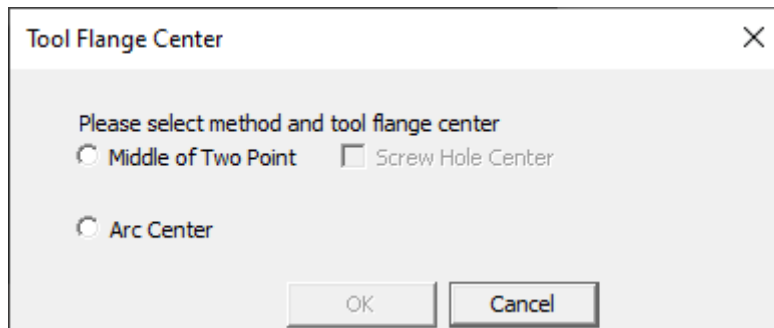
The image shows a 'Tool Flange Center' dialog box. It has a title bar with the text 'Tool Flange Center' and a close button (X). The main area contains the text 'Please select method and tool flange center'. Below this text, there are three radio button options: 'Middle of Two Point', 'Screw Hole Center', and 'Arc Center'. The 'Middle of Two Point' option is currently selected. At the bottom of the dialog box, there are two buttons: 'OK' and 'Cancel'.

Figure 7: Tool Flange Center

- **Middle of Two Point:** Users select the center point determined by choosing two points on the end tool as the center of the tool flange.
- **Middle of Two Point / Screw Hole Center:** Users select two screw holes and use them to determine the center point of the tool flange.
- **Arc Center:** Users select the center of the arc as the center of the tool flange.

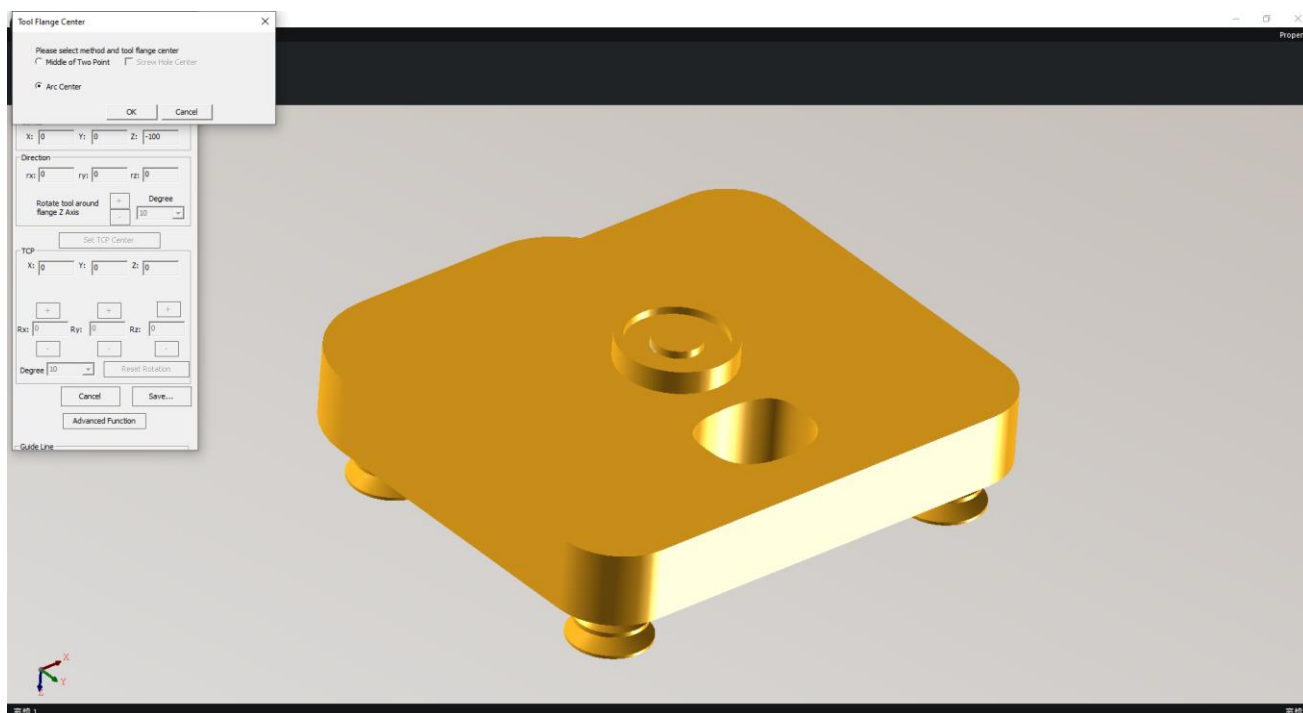


Figure 8: Advanced Function

Also, users can click **Advance Function > Framework** to find features, or check the box in **Guide Line** to move the guide line to the specified position and click **OK** to determine the center of the tool flange.



Figure 9: Framework

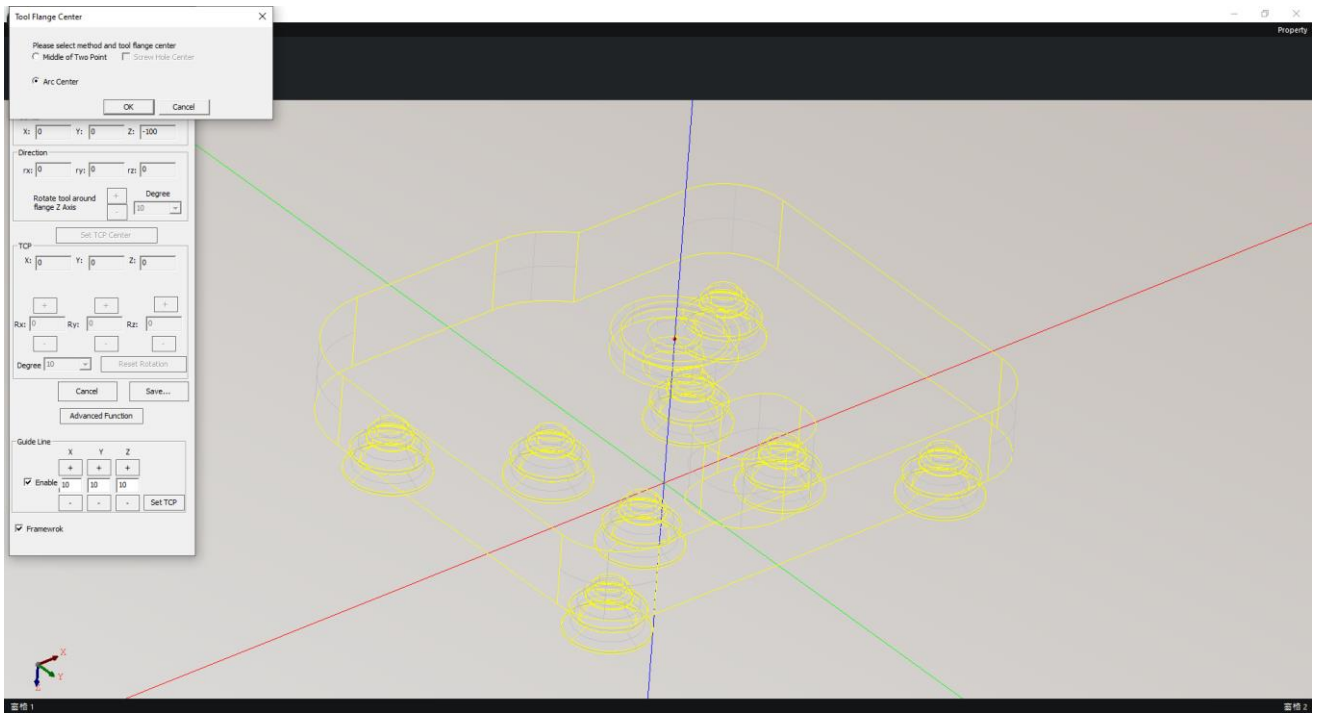


Figure 10: Guide Line

Once the Tool Flange Center is set, the **Set Flange Face** dialog box will pop up. Simply select the plane to connect to the robot flange face on the tool and click **OK**.

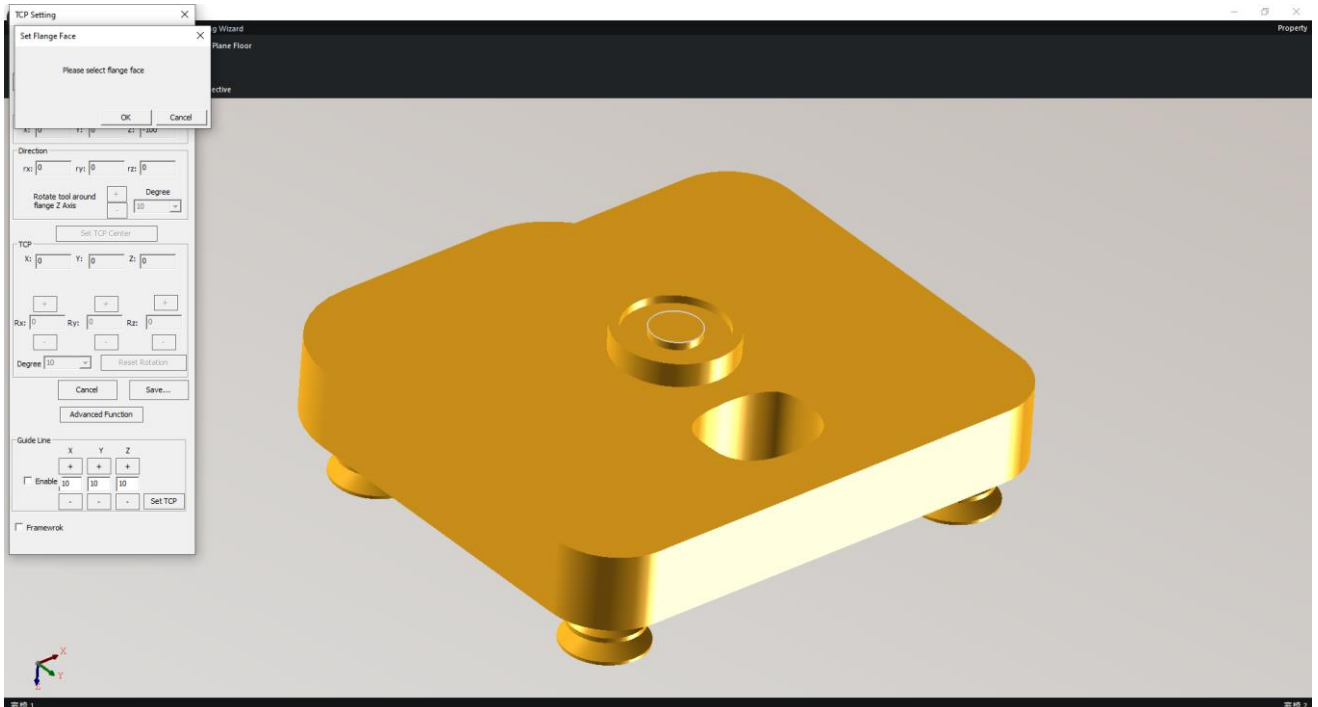


Figure 11: Set Flange Face

Once the tool flange is set, the tool will be connected to the robot. Users can, however, adjust the Z-axis rotation angle of the connection surface.

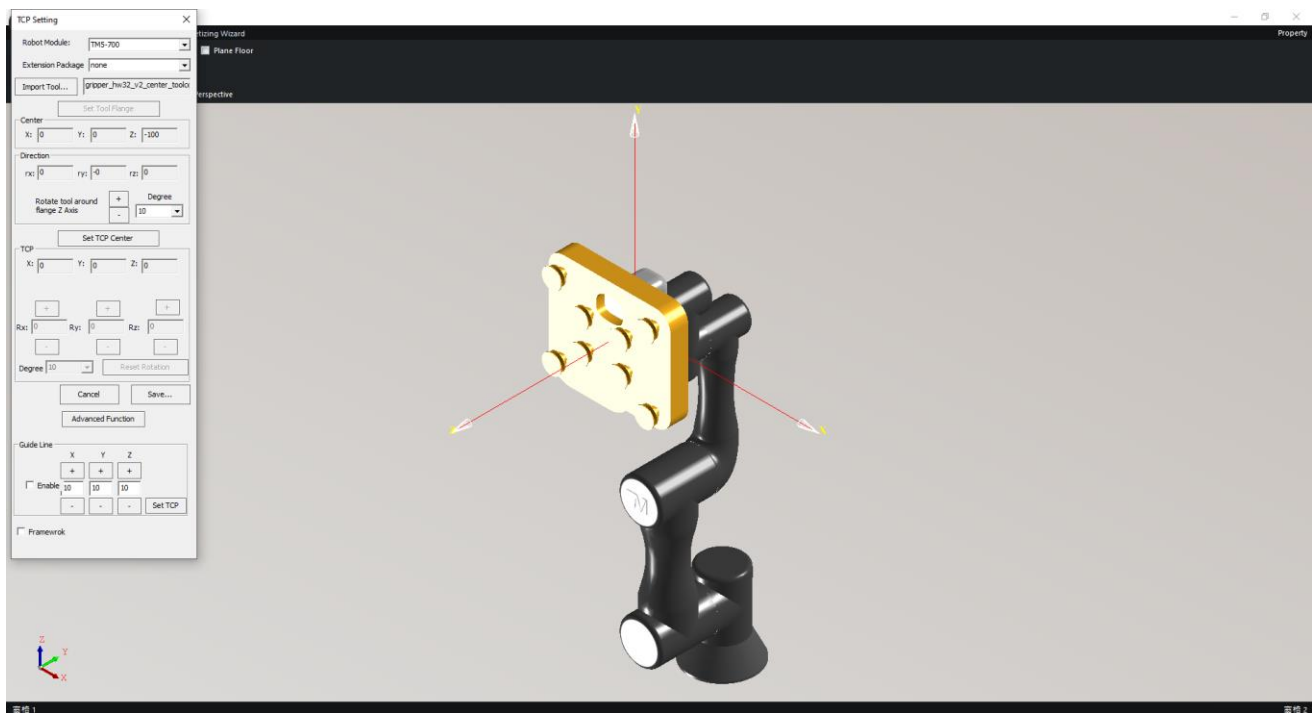


Figure 12: Z-axis Rotation Angle

2.4 TCP Setting

Users can set TCP center by clicking **Set TCP Center** after completed **Set Tool Flange**.

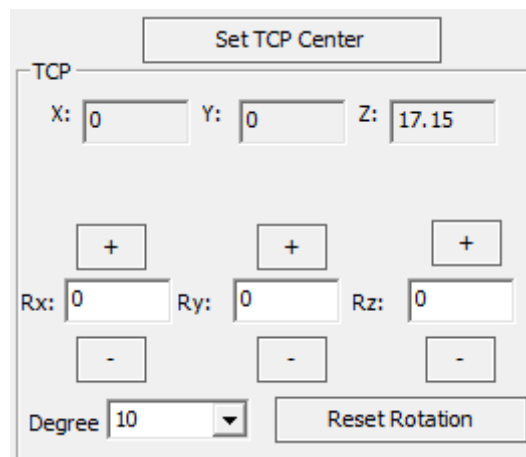


Figure 13: Set TCP Center

The location of the TCP center is determined by the same feature selection process.

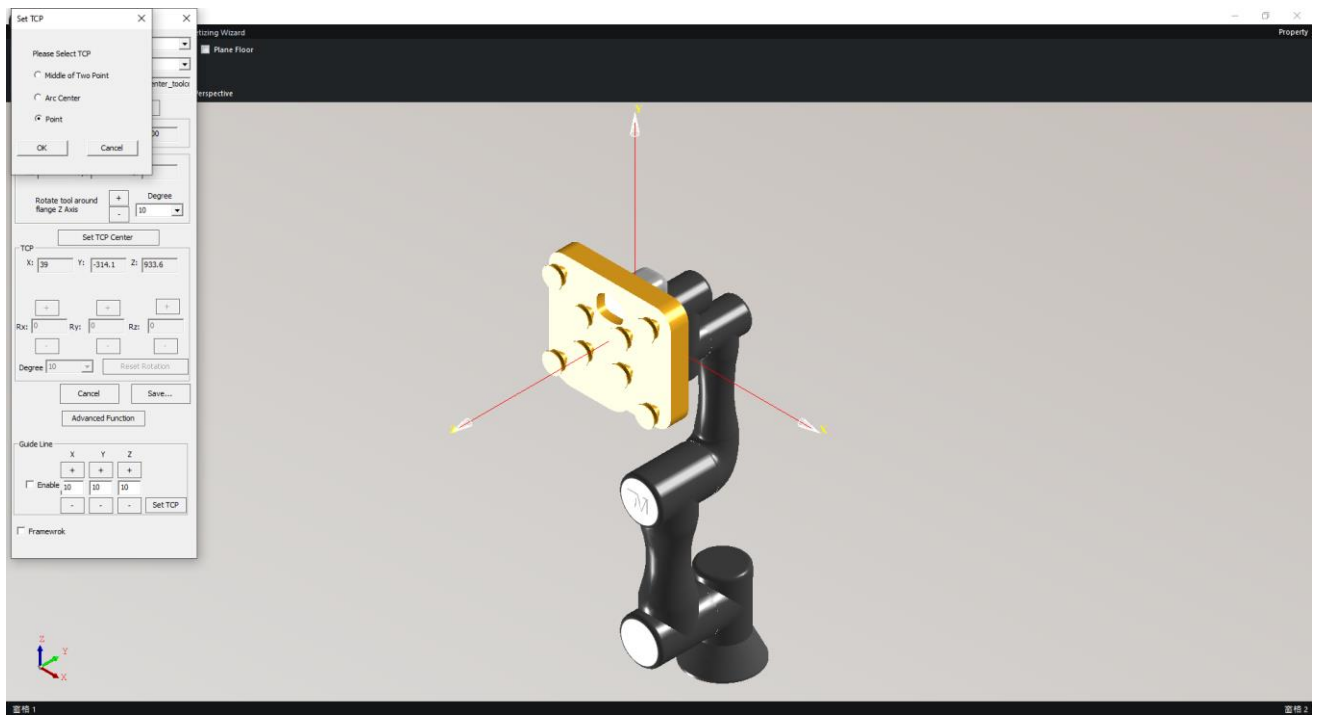


Figure 14: TCP Setting

2.5 Save TCP

Once completed all the steps, users can click **Save** at the bottom of the dialog box to save the TCP information.

When saving the .tcp file, a .tcp file compressed in a zip file is generated for the robot to import as well. The zip file comes with the relative relationship between the TCP and the robot flange of the end tool.

Users should enter the rest of the information in **TCP setting** after imported.

The file must be saved in the directory under **TM_Export** → **TMstudio** of the software package.

TMstudio-V1.12.1100 > TM_Export > TMstudio

2.6 Load TCP

In **TCP generate**, click **Load** to open the saved .tcp file. Users can modify the previously saved settings.

3. Workstation

In **Workstation**, users can load the user-designed environment model of the workstation to fix the relative relationship between the environment and the workstation in the process, operate the robot with the virtual controller, and proceed with the distance measurement in the measurement function.

3.1 File

Click **File** to use the dropdown menu. Users have to select “New” to create a new scene file or “Open” to open an existing scene file in order to start **Workstation**.

New: add a new scene file

Open: open an existing scene file

Save: save the current scene

Export to TMflow: export saved scene to TMflow

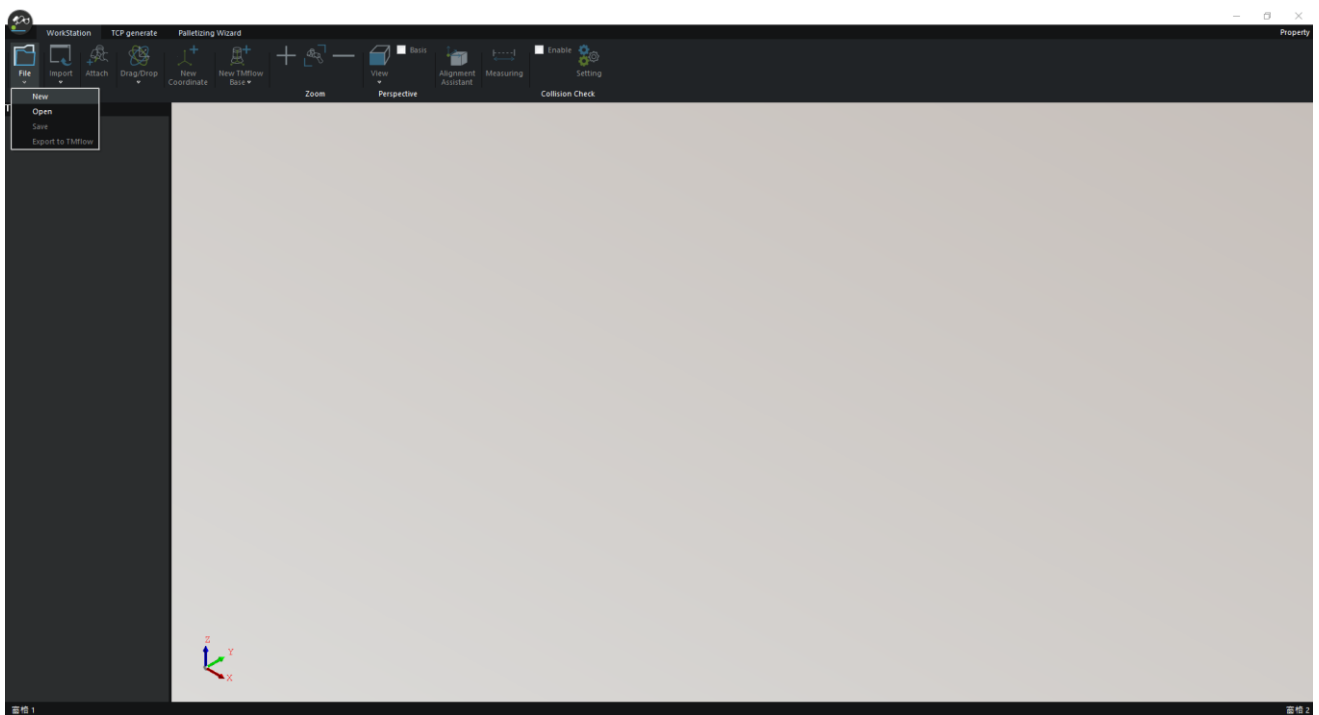


Figure 15: File

Before exporting the scene to TMflow, **save** the scene first. Enter a name for the scene.

When **exporting** the scene, input the name of the saved scene.

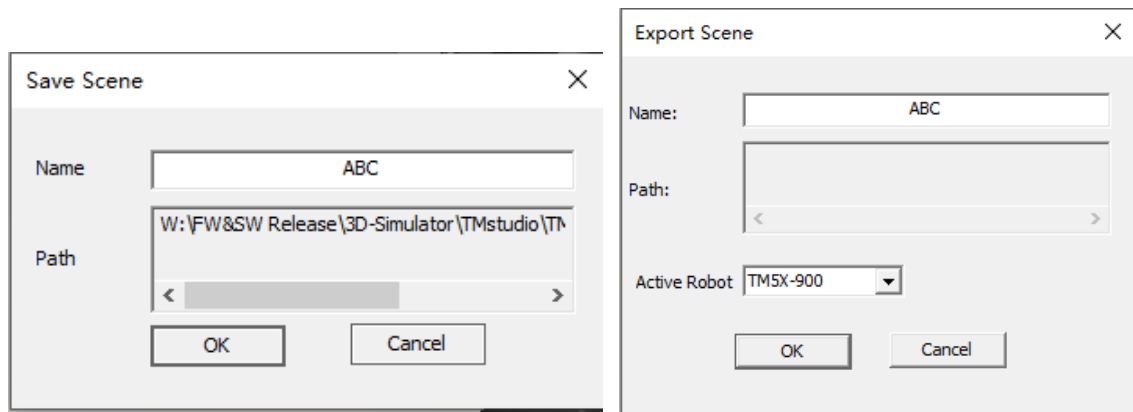


Figure 16: Save and Export

3.2 Import

Click **Import** to load the CAD files (in stp. Format) or import the selected robot model. Refer to the options below for drop-down menu.

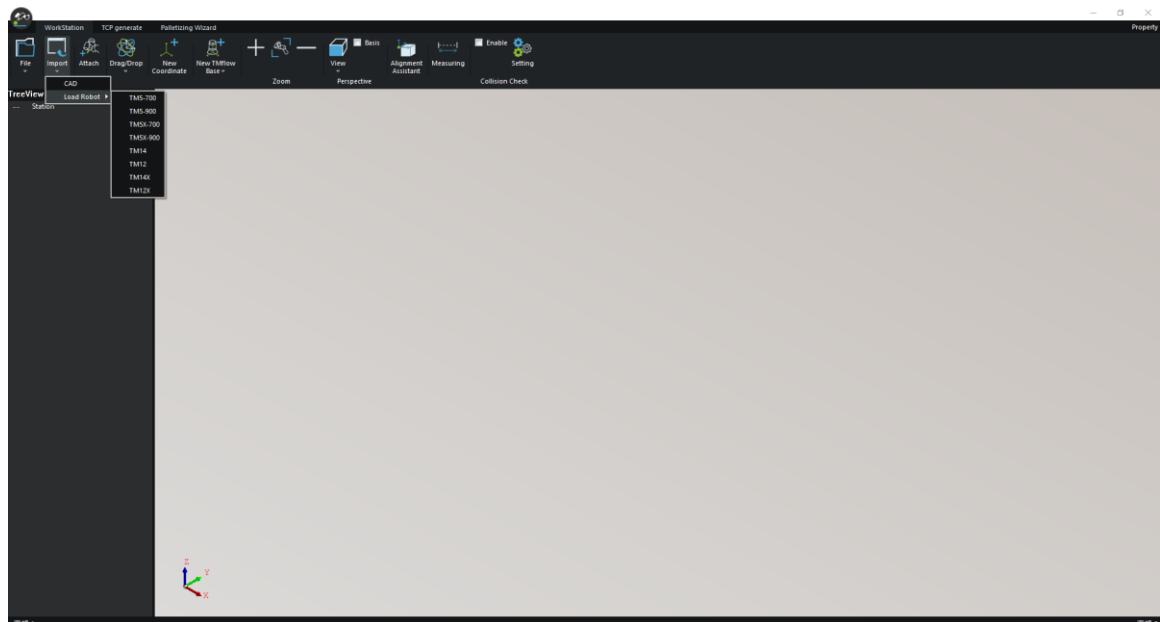


Figure 17: Import

3.3 Attach

After importing the robot model, users can click **Attach** to pop up the dialog box to select the desired **.tcp** file for the tool to be used. Next, the end tool model becomes translucent and controllable with the mouse cursor, and users can drag it onto the robot to finish attaching the tool.

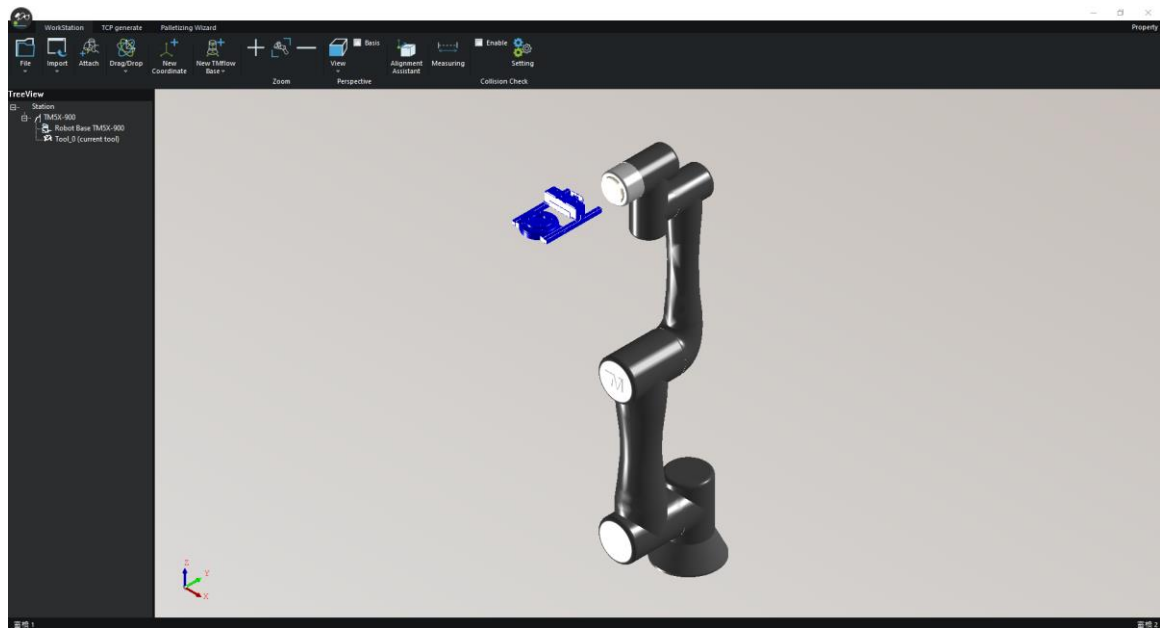


Figure 18: Attach (1/2)

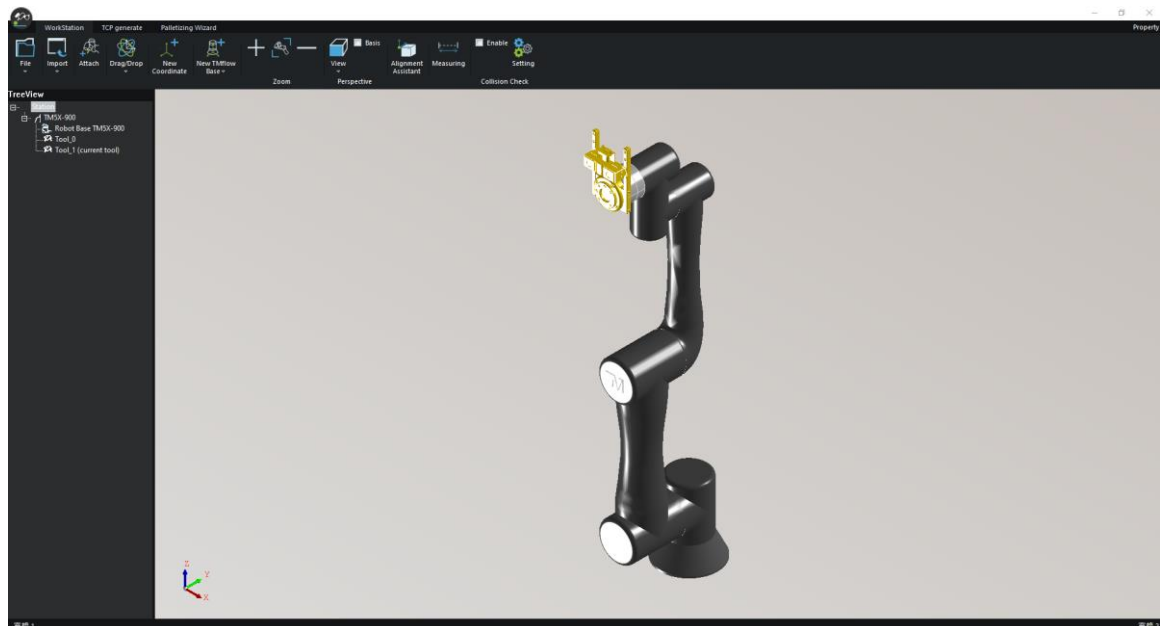


Figure 19: Attach (2/2)

3.4 Drag/Drop

Drag/Drop is used to drag the currently selected target with the displayed reference coordinate system. To enable the reference coordinate, right-click on the selected target and select “**Show Coordinate**”. Drag/Drop can be enabled or disabled in the Drag/Drop dropdown. Refer below for the button positions in the dropdown.

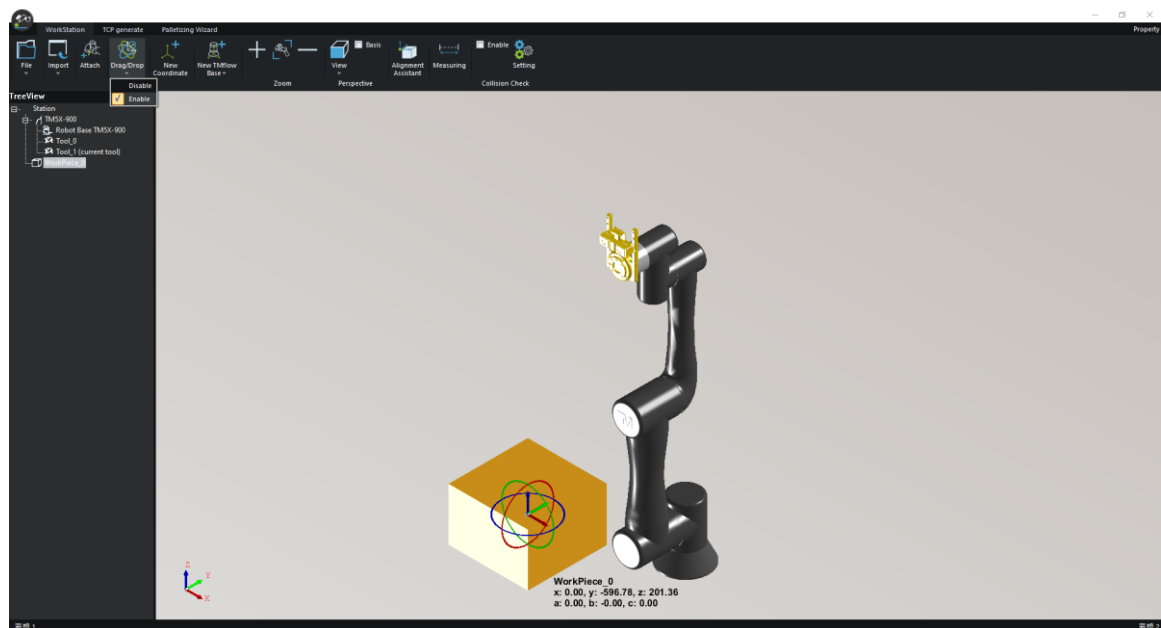


Figure 20: Drag/Drop

Press and hold the left button on the mouse with the desired moving direction to have the selected target move along the direction or rotate. Drag and drop along the X axis of the reference coordinate system as shown below.

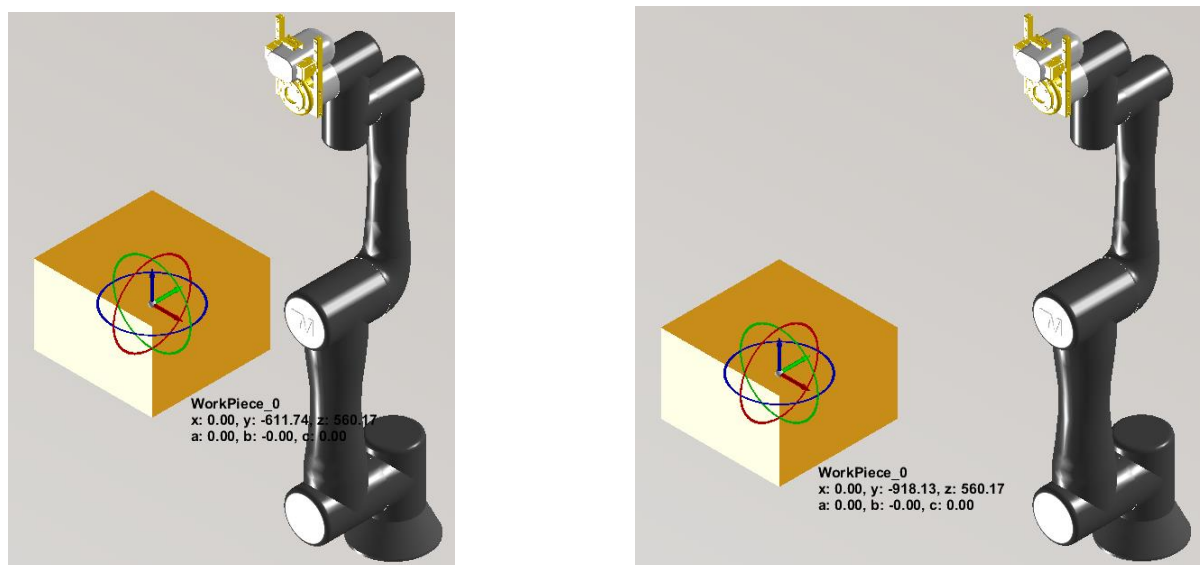


Figure 21: Press and Hold to Drag and Drop

Double click on the desired moving direction with the left button on the mouse to pop up the dialog box to enter the distance to move or the angle of rotation.

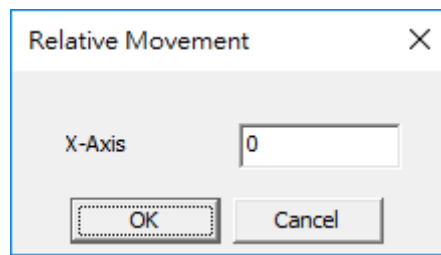


Figure 22: Relative Movement

3.5 New Coordinate

Click **New Coordinate** to add a new reference coordinate system to the scene. If there is a selected target when adding, the reference coordinate system will be added to the target. If there is no selected target, the reference coordinate system will be added at the origin of the coordinate to the scene.

Adding a reference coordinate system to the selected target is shown as below.

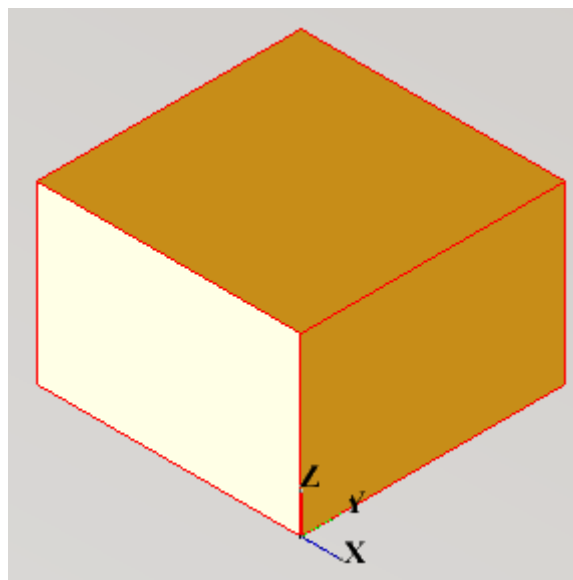


Figure 23: New Coordinate

3.6 New TMflow Base

Click **New TMflow Base** to add a **Custom base**, **Vision base** or **Import Landmark** to the object(s) in the scene.

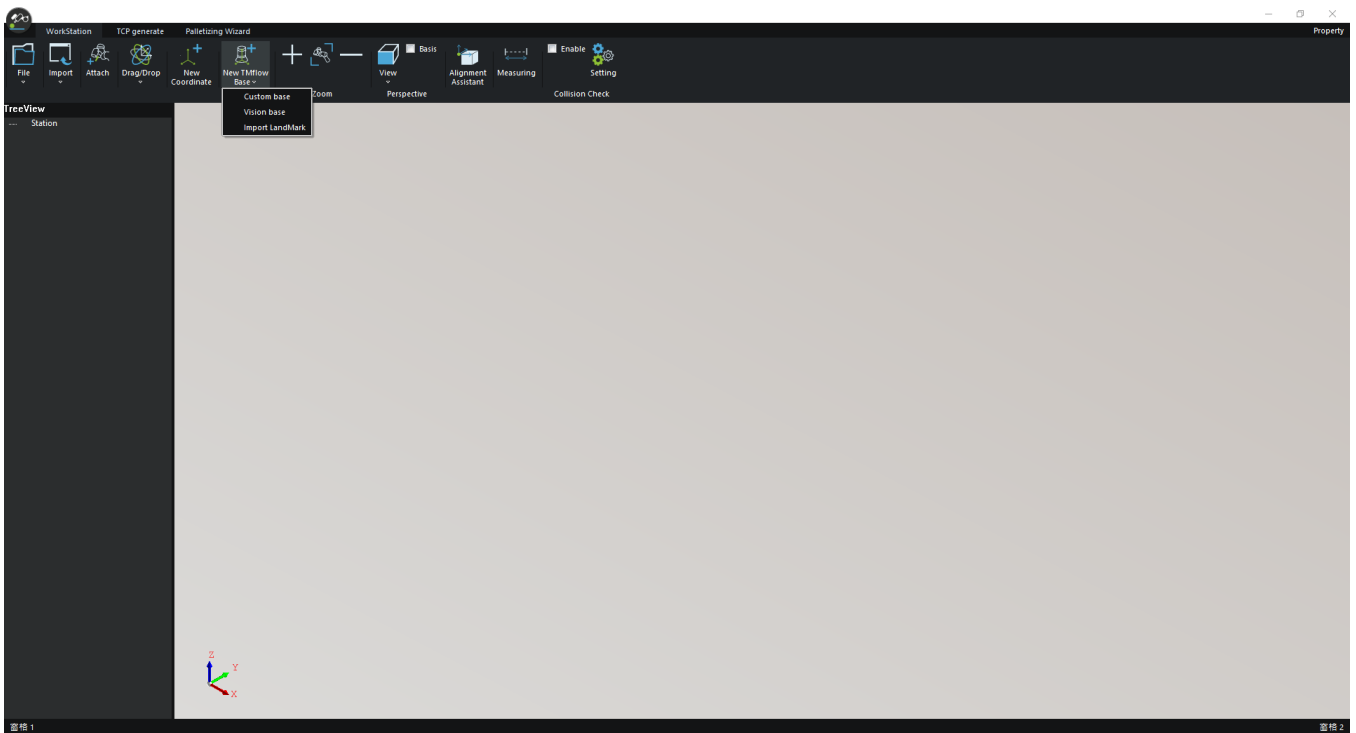


Figure 24: Add New TMflow Base

An addition of Custom base or Vision base provides a reference base coordinate to the selected object. As illustrated by the images below, when adding a base to a selected object, the reference base will show the XYZ vectors.

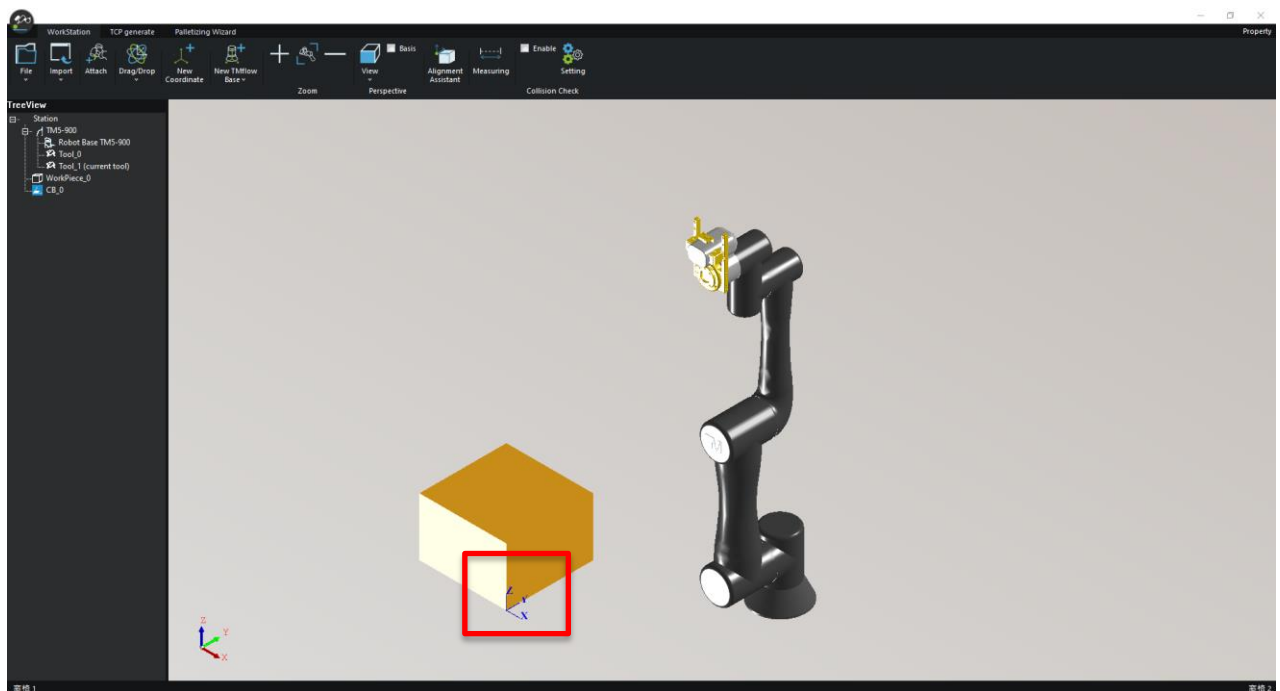


Figure 25: Adding new base to selected objects

If there is no selected object, the reference base will appear at the original place in the scene.

Users may **import Landmark** and apply it on a selected target. In addition, if users double-click “LM_x” (landmark) on the TreeView and right-click on the green icon of “LM_x”, they can **create vision job**. The created Vision Job with Landmark can be saved and exported to TMflow.

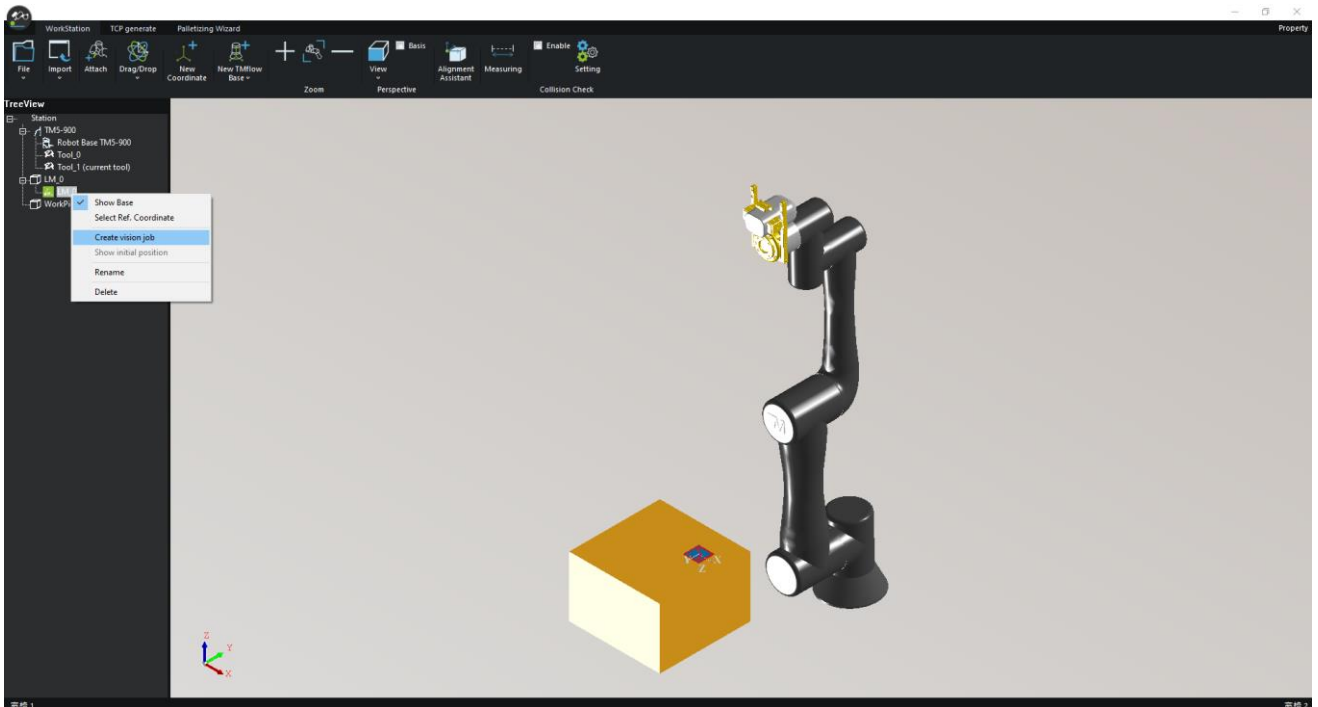
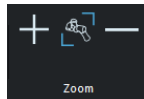


Figure 26: Importing Landmark and adding a base

The added base can be **merged** with objects in the scene and exported to TMflow. To merge base with an object, press and hold the CTRL key and highlight the items in **TreeView**. For details, please see **section 3.14**.

3.7 Zoom

Zoom is used to adjust the distance of the 3D viewer display and control the display all objects in the 3D viewer.



3.8 View

View helps users switch views from various angles. Refer below for the perspectives in the dropdown menu.

- View Front: view the scene from the front
- View AXO: view the scene from axonometric angle
- View Top: view the scene from the top
- View Bottom: view the scene from the bottom

- View Left: view the scene from the left
- View Right: view the scene from the right
- View Back: view the scene from the back

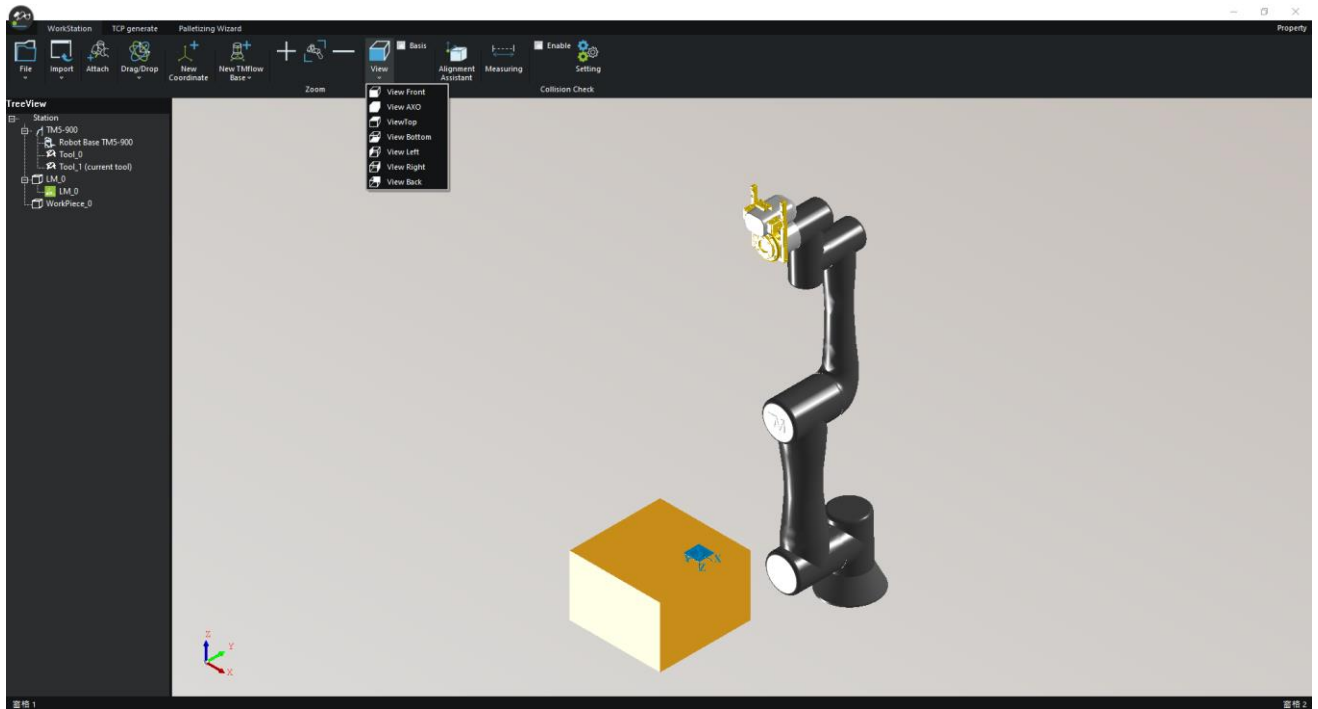
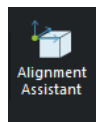


Figure 27: View

3.9 Alignment Assistant

Alignment Assistant helps users select points by the features to align the reference coordinate system with a certain position or orientation.



Click **Alignment Assistant** to pop up the dialog box as show below. From the top, items in the dialog box go by the alignment teaching diagram, the alignment mode switch tabs, the dropdown of **Coordinate / Base** as the reference coordinate system selection, **Characteristics** as the feature selection method, and **Moving Item**.

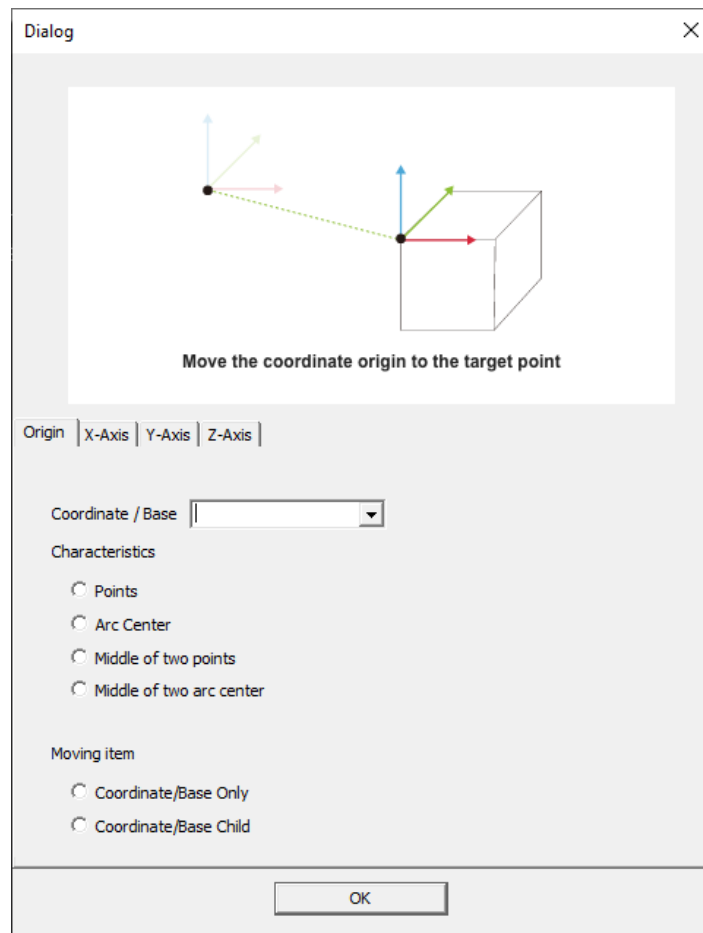


Figure 28: Alignment Assistant

The alignment goes with aligning the origin of the reference coordinate system with the selected feature points and pointing the different axial directions of the reference coordinate system to the selected feature points. The teaching diagrams are shown as below.



Figure 29: Alignment Teaching Diagrams

The using of **Characteristics** is the same as the **TCP setting** in the previous chapter. Select the feature mode first and then choose the feature points to be aligned.

Moving Item comes with **Coordinate/Base Only** to align the reference coordinate system only and **Coordinate/Base Child** to align the child parts along with the reference coordinate system.

Click **Confirm** after completed the setting to align to the selected feature point by the alignment method.
Refer below for the alignment of the reference coordinate system to the origin.

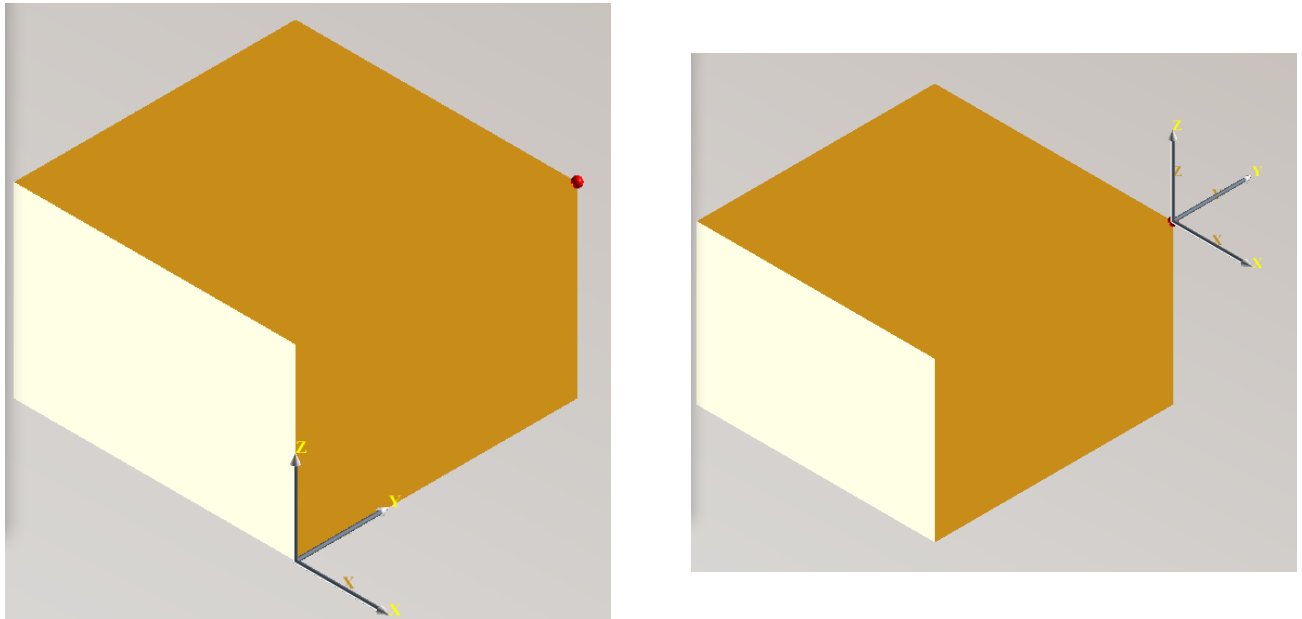


Figure 30: Moving Item Alignment

3.10 Measuring

Measuring provides users with a way of distance measuring between two positions in the scene.

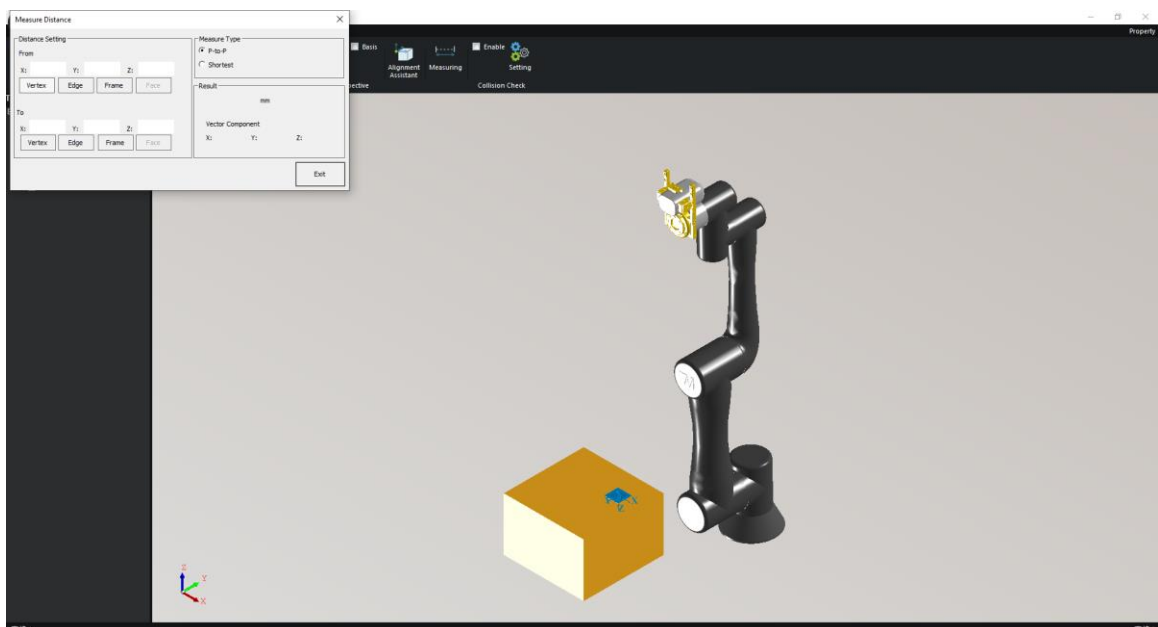


Figure 31: Measuring (1/5)

The **Distance Setting** feature allows users to use **Vertex**, **Edge**, **Frame** or **Face** aspects to measure the distance in between. Note that Face is only available **Shortest** under Measure Type, but not **P to P**.

Vertex

Users may measure the distance between vertex points. First, select “Vertex” (“From X” in this example) and double-click on the destined position of the selected target to set the first vertex point. Then select “Vertex” (“To Y” in this example) and double-click on another destined position to set the second vertex point. A line will appear and link the two vertex points, and relevant distance values will appear.

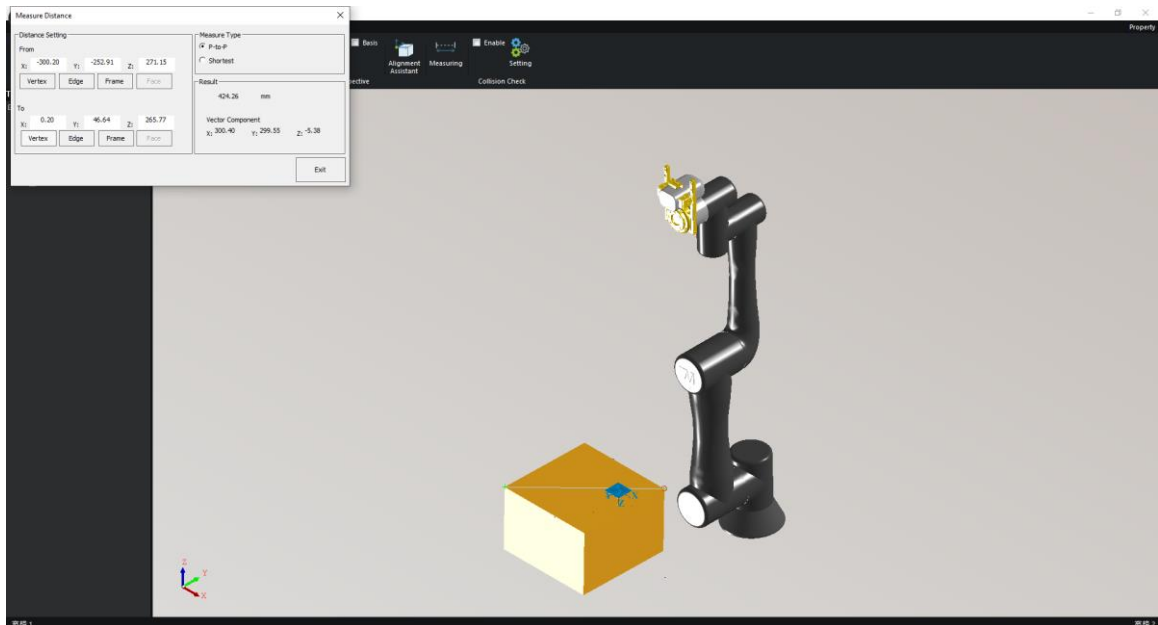


Figure 32: Measuring (2/5)

Edge

Select **Edge** (“from X” in this example) on **Distance Setting** to highlight a destined edge on the target and set a measuring point. Then select **Edge** (“to Y” in this example) on **Distance Setting** to highlight another edge on the target and set another measuring point. The distance values will appear on **Distance Setting**.

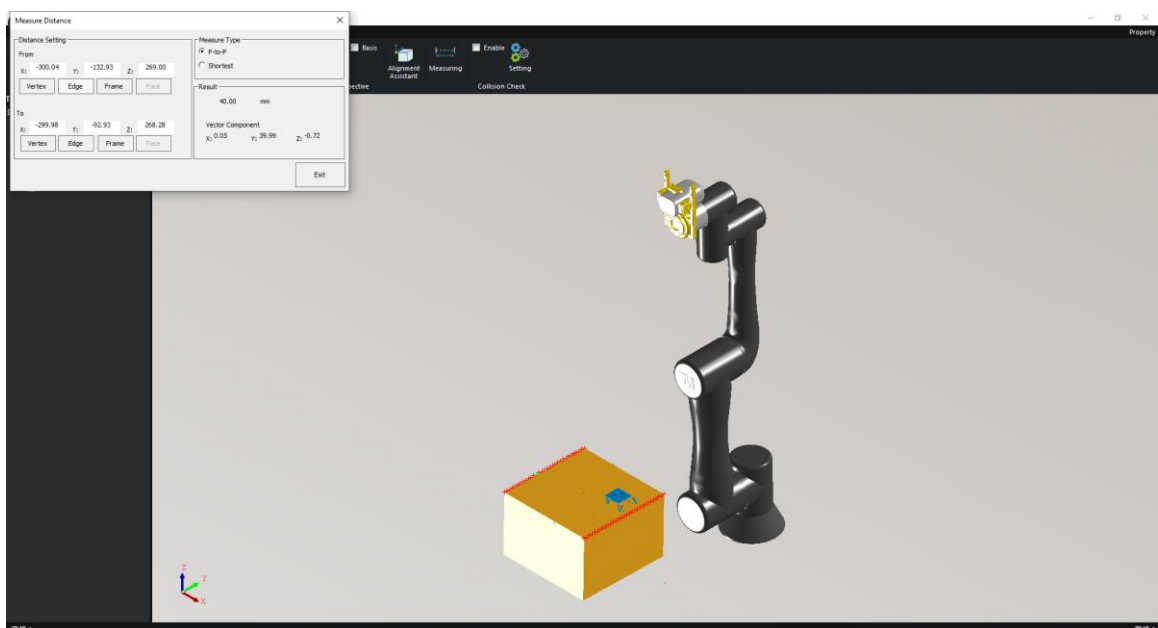


Figure 33: Measuring (3/5)

Frame

The method for Frame is similar to Edge. First, select **Frame** (from X) to highlight a frame as shown below.

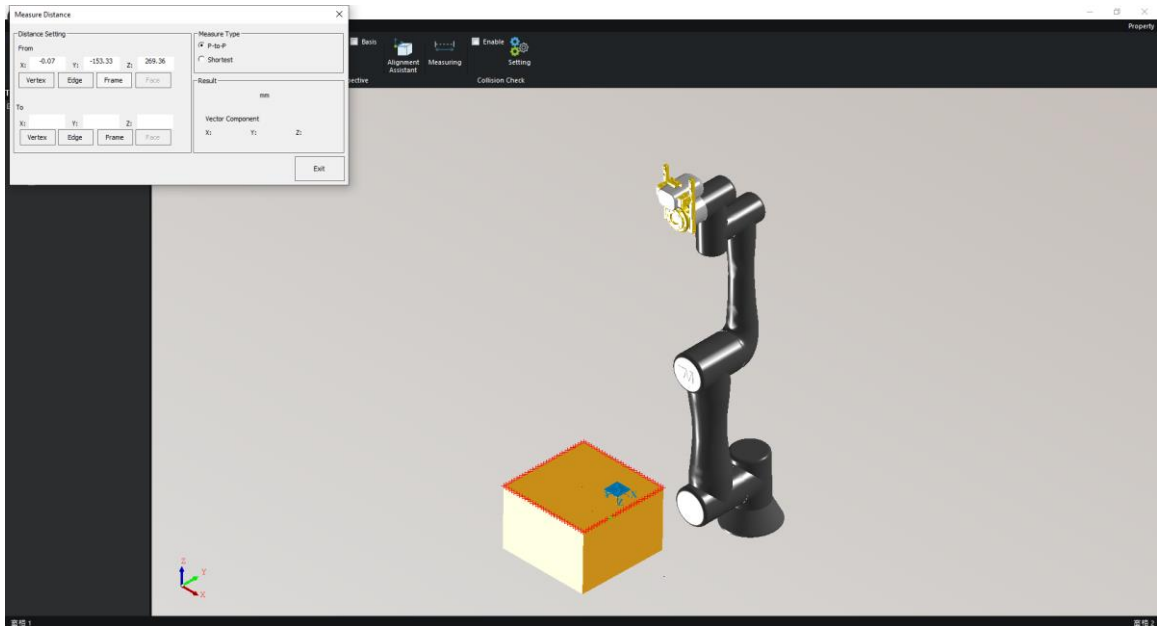


Figure 34: Measuring (4/5)

Then select **Frame** (to Y) to highlight the frame again. Double-click on two positions you'd like to calculate the distance on the highlighted frame. Then the distance values will appear.

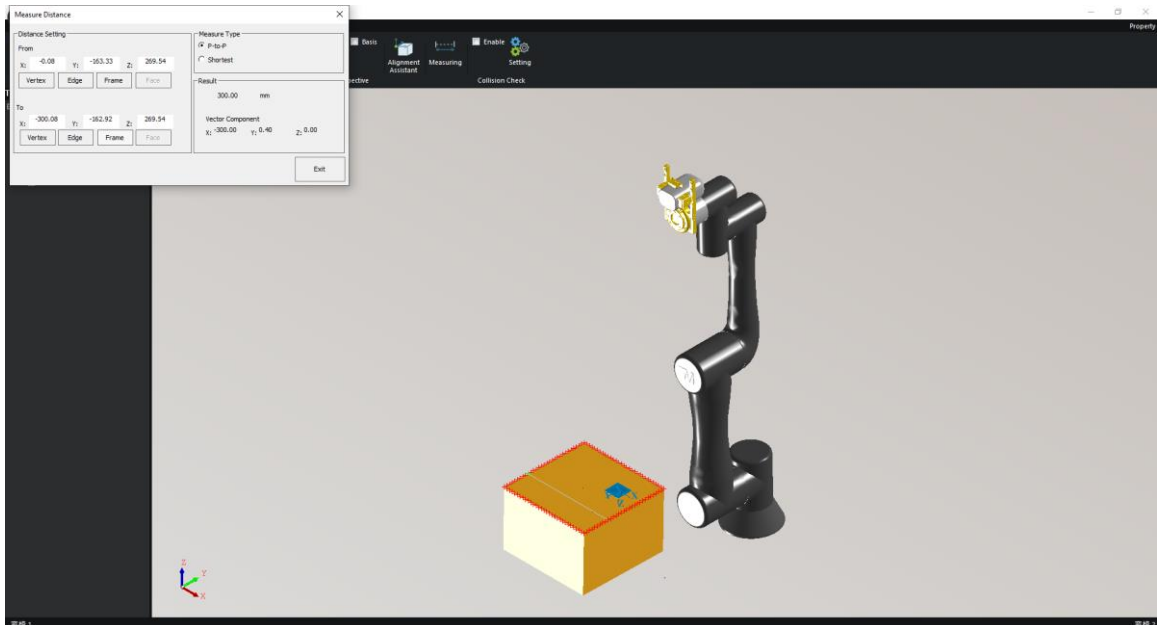


Figure 35: Measuring (5/5)

3.11 Collision Check

Users can enable **Collision Check** to detect collisions in the set collision pair. A warning message will pop up if there is a detected collision. Click **Setting** to pop up the dialog box of **Collision Setting** as shown below.

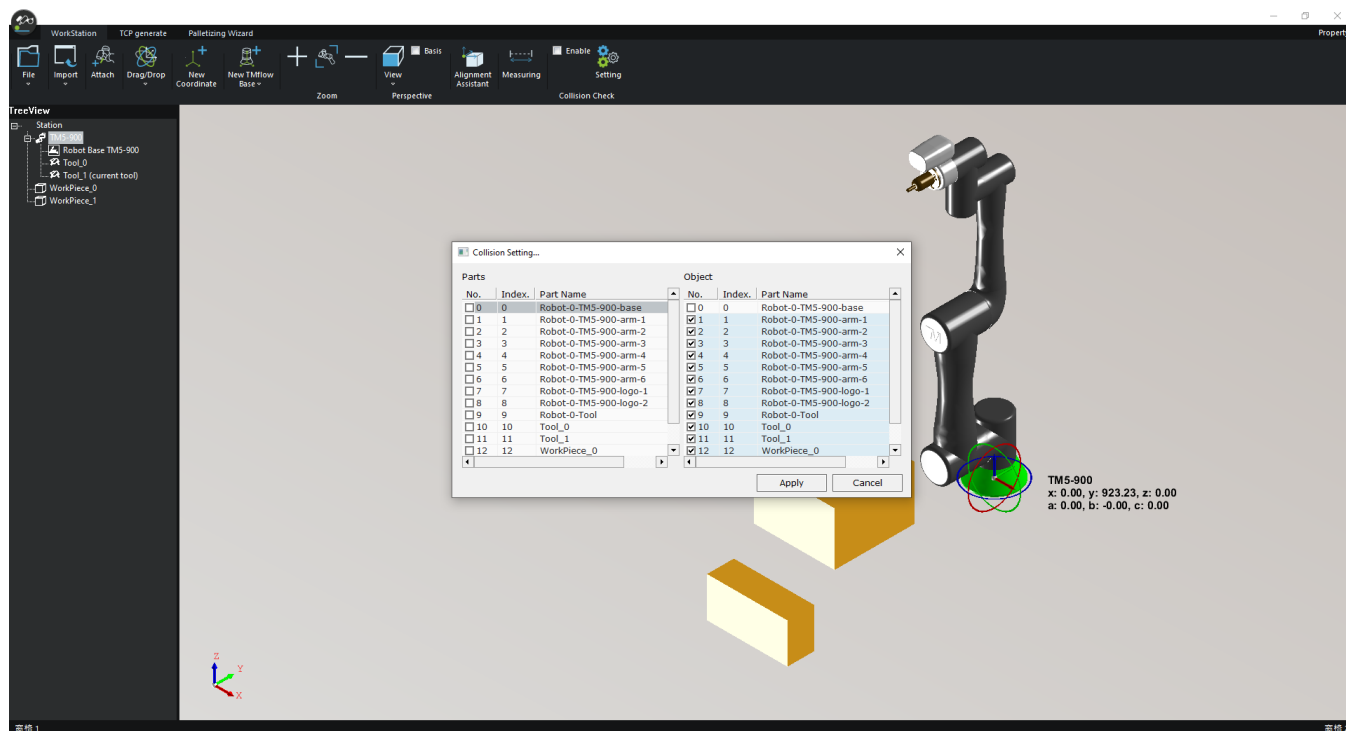


Figure 36: Collision Check

Check or uncheck the boxes of Parts or Objects to enable or disable detections.

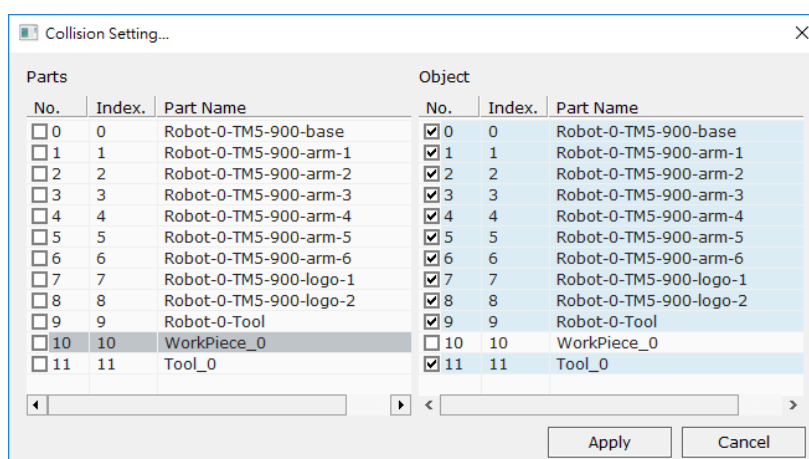


Figure 37: Collision Setting

As shown below, the warning message pops up with the name of the collision part highlighted in red once users enabled **Collision Check**.

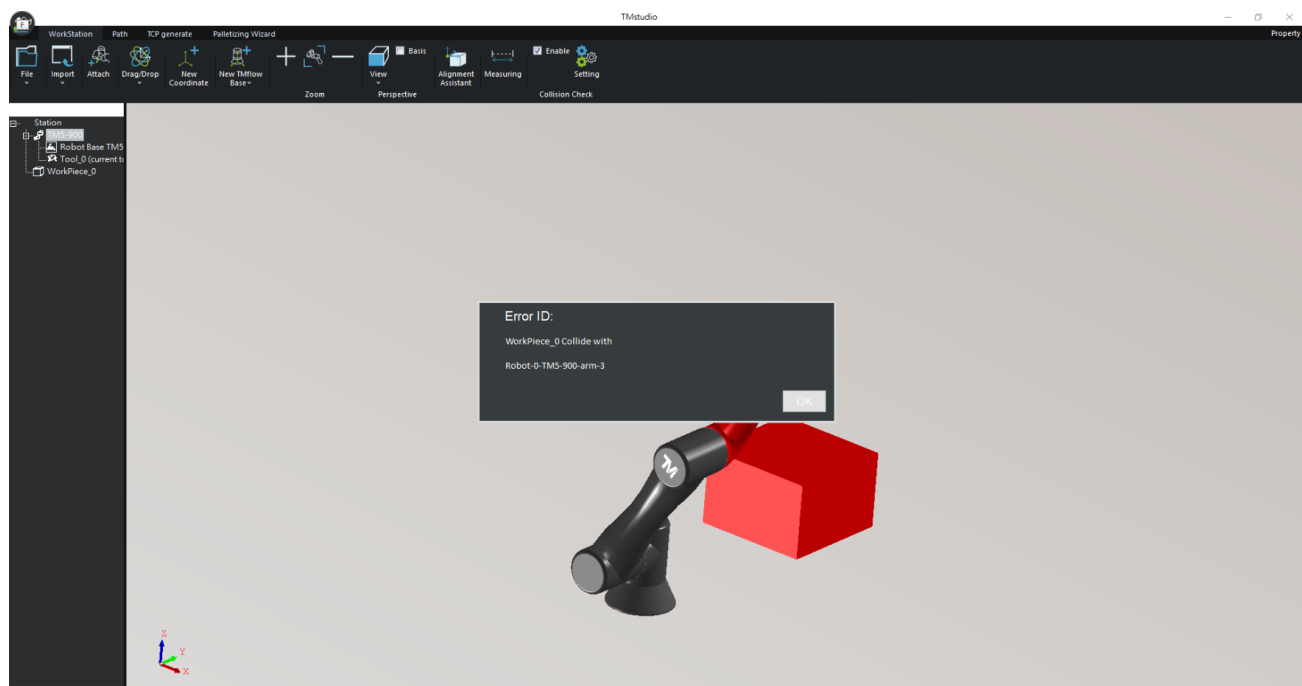


Figure 38: Collision check

3.12 TreeView Diagram

The **TreeView** at the left denotes the relationship of the objects in the current scene. When a parent object moves in the scene, its child objects move as well. Drag the name of the item in the **TreeView** directly to change the relationship between objects.

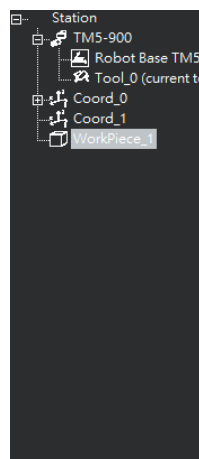


Figure 39: Tree Diagram

3.13 Right Click Menu

Right click the button on the mouse to pop up the right click menu when selecting a **TreeView** item or an object in the 3D viewer.

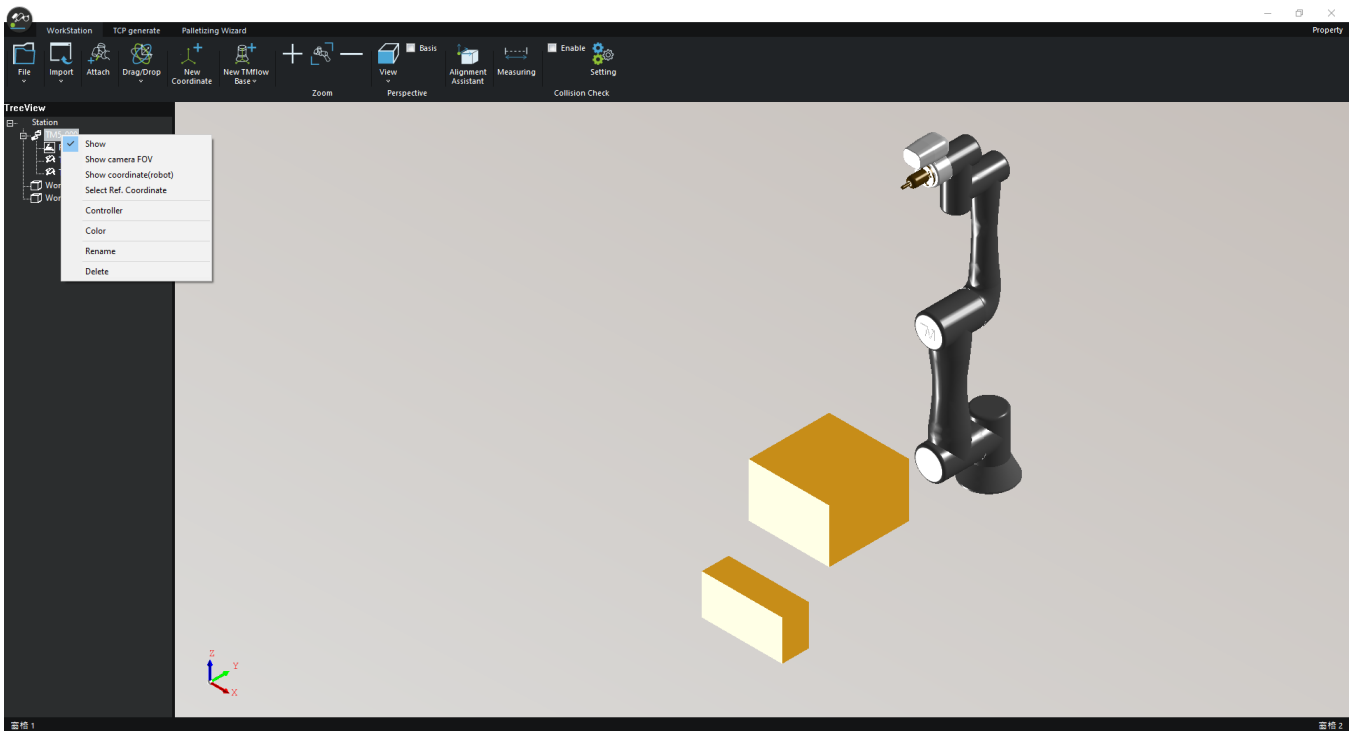


Figure 40: Right Click Menu

Check or uncheck **Show** to display or hide the object.

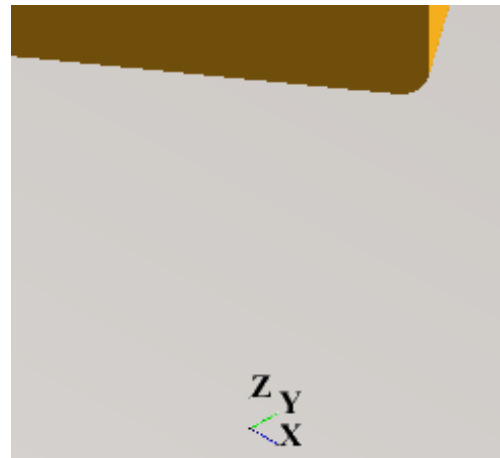
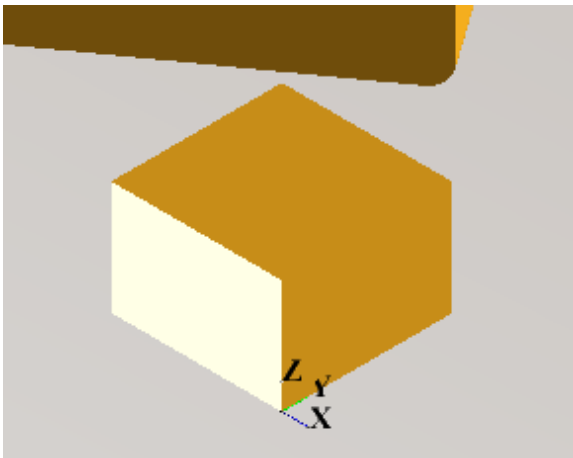


Figure 41: Show

Check **Show coordinate** to display the relative coordinate value of the object to the reference coordinate. Users have to check **Show coordinate** to enable **Drag/Drop** or uncheck to turn into a simple arrow mode as shown below.

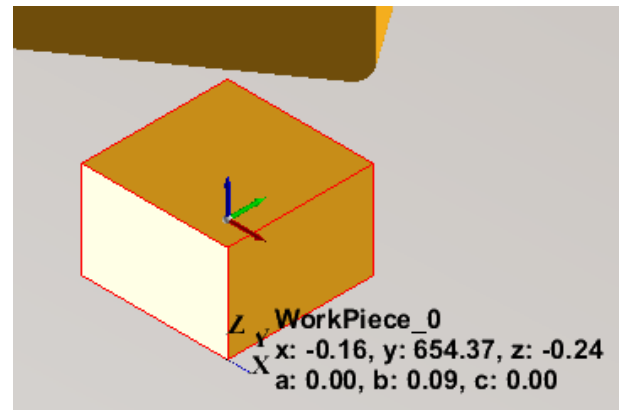
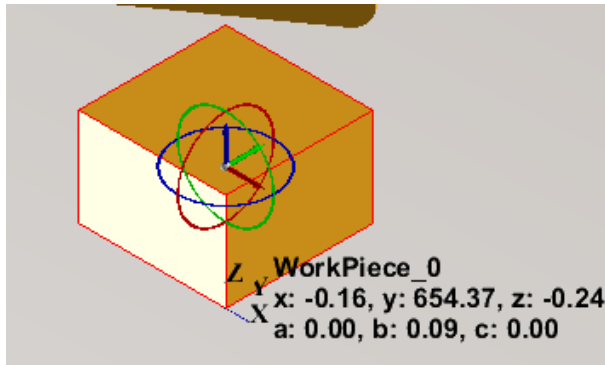


Figure 42: Show Coordinate

Check **Select Ref. Coordinate** to changes the relative reference coordinate of the current object and its value based on the different reference coordinate. The default is to deselect and refer to the origin coordinates of the scene as shown below.

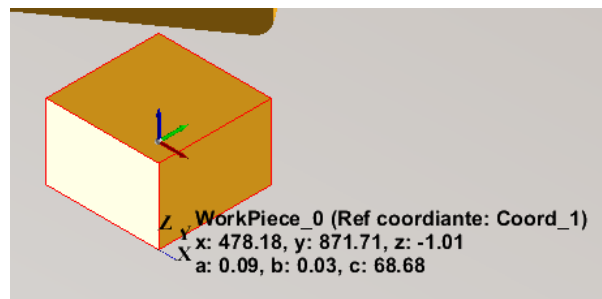


Figure 43: Select Ref. Coordinate

Check **Color** to change the color of the object, **Rename** to change the name of the object, or **Delete** to remove the object.

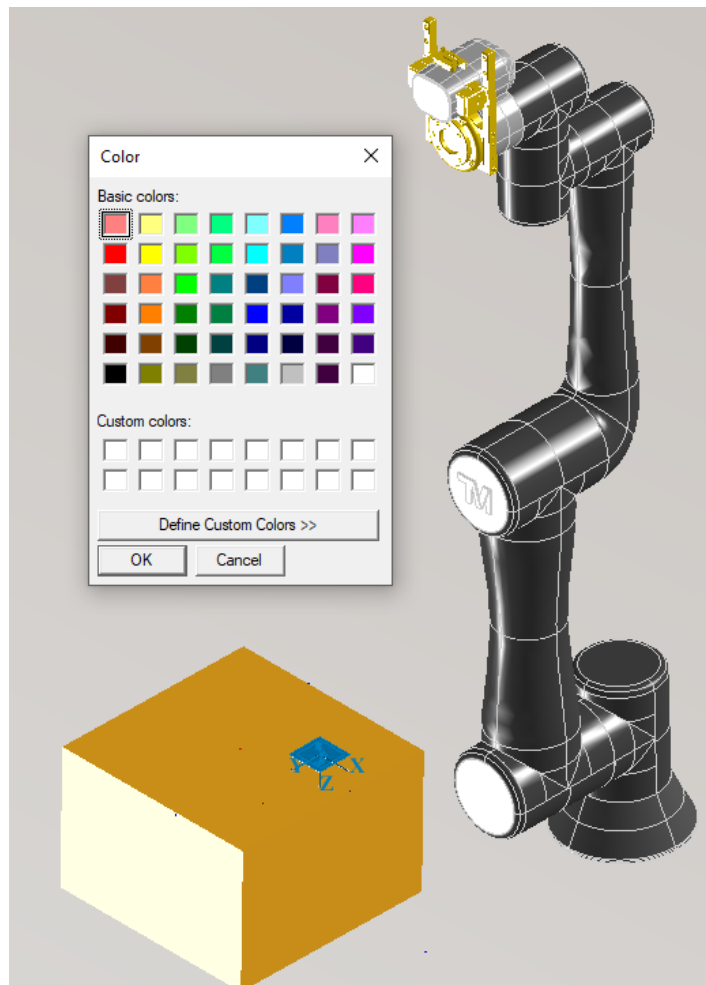


Figure 44: Color

Right click the button on the mouse when selecting the robot to pop up the right click menu of the display camera FOV and controller functions as shown below.

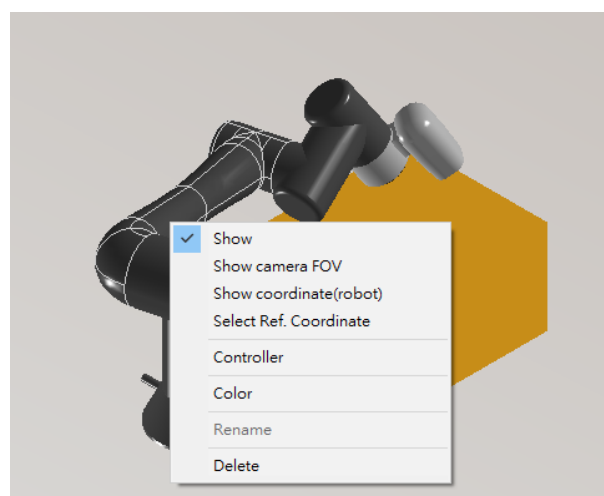


Figure 45: Show on the Robot

Check **Show camera FOV** to create a four-corner vertebra on the robot camera. When there is an object in the field of view, the four corners will be highlighted in red as shown below.

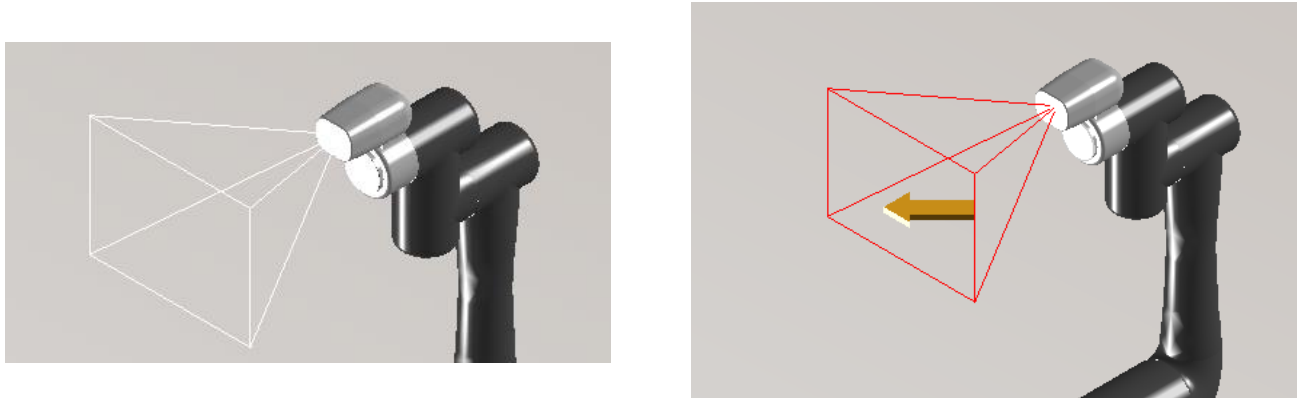


Figure 46: Show Camera FOV

Check **Controller** to pop up the **Robot Controller** dialog box that comes with the **Joint** tab and the **Coordinate** tab. Users can use the dialog box to control the robot posture and to drag and drop the tool.

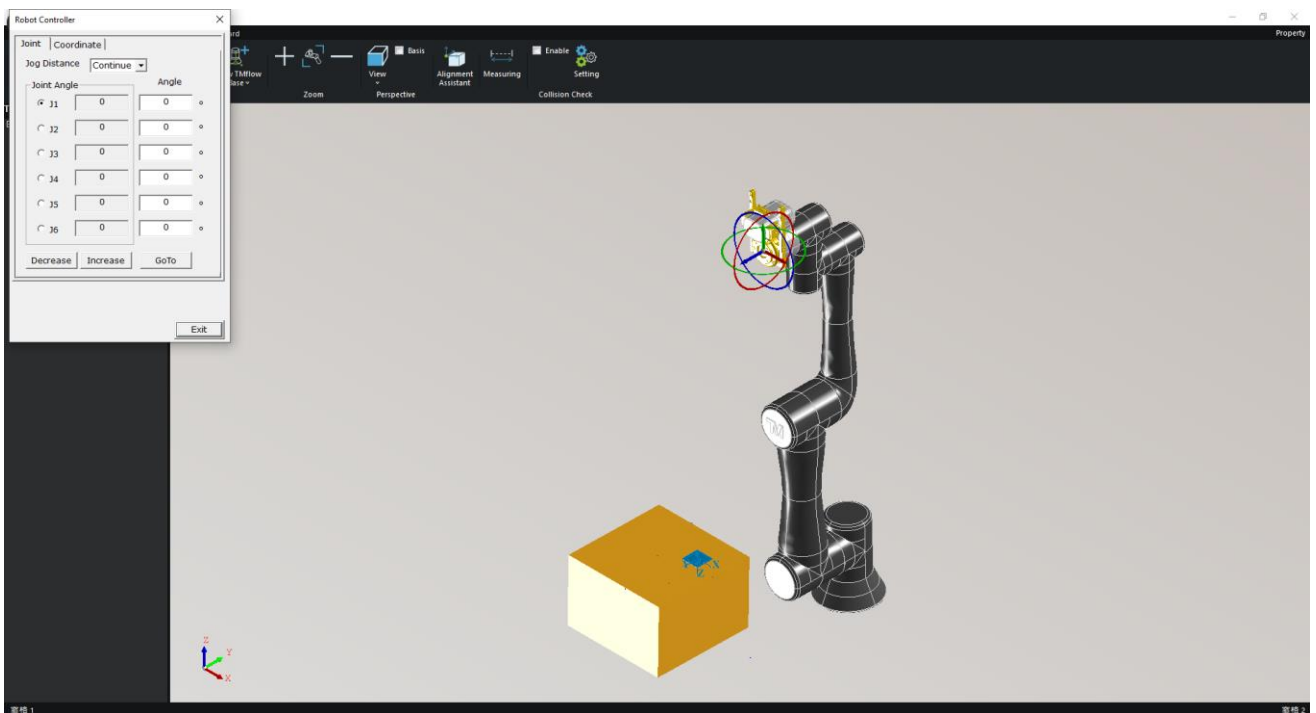


Figure 47: Robot Controller

Use the **Jog Distance** dropdown to select **Continuous** or any units. For **Continuous**, the robot will continue to move if users continue to click **Decrease** or **Increase**.

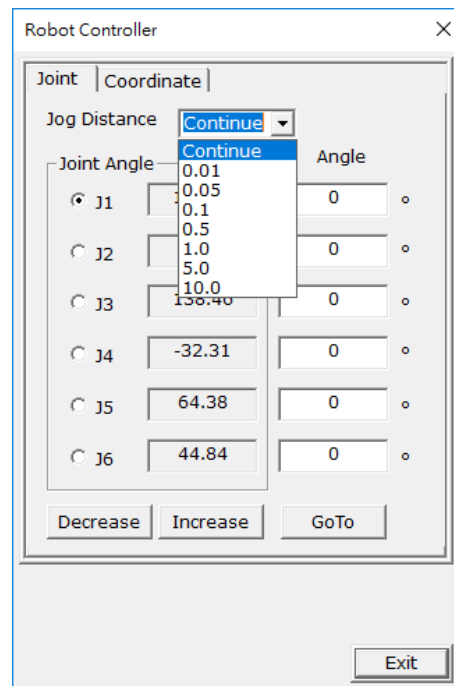


Figure 48: Jog Distance

Users can also enter the value directly and click **GoTo** to have the robot turn to a specified pose.

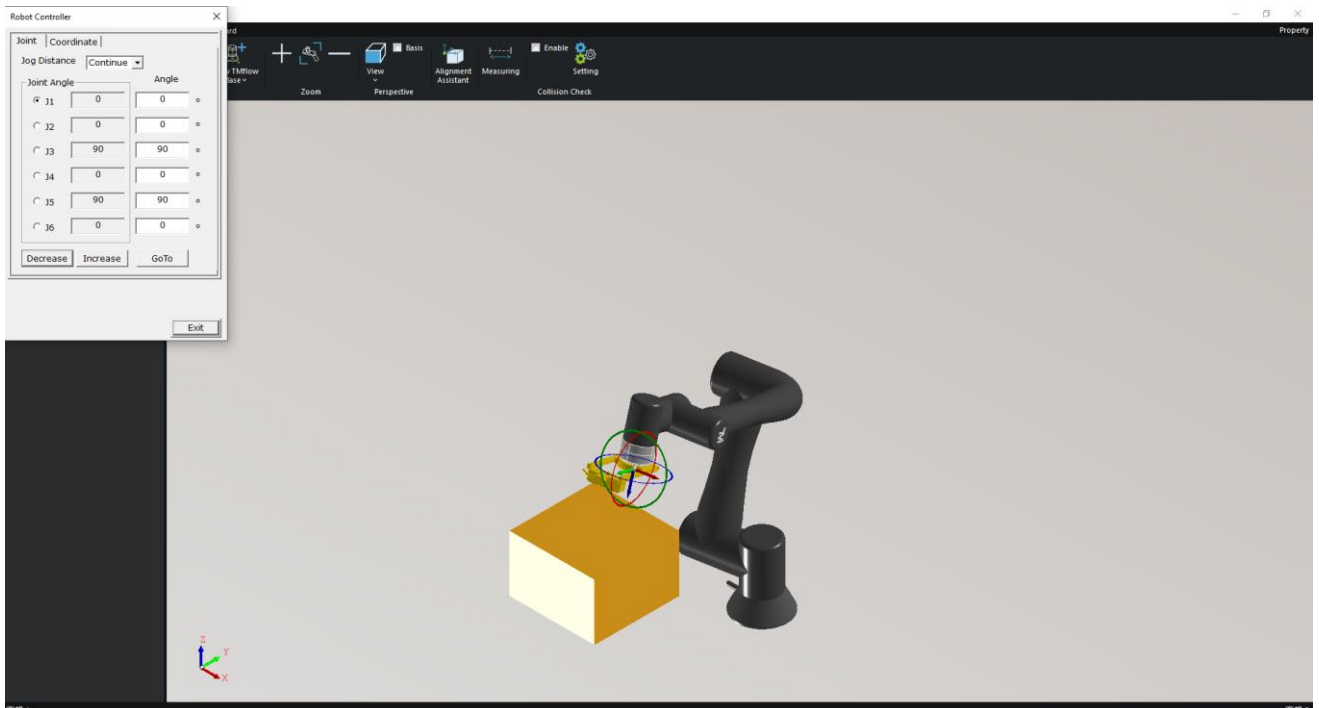


Figure 49: GoTo

3.14 Merge

Press and hold the CTRL key and click the left button on the mouse to select multiple work pieces, and then users can **Show**, **Merge**, or **Delete** multiple work pieces at once as shown below.

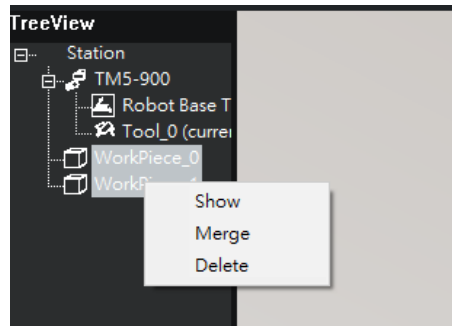


Figure 50: Merge

The merged object becomes one item in **TreeView** as shown below.

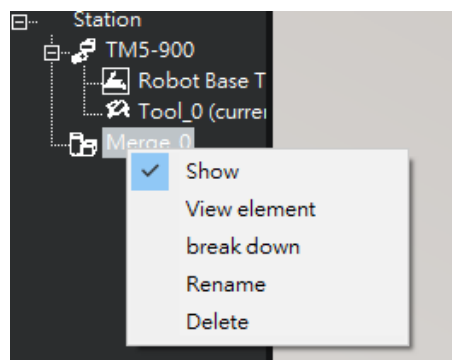


Figure 51: Merged Object

Click **View element** to pop up a dialog box to view the elements of the merged object as shown below.

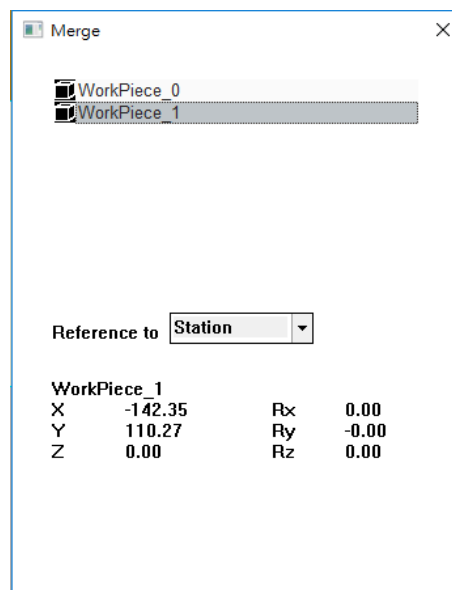


Figure 52: View Element

Click **break down** to separate elements in a merged object

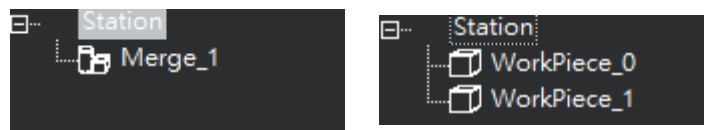


Figure 53: Break Down

3.15 Auto Save and Exit

When exiting the current scene in Workstation without saving the file, the “Auto save scene, continue?” message will appear. Users will have to click “Yes” in order to exit Workstation. If users click “No”, they will remain in the current scene.

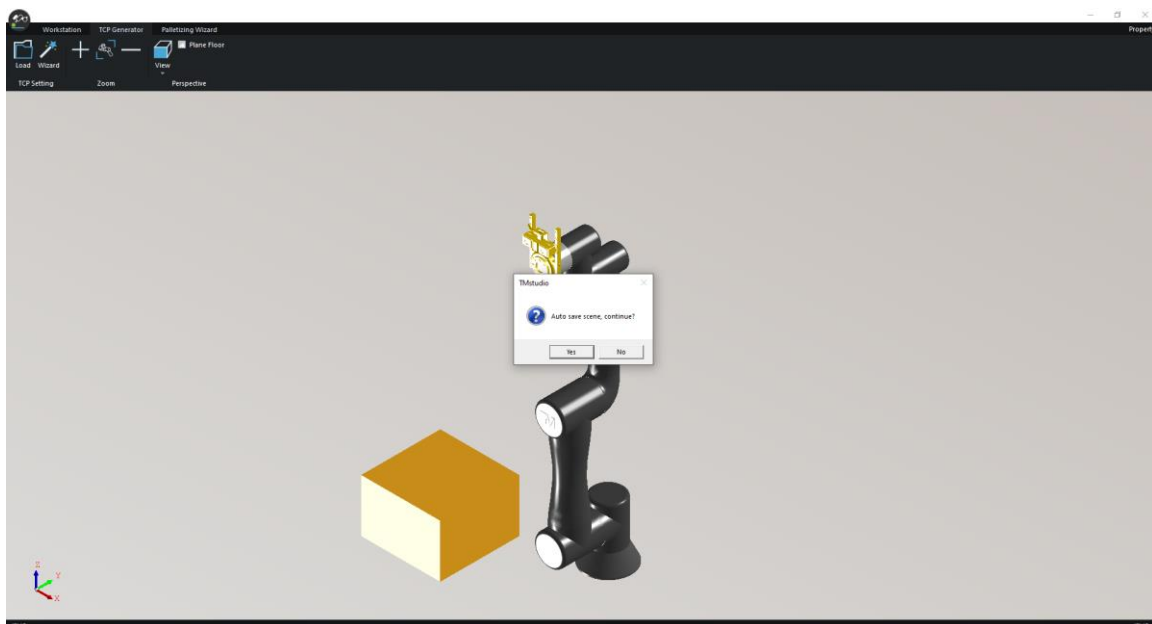


Figure 54: Auto save scene

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