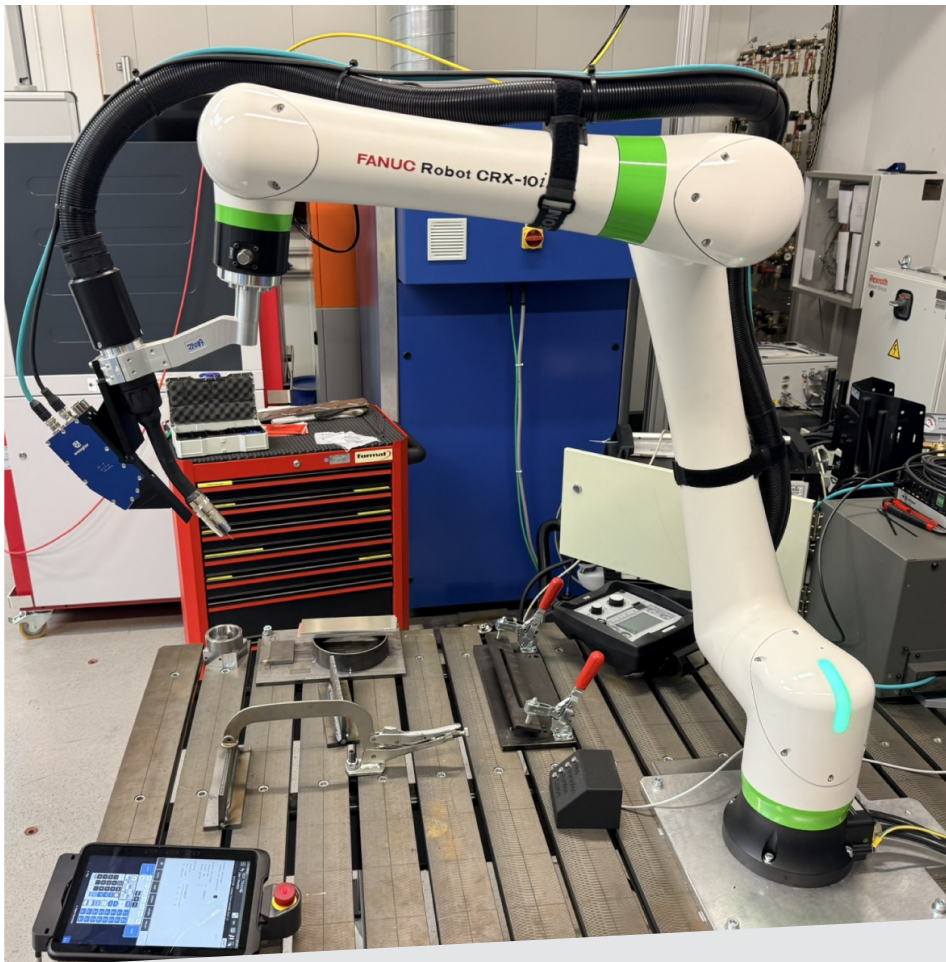


Operating Instructions

Setup and Calibration

FANUC 10-Point-Methode



EN



Table of Contents

1	Introduction.....	3
2	Calibration Equipment	4
3	System Requirements FANUC	5
4	Preparation of wenglor System.....	6
4.1	Connection Hardware	6
4.2	Setting wenglor weHub.....	7
5	Parametrize Calibration Job	10
6	Preparation wenglor System in the Teach Pendant.....	14
7	Calibration	15
7.1	Important Points to consider	15
7.2	Tool and User Frame Coordinate System	16
7.3	Calibration Plate.....	17
7.4	Sensor Calibration with the 10-Point Teaching Method	18
7.5	Reference Point TCP - Ref#1	19
7.6	Reference Point TCP - Ref#2	20
7.7	Ref#1 - Pair1 (no rot.).....	21
7.8	Ref#2 - Pair1 (no rot.).....	23
7.9	Ref#1 - Pair2 (+z rot.)	25
7.10	Ref#2 - Pair2 (+z rot.)	27
7.11	Ref#1 - Pair3 (+z/+y rot.)	29
7.12	Ref#2 - Pair3 (+z/+y rot.)	31
7.13	Ref#1 - Pair4 (+z/-y rot.)	33
7.14	Ref#2 - Pair4 (+z/-y rot.)	35
7.15	Confirmation and Calibration.....	37
8	Setting for Tracking Job	38

1 Introduction

The content of this document is intended to assist in the calibration of the wenglor system and a FANUC robot with R-30iB Plus.

The document provides step-by-step instructions for quickly and easily performing the necessary steps for calibration using

The instructions also use content and images from the FANUC manual instructions

Document ID: B-84234EN/01

FANUC Robot series **R-30iB Plus/R-30iB Mate Plus Controller**

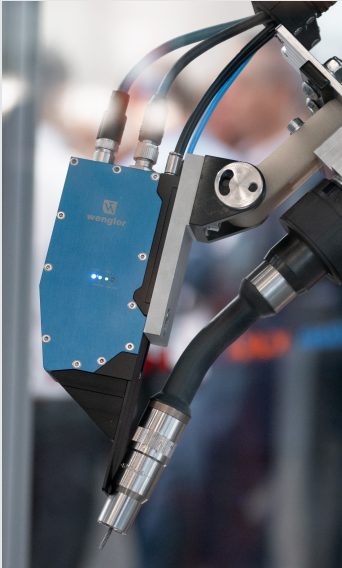
OPERATOR'S MANUAL

B-84234EN/01

© FANUC CORPORATION, 2021

2 Calibration Equipment

The following components were used to create the calibration document. Depending on the application, other components may also be used.

wenglor	FANUC	Calibration plate
MLZL141 MVCV001 uniVision 3 software	CRX-10iA FANUC R-30iB Plus ArcTool software R901	Random Lap-Joint with at least 350 mm length
 	 	

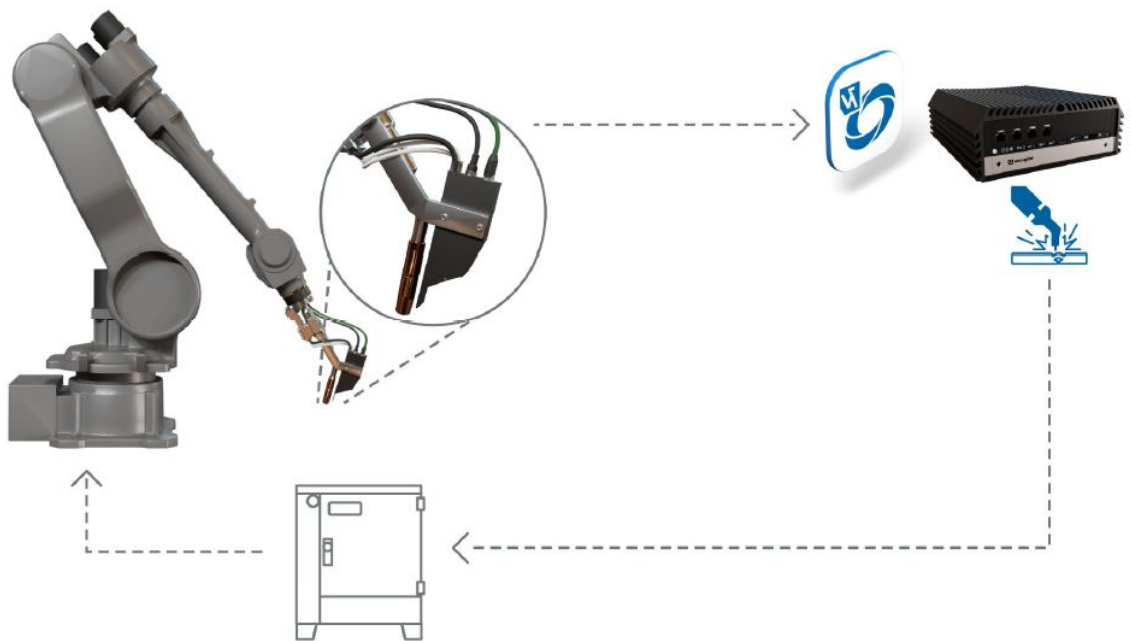
3 **System Requirements FANUC**

- Controller: R-30iB or R-30iA
- Software ArcTool SW V8.30P/36
- Software options: R691 (Universal Sensor Interface) and R648 (User Socket Messaging) or
- Controller: R-30iBPlus or R-30iA • Software ArcTool SW V9.40P/27
- Software options: R901

4 Preparation of wenglor System

4.1 Connection Hardware

- wenglor Profile Sensor and the wenglor Machine Vision Controller must be connected to a power source (see notes in the operating instructions)
- The Ethernet cable of the Profile Sensor is connected to one of the four CAM ports on the front panel
- An additional connection cable is connected to one of the Ethernet ports on the rear of the wenglor Machine Vision Controller and the **LAN 3 port** in the robot controller
- To connect to the machine vision controller and a laptop, the second Ethernet port on the rear panel can be used



Additional note

The wenglor Machine Vision Controller requires its own power supply unit and can't be powered via the robot controller

4.2 Setting wenglor weHub

- Start wenglor weHub on the desktop



- Change the IP address of the wenglor Machine Vision Controller to be on the same network as the robot controller.

Running

weHub is not connected to device.
weHub is not connected to AI Lab. Go to [Settings](#) and login.

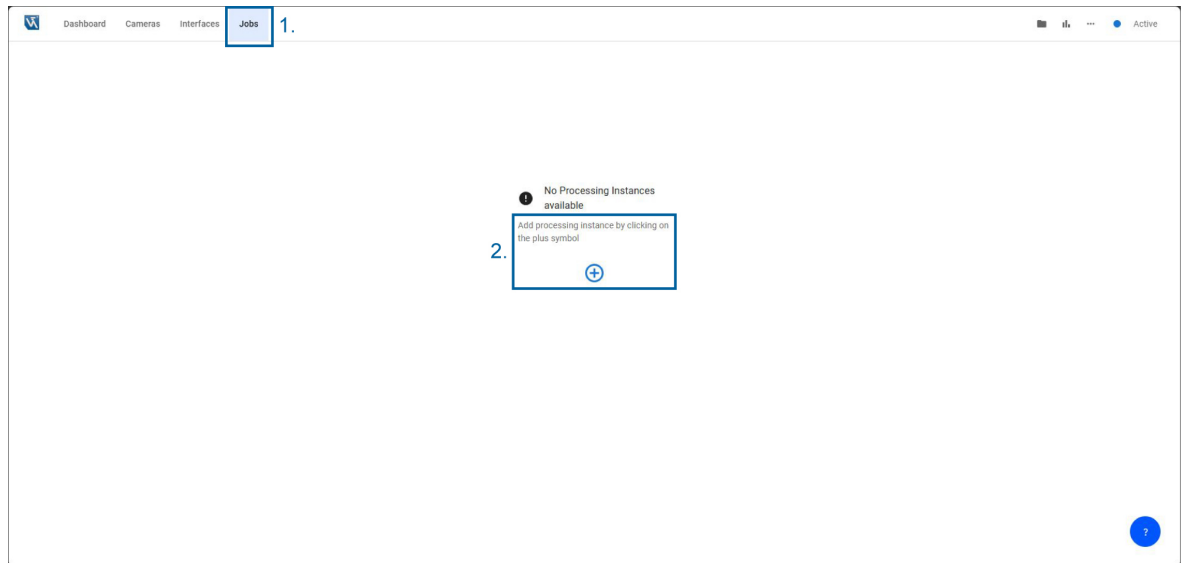
More info: <https://www.wenglor.com/product/MVCV001>

Name	Type	Article Number	Serial Number	IP Address	Subnet Mask	Gateway
FANUC TechCenter	Machine Vision Controller	MVCV001	10287	192.168.2.3	255.255.255.0	0.0.0.0

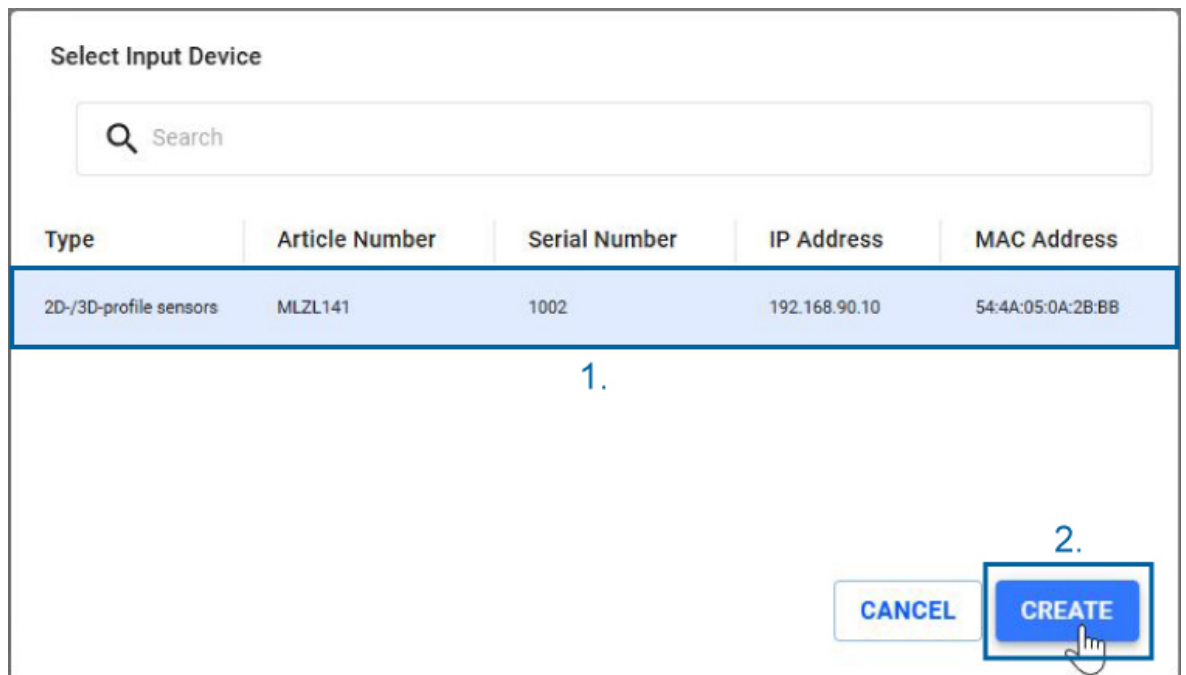
- Open the device by clicking on the corresponding icon.

Fav	Device Status	AI Lab Status	Name	Type	Article Number	Serial Number	IP Address	Actions
☆	● Active	● Not connected	FANUC TechCenter	Machine Vision Controller	MVCV001	10287	192.168.2.3	

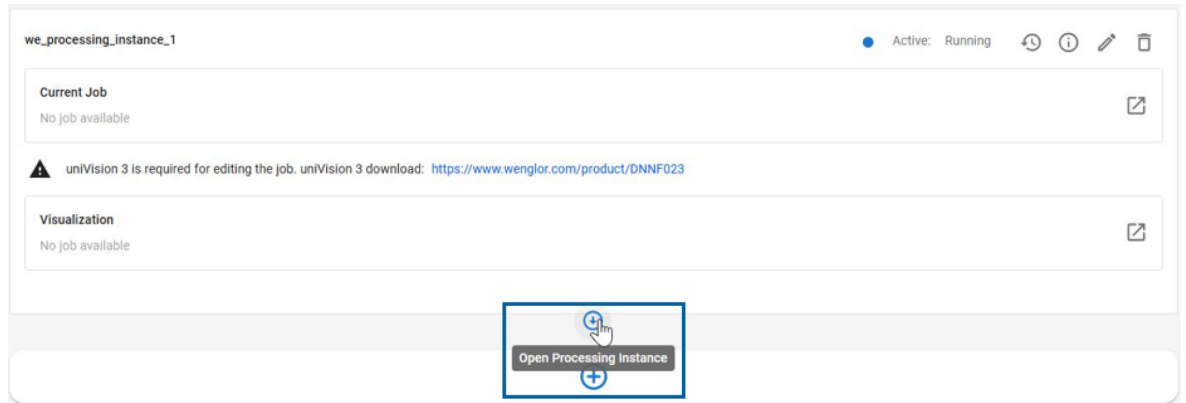
- Open “Jobs” and add a new processing instance by clicking on the “+” sign.



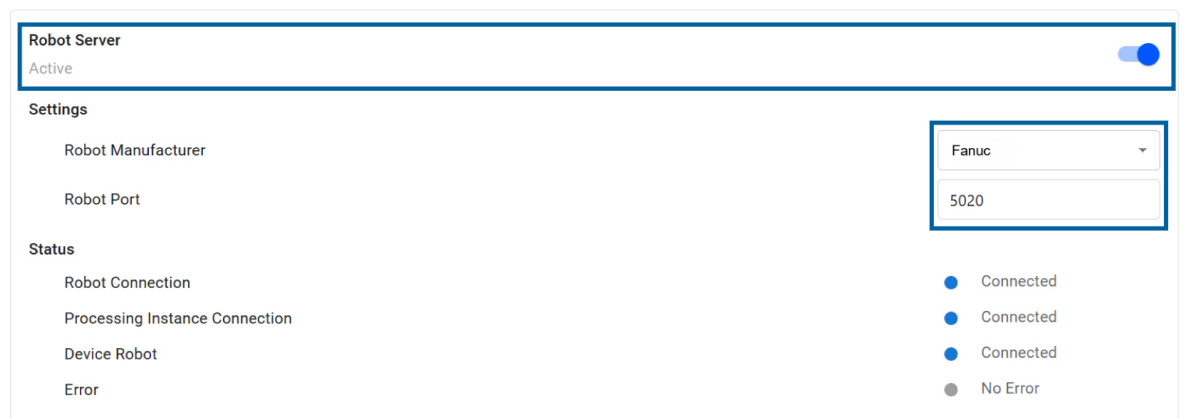
- Select the correct 2D/3D Profile Sensor in the device list and click on “CREATE”.



- Open the Processing Instance and scroll down to Robot Server



- Activate the Robot Server and select FANUC as Robot Manufacturer (Robot Port 5020 is default for FANUC)



Status notes

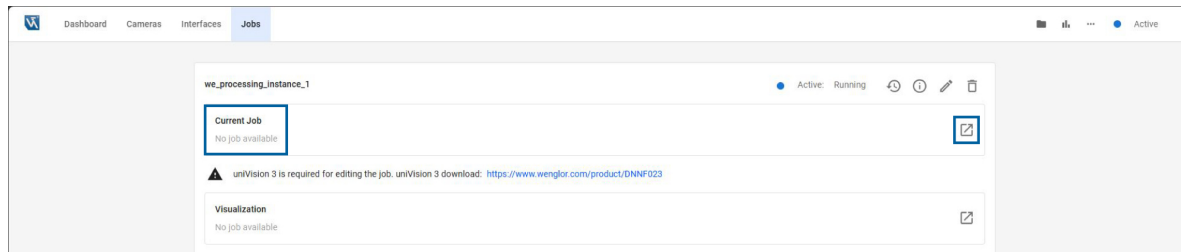
The robot connection is established when the status shows “Connected.”

If the connection cannot be established, please check the following:

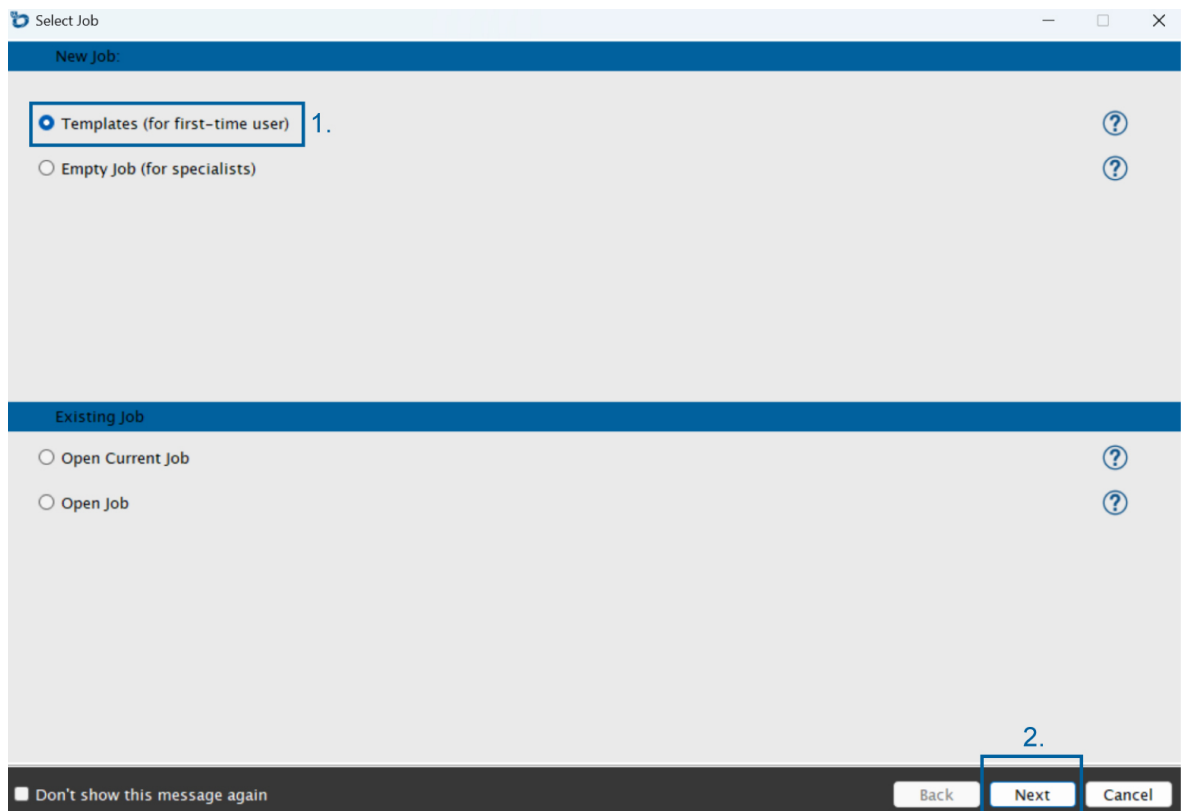
- Make sure the computer and the robot are connected to the same network.
- Verify that the IP address and robot port are correct.
- Restart the robot controller after entering the IP address of the wenglor controller in the teach pendant.
- Make sure the “Device robot weld seam tracking” license is valid and activated.

5 Parametrize Calibration Job

- Scroll up to top and start the uniVision Job parametrization by clicking on “Open Device”



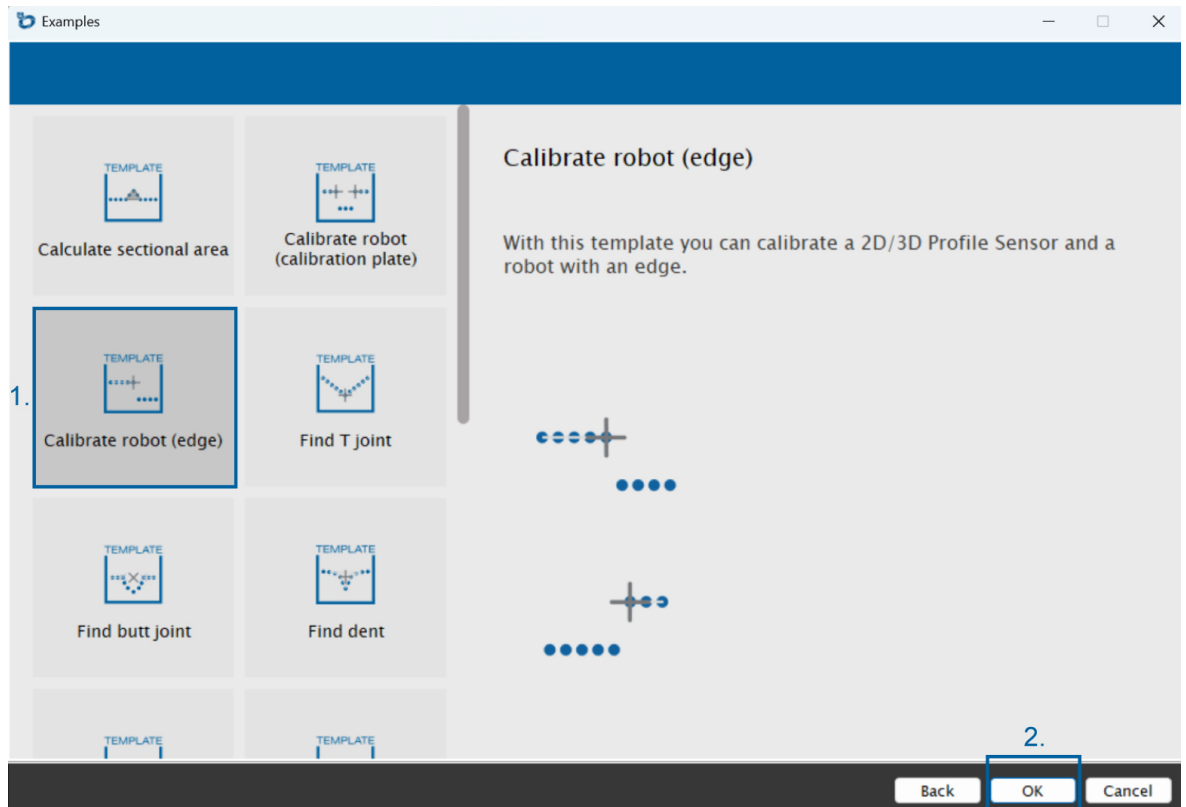
- Create the Calibration Job by using Templates (for first-time-user) and click “Next”



Template notes

If the template is used in job parameterization, the tracking point and validity are automatically linked in Device Robot and sent to the Robot Controller.

- For calibration with FANUC use the Template: Calibrate robot (edge) and click “Ok”



- To find the “Tracking Point Top”, **consider** the edge direction of your lap joint and choose **Step-Up** or **Step-Down**

File Settings View Help

Job Tree

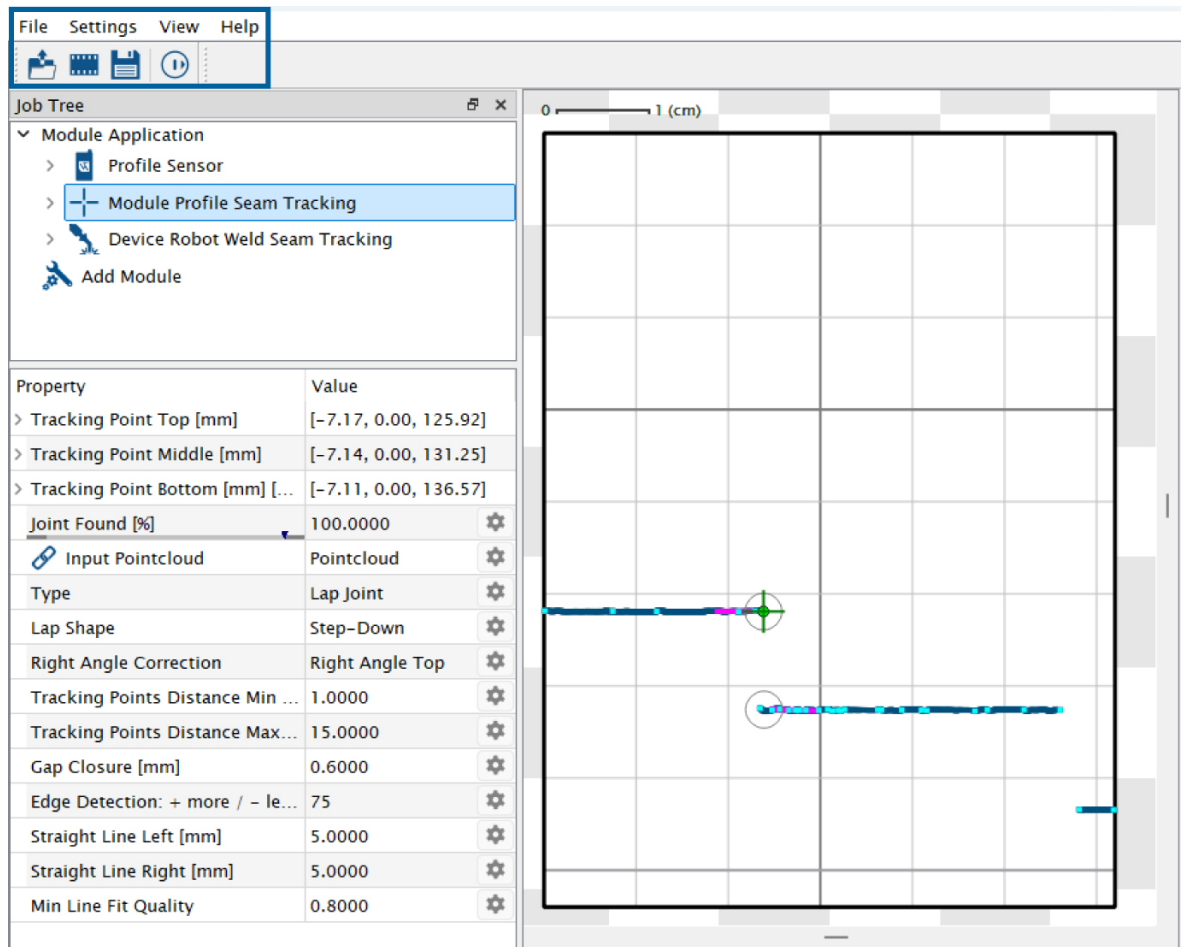
- Module Application
 - Profile Sensor
 - Module Profile Seam Tracking
 - Device Robot Weld Seam Tracking
 - Add Module

Property	Value
Tracking Point Top [mm]	[-7.17, 0.00, 125.92]
Tracking Point Middle [mm]	[-7.14, 0.00, 131.25]
Tracking Point Bottom [mm] [...]	[-7.11, 0.00, 136.57]
Joint Found [%]	100.0000
Input Pointcloud	Pointcloud
Type	Lap Joint
Lap Shape	Step-Down
Right Angle Correction	Right Angle Top
Tracking Points Distance Min ...	1.0000
Tracking Points Distance Max...	15.0000
Gap Closure [mm]	0.6000
Edge Detection: + more / - le...	75
Straight Line Left [mm]	5.0000
Straight Line Right [mm]	5.0000
Min Line Fit Quality	0.8000

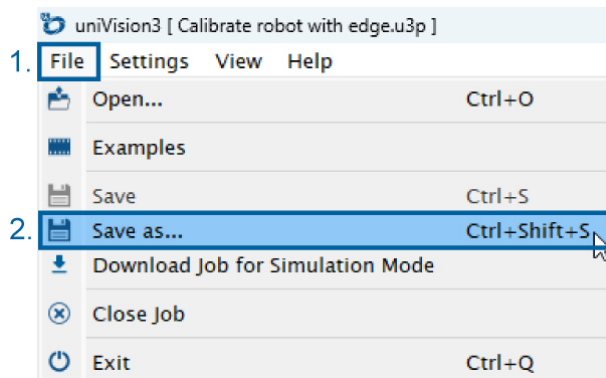
0 1 (cm)

Step-Down

- Open File settings

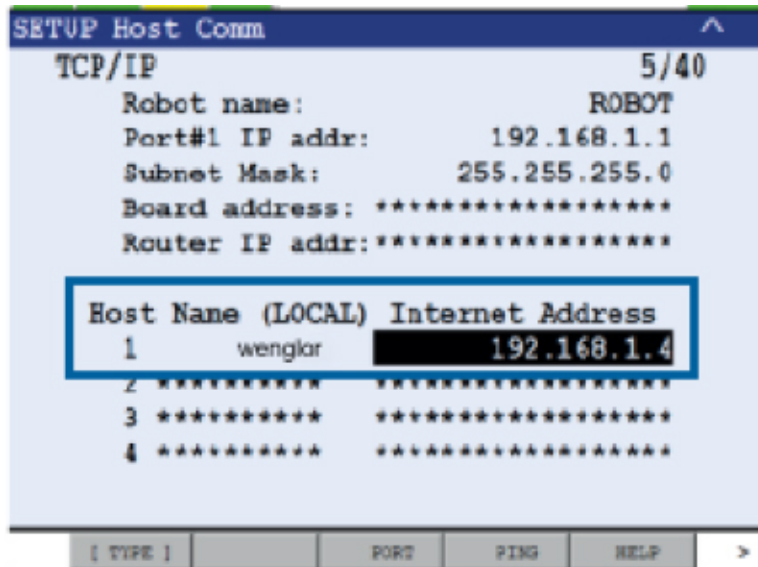


- Save the Job as a number (e.g. 40)



6 Preparation wenglor System in the Teach Pendant

- Open the network settings by pressing [MENUE] → select [SETUP] and press [F1]
- Select [Host Comm] and [TCP/IP]
- Enter e.g. wenglor as Host Name (LOCAL) and the IP Address of the Machine Vision Controller
- Test the connection from the robot to the wenglor Machine Vision Controller by pressing the ping [F4]



IP address wenglor
Machine Vision Controller

Additional note

After entering the IP address of the wenglor Machine Vision Controller, the robot controller has to be restarted.

7 Calibration

7.1 Important Points to consider

Before start calibration, the following points must be taken into account:

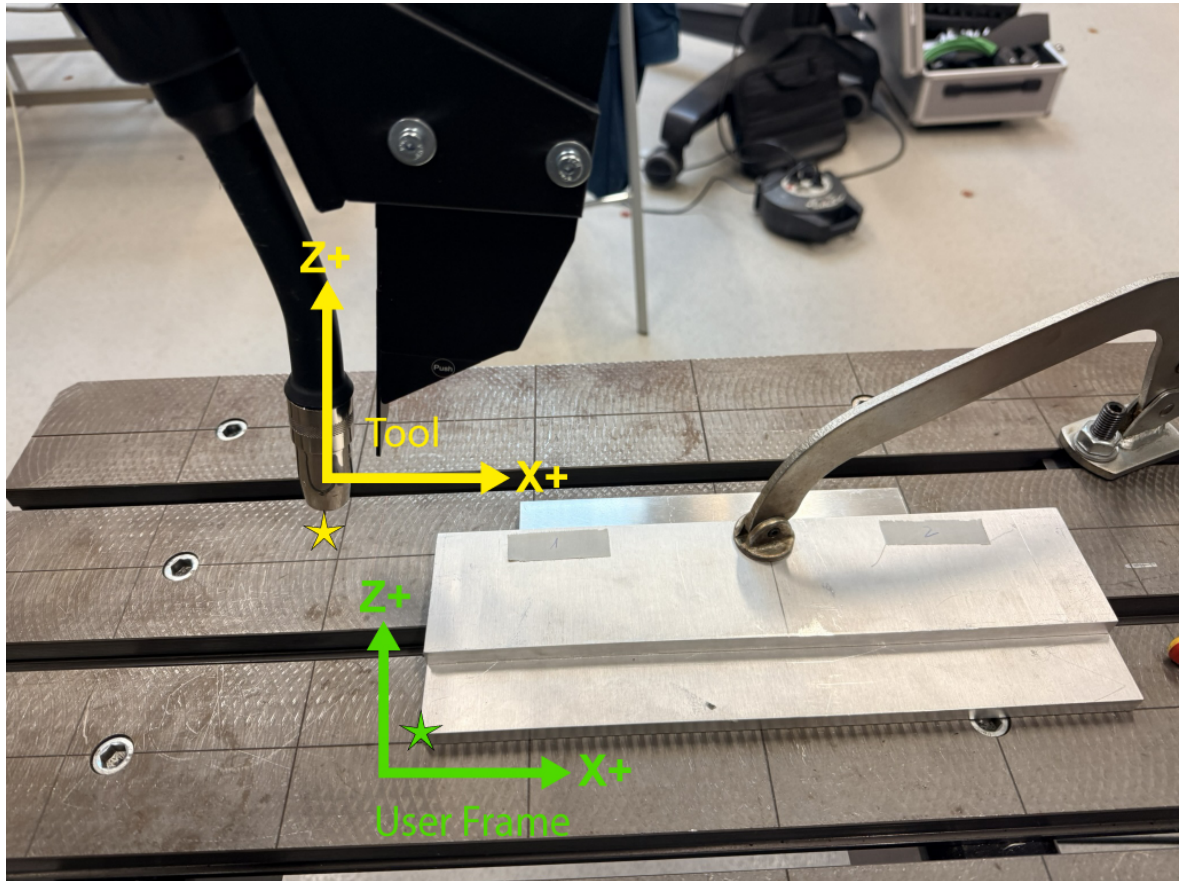
- The 10-point teaching method calibration uses two different coordinate systems
- WORLD - used to move linearly from point 1 to point 2
- TOOL - used to change the alignment of the torch for the different pairs
- TOOL Frame with an accurate TCP is required beforehand

Five reference point pairs are stored for calibration.

- TCP: Move the TCP to Reference Point 1 and Reference Point 2
 - TCP alignment at Reference Point 1 and Reference Point 2 is important
 - TCP is exactly positioned at the edge of Lap joint and at the marking line on the calibration tool
 - TCP is close to 0° in W(J4) and P(J5)
- Pair1: Move the laser line from the sensor to Reference Point 1 and Reference Point 2
 - Tracking Point Top is determined and visible in the Field of View in uniVision software
 - Laser line must overlap with the marking line of Reference Point 1 and Reference Point 2
 - Pair 1 has the same torch alignment as the TCP reference points, regardless of the angle deviation of the sensor relative to the torch
 - Pair 1 Ref#1 is also our “starting point” when we reposition the torch angle for Pair 2, 3 and 4
- Pair 2, 3, and 4: Change posture in [TOOL] and make sure that laser line cuts precisely at Reference Point 1 and Reference Point 2
- Heights must be taken into account when positioning the laser line at the Reference Point 2
- For each pair where Reference Point 1 is approached, the same torch alignment must be maintained when moving the torch to reference point 2
 - Only X(J1), Y(J2), and Z(J3) may be used in [WORLD] when moving from Reference Point 1 to Reference Point 2
 - If the angle changes during this movement from Reference Point 1 to Reference Point 2, this may result in an incorrect calculation of the sensor frame

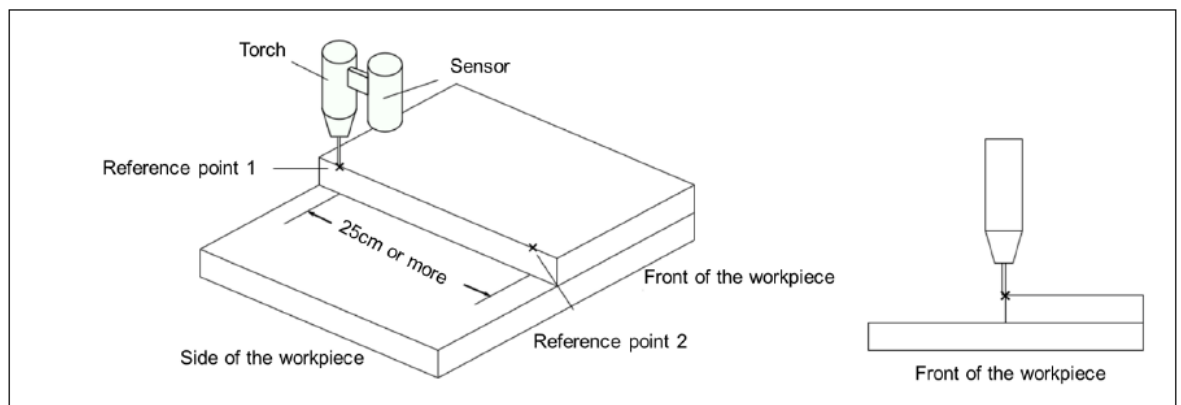
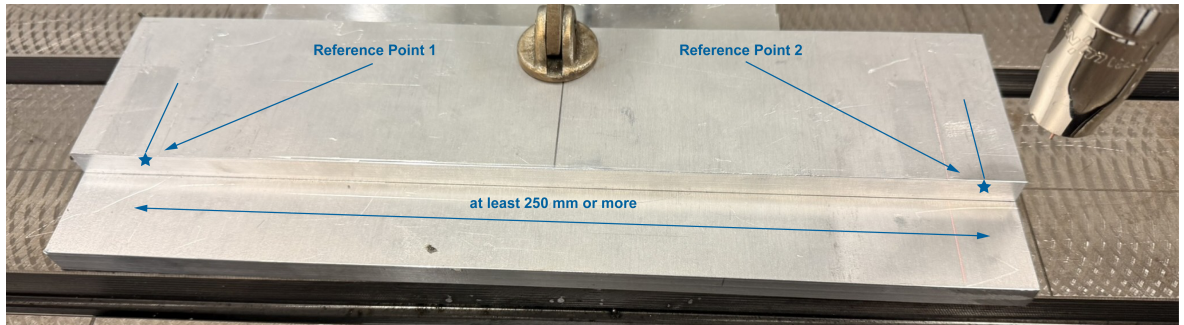
7.2 Tool and User Frame Coordinate System

- Make sure that the tool and the user frame have the correct orientation
- Coordinate system is based on the right-hand coordinate system
- Tool: **X+** in the welding direction and **Z+** is upwards
- The user frame coordinate system can be positioned at the corner of the calibration plate
- User frame: **X+** in the welding direction and **Z+** is upwards



7.3 Calibration Plate

- The calibration plate needs a Lap-Joint and the distance **at least** 250mm or more between Reference Point 1 and Reference Point 2 is mandatory
- Please ensure that the calibration plate has a flat surface and sharp edges
- Mark a small line to the calibration plate to mark the Reference Point 1 and Reference Point 2
- Note the orientation of the calibration plate relative to the torch, sensor, reference point 1, and reference point 2



Additional note

It is recommended that the calibration plate be aligned parallel to the robot's coordinate system, to simplify the process.

7.4 Sensor Calibration with the 10-Point Teaching Method

- Press the [MENU] key and select “SETUP”
- Press F1 [TYPE] and select “Sensor Setup” – the sensor setup screen will be displayed
- Press F2 [CALIB] – the Sensor Calibration screen will be displayed
- Move cursor in the Teach Pendant on “Method” and select “10points”
- Move cursor on position register and enter the position register number to use for calibration
 - The data of the position register is erased by calibration process, please select unused position register in TP programs
- “Sensor Schedule” means the job number of uniVision software (enter 1 if the calibration job in uniVision was saved as 1)

Sensor Calib.

6/11

Sensor No :1 ENABLE
Frame No :1
Equip. Group :1
Method :10points
Position Register:1
Sensor Schedule :1

Current Sensor Frame
X: 34.849 Y: 23.107 Z: 382.490
W: -178.404 P: -54.521 R: -2.463

Reference Point	#1	#2
TCP	RECORD	RECORD
Laser Line on Marked		
Pair1 (no rot.)	RECORD	RECORD
Pair2 (+z rot.)	RECORD	RECORD
Pair3 (+z/+y rot.)	RECORD	RECORD
Pair4 (+z/-y rot.)	RECORD	RECORD

[TYPE]

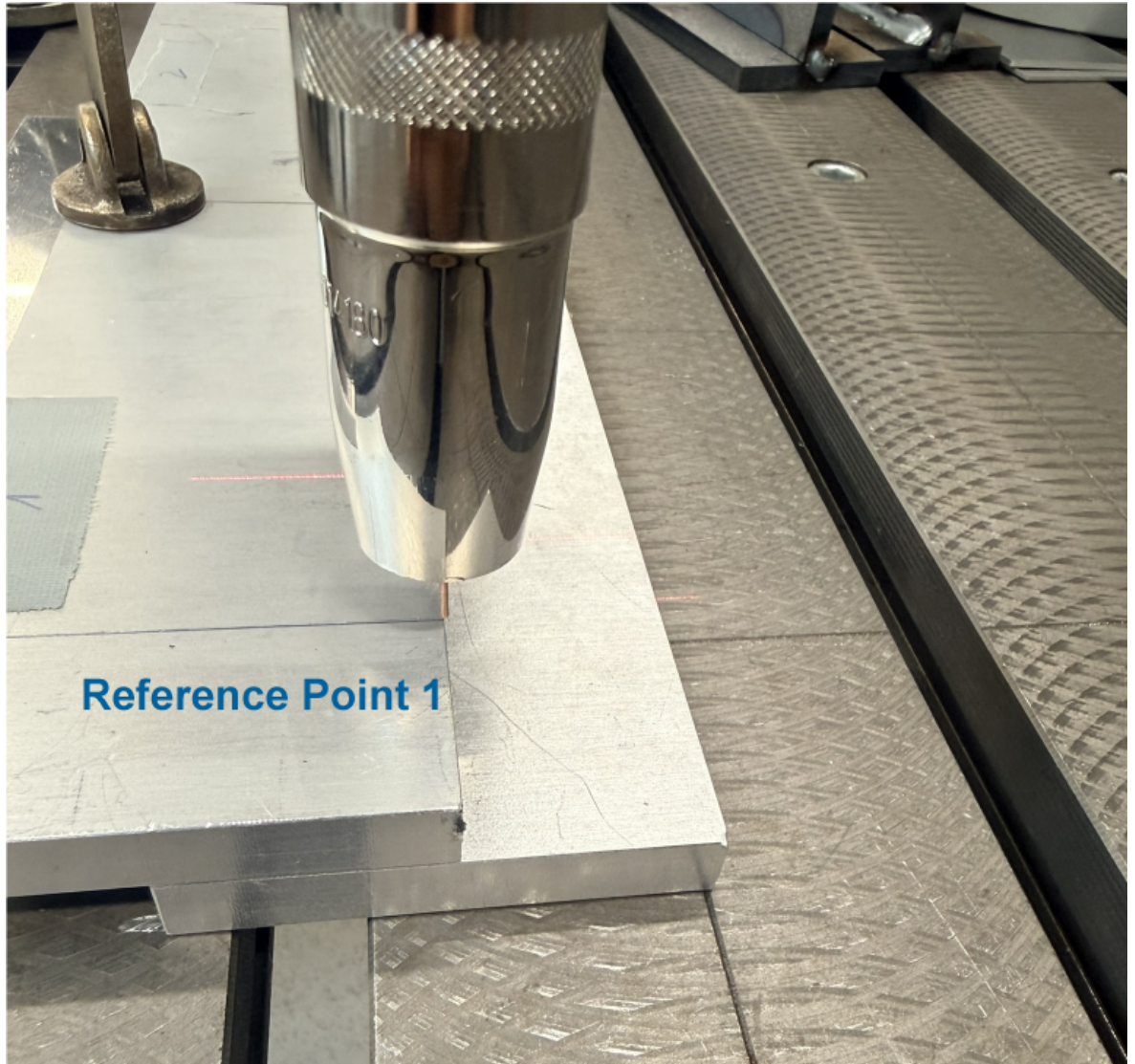
SETUP

APPLY

CLEAR

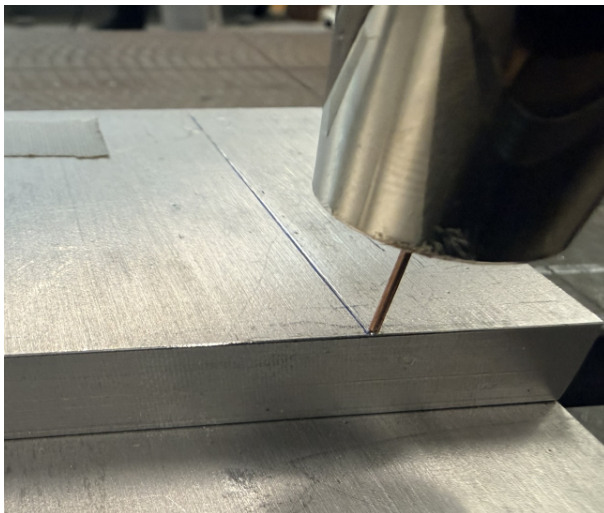
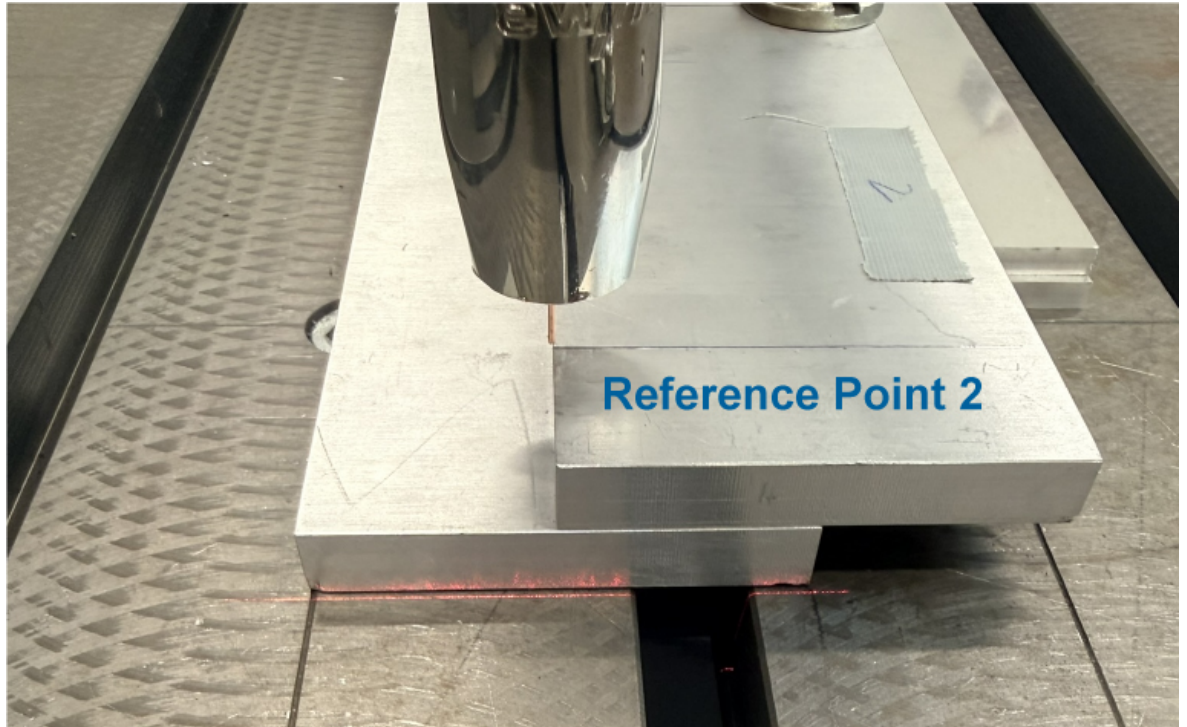
7.5 Reference Point TCP - Ref#1

- Move the TCP in [WORLD] to Reference Point 1 on the Calibration Plate by the jog operation of the robot
- TCP is placed directly on the edge of Reference Point 1 and torch rotation W(J4) and P(J5) is close to 0°
- Move the cursor in the Teach Pendant over TCP Reference Point 1 and press [SHIFT] + F3 [RECORD]



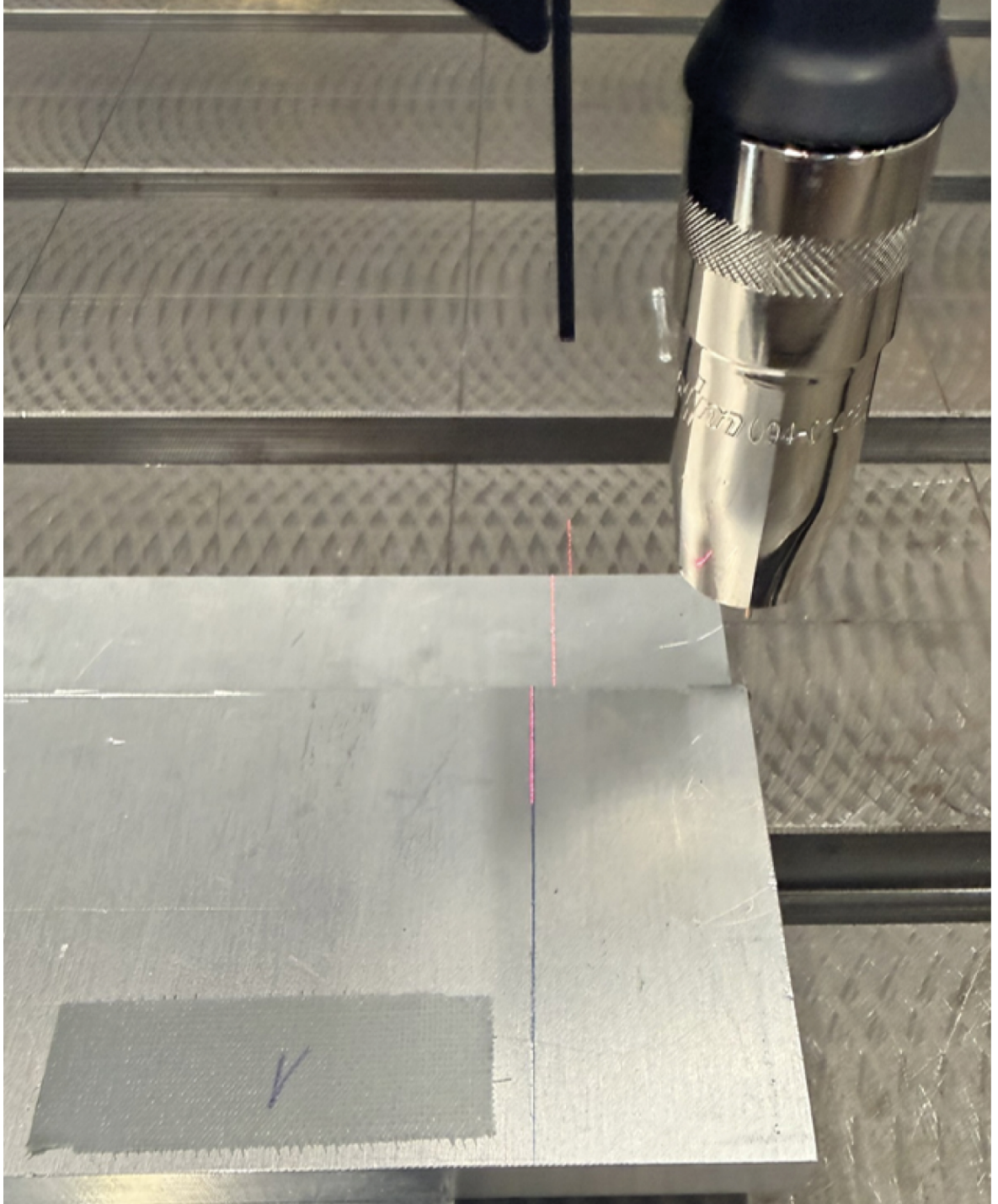
7.6 Reference Point TCP - Ref#2

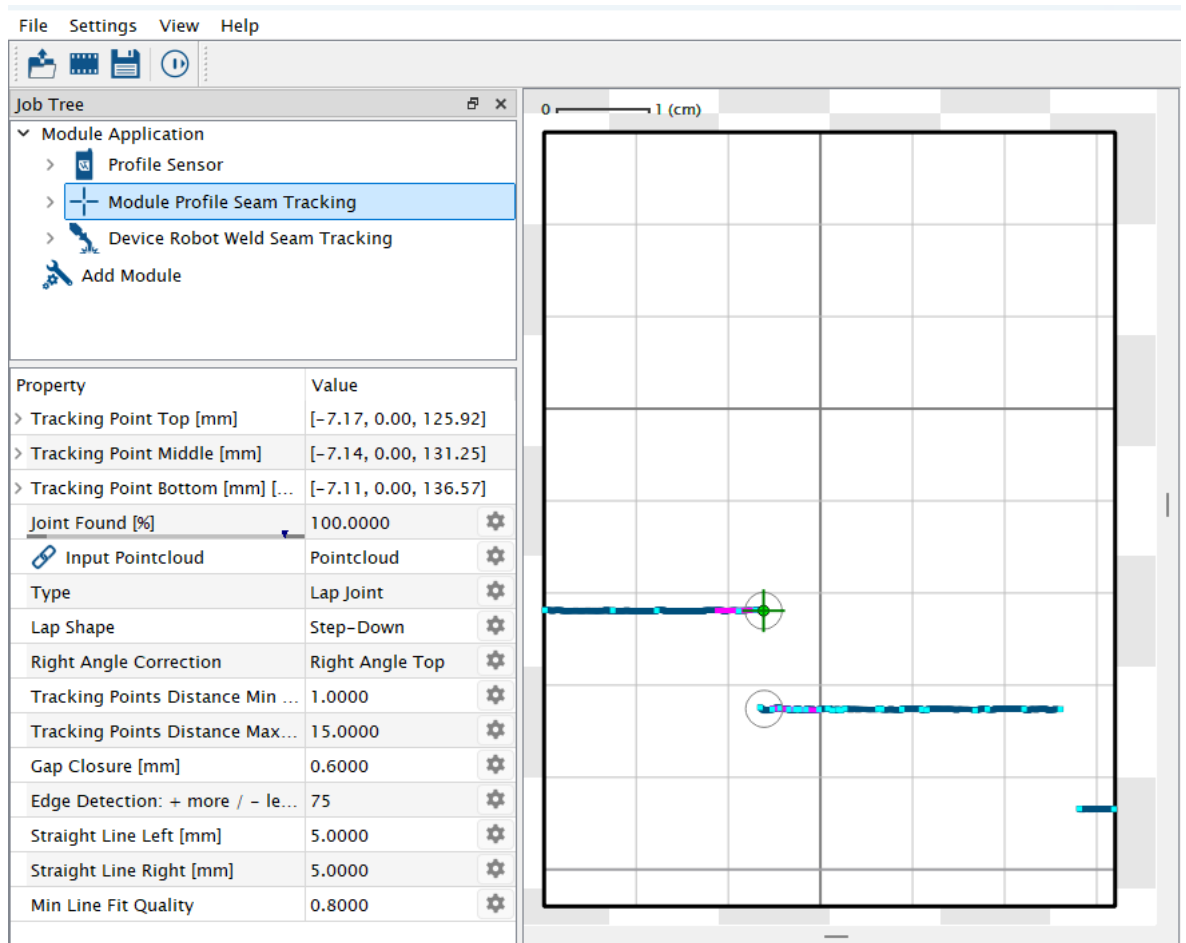
- Move the TCP in [WORLD] to Reference Point 1 on the Calibration Plate by the jog operation of the robot
- TCP is placed directly on the edge of Reference Point 1 and torch rotation W(J4) and P(J5) is close to 0°
- Move the cursor in the Teach Pendant over TCP Reference Point 1 and press [SHIFT] + F3 [RECORD]



7.7 Ref#1 - Pair1 (no rot.)

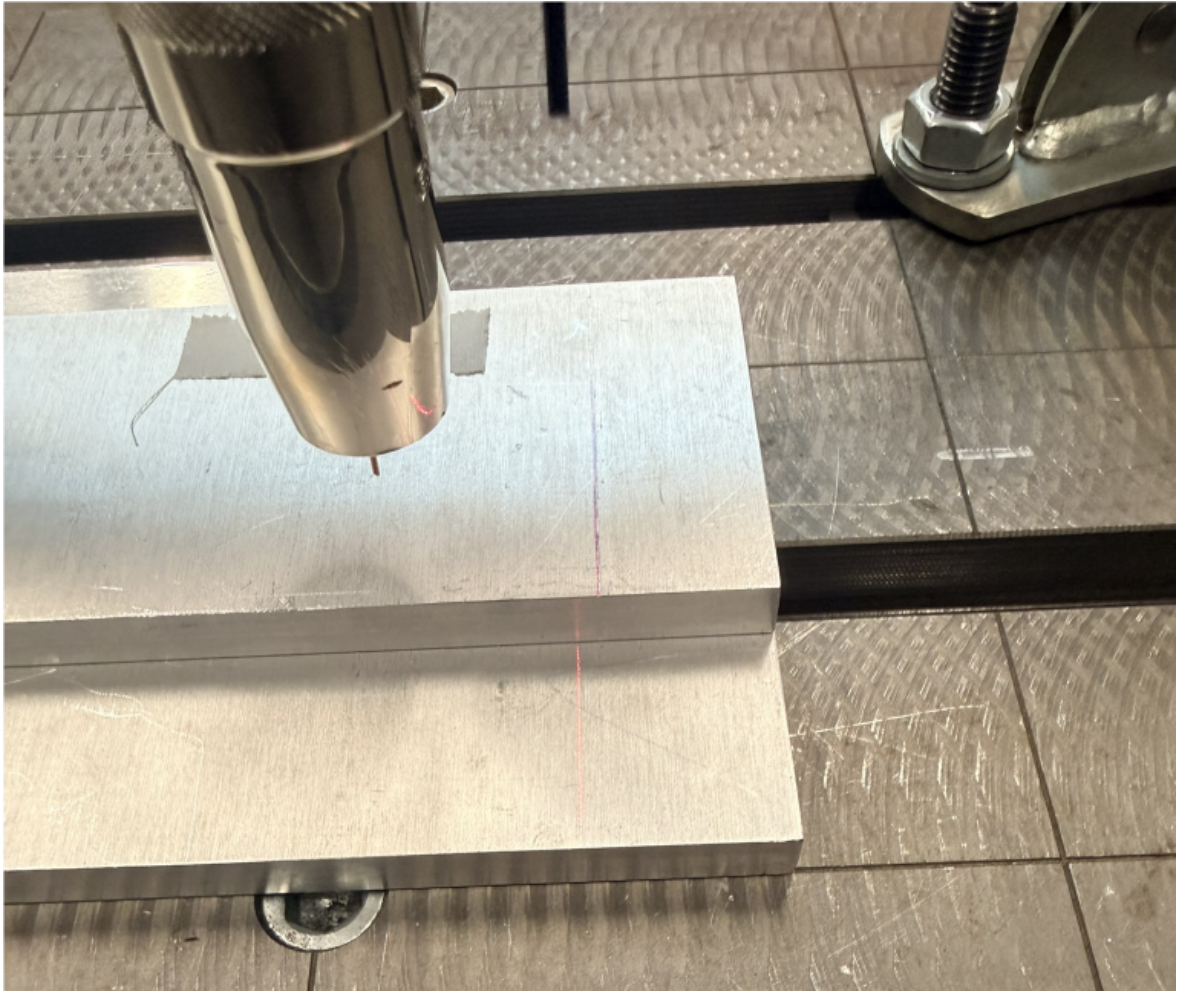
- Turn on the laser of the wenglor Profile Sensor in the Teach Pendant and move the cursor over TCP Reference Point 1
- While pressing the [SHIFT] key, press the [F2 MOVE_TO] key and move the TCP to Reference Point 1
- Perform jog operation and move robot in [WORLD] so that laser line overlaps exactly at the Reference Point 1 and that the "Tracking Point Top" in the uniVision software is stable in the Field of View
- Move the cursor in the Tech Pendant over **#1 - Pair1 (no rot.)** and while pressing [SHIFT] key, press the F3 [RECORD] key

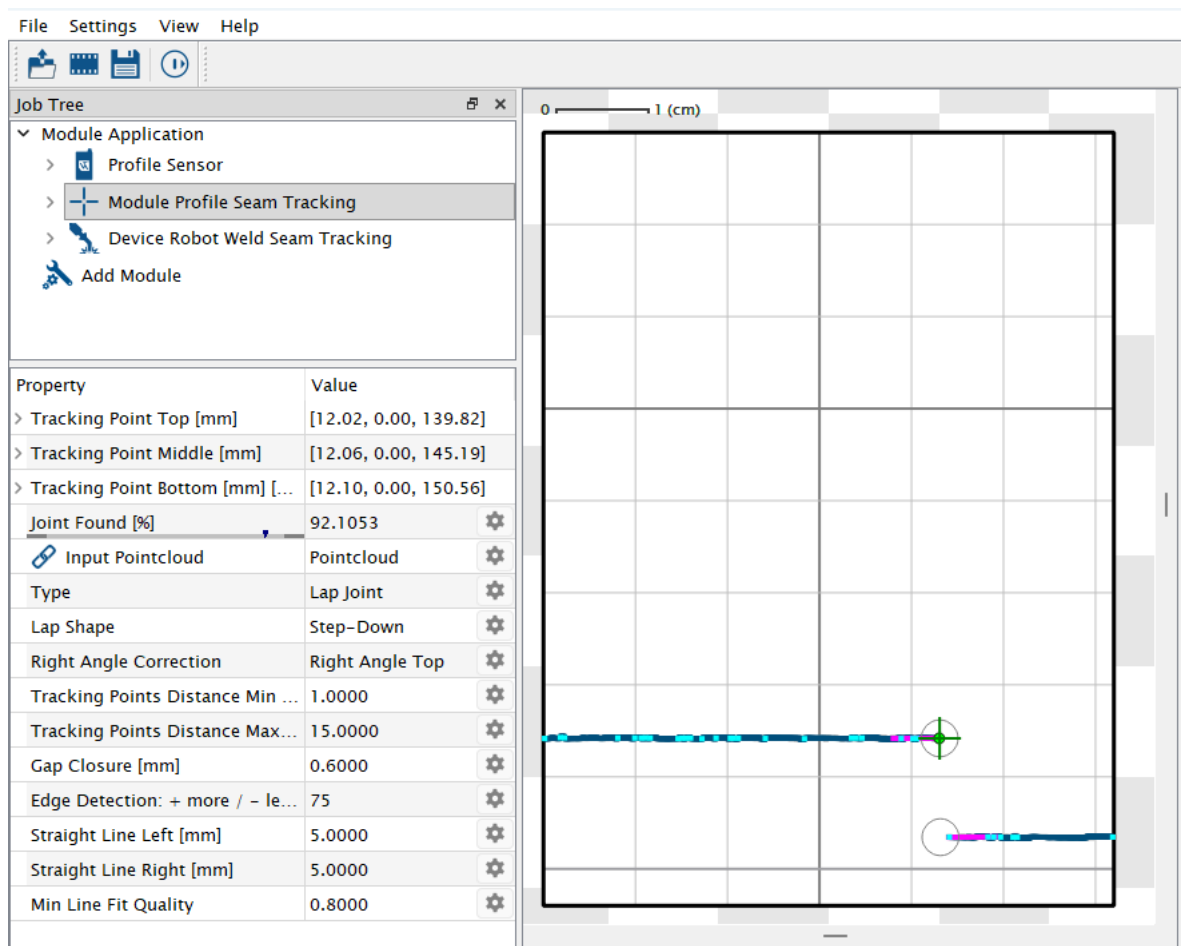




7.8 Ref#2 - Pair1 (no rot.)

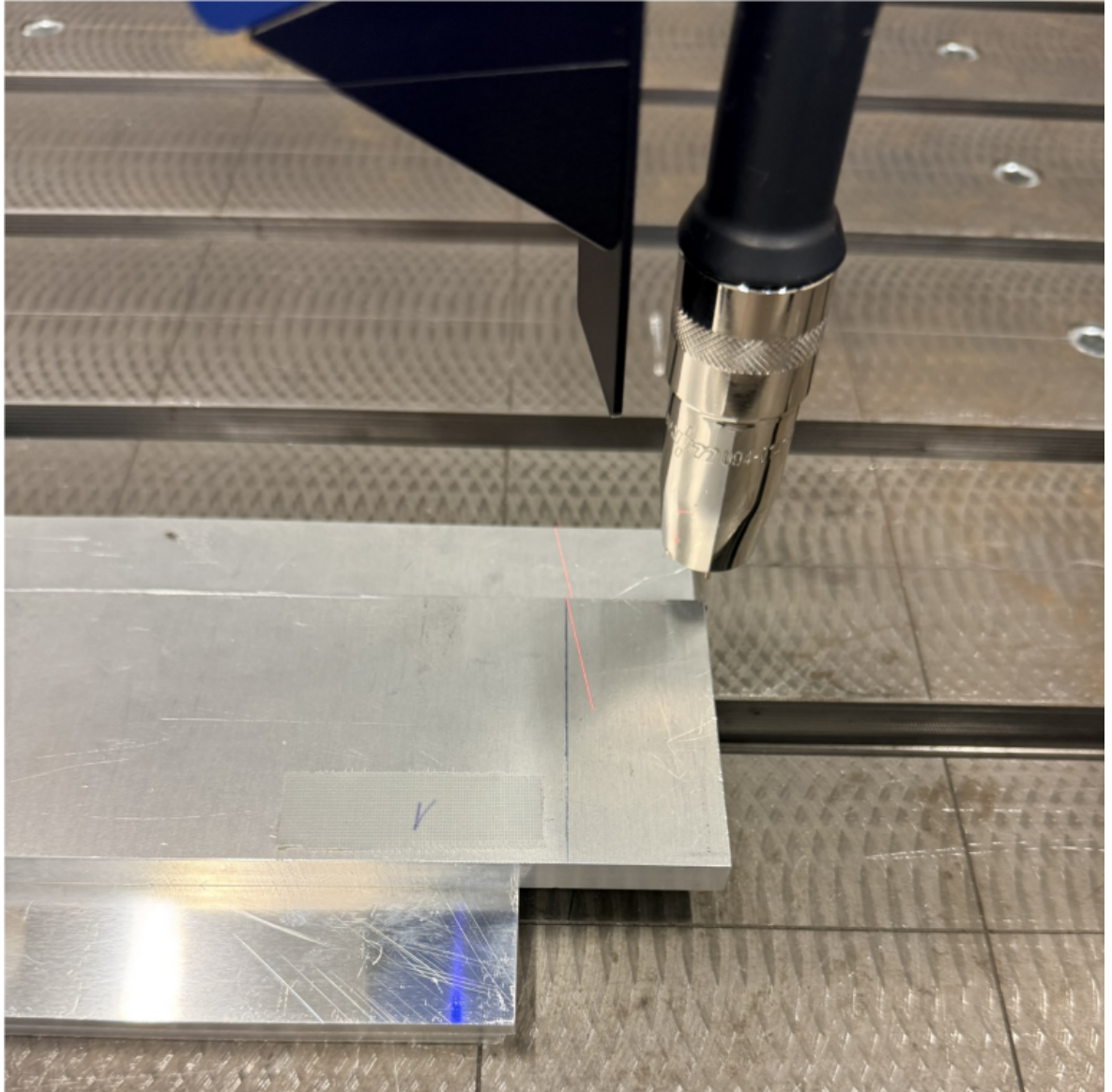
- Perform jog operation and move robot in [WORLD] to Reference Point 2 by changing only the values of X(J1), Y(J2), and Z(J3) (change only the height without twisting or tilting)
- Make sure the laser line overlaps exactly at the Reference Point 2 and that the “Tracking Point Top” in the uniVision software is stable in the Field of View and lower than in Ref#1
- Move the cursor in the Tech Pendant over **#2 - Pair1 (no rot.)** and while pressing [SHIFT] key, press the F3 [RECORD] key

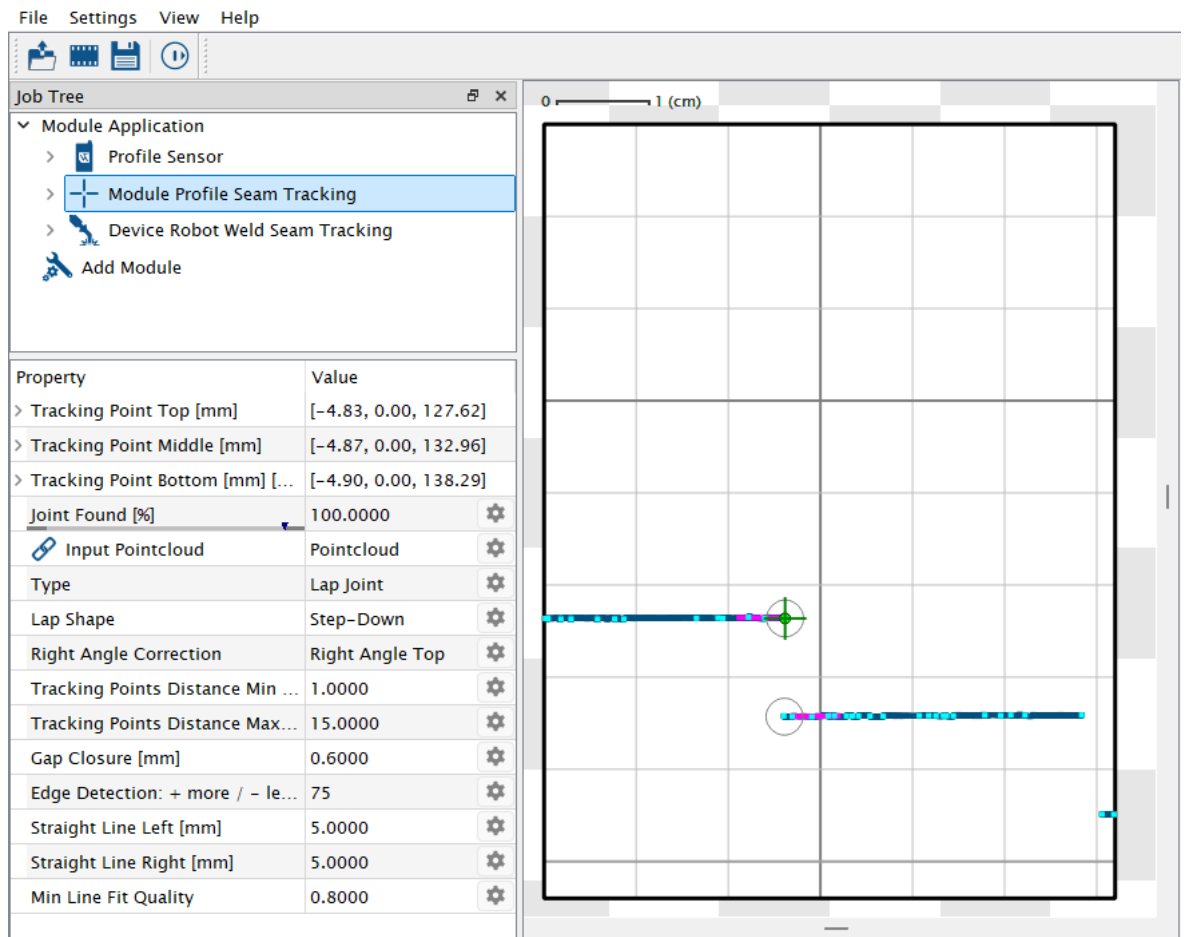




7.9 Ref#1 - Pair2 (+z rot.)

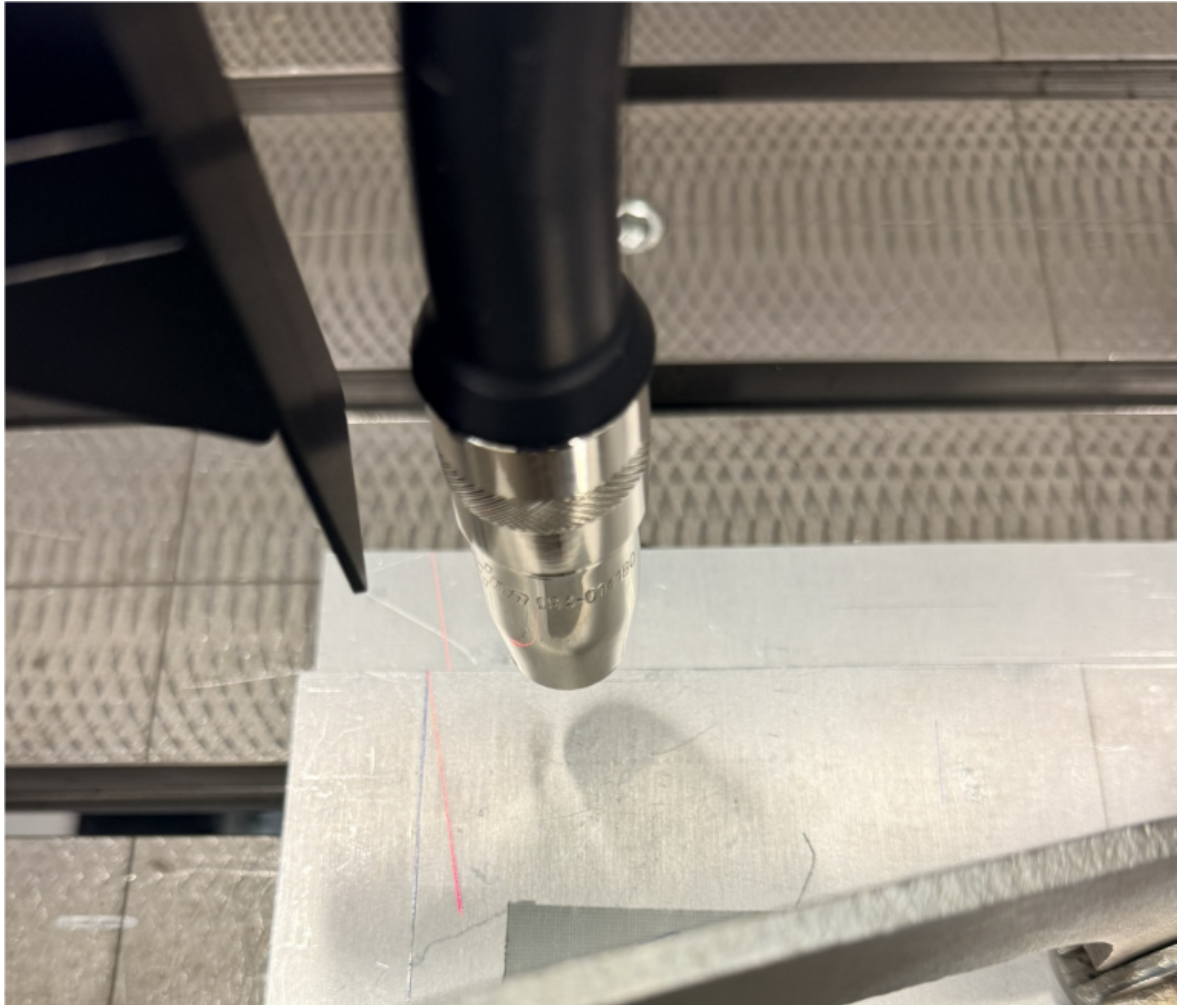
- Perform jog operation, move robot in [WORLD] back to Reference Point 1
- Change posture in [TOOL] and rotate the sensor about Z(J3) by approx. 20° in the positive range from the “Pair1 (no rot.)” position
- Move robot in [WORLD] so that the laser line cuts precisely at Reference Point 1 and that the “Tracking Point Top” in the uniVision software is stable in the Field of View
- Move the cursor in the Tech Pendant over **#1 - Pair2 (+z rot.)** and while pressing [SHIFT] key, press the F3 [RECORD] key

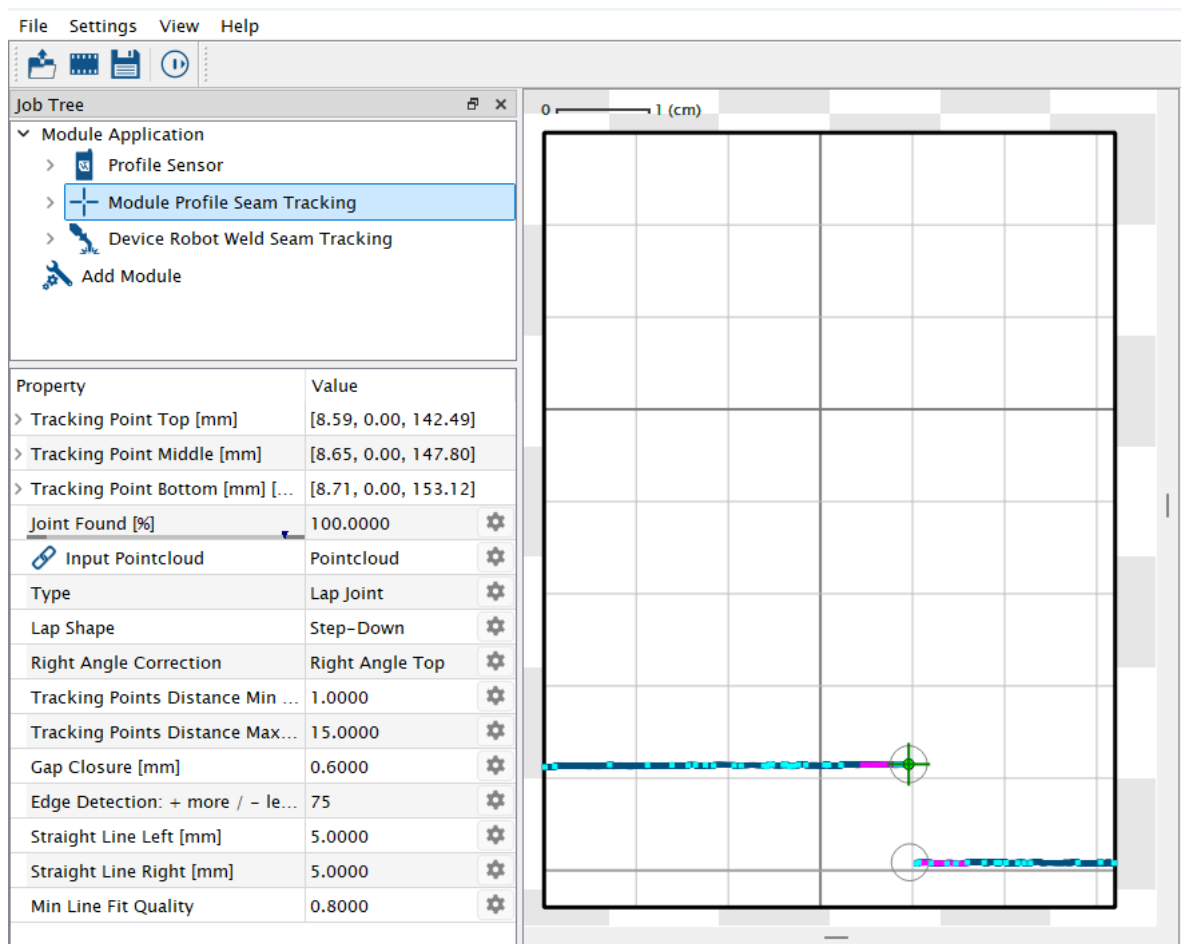




7.10 Ref#2 - Pair2 (+z rot.)

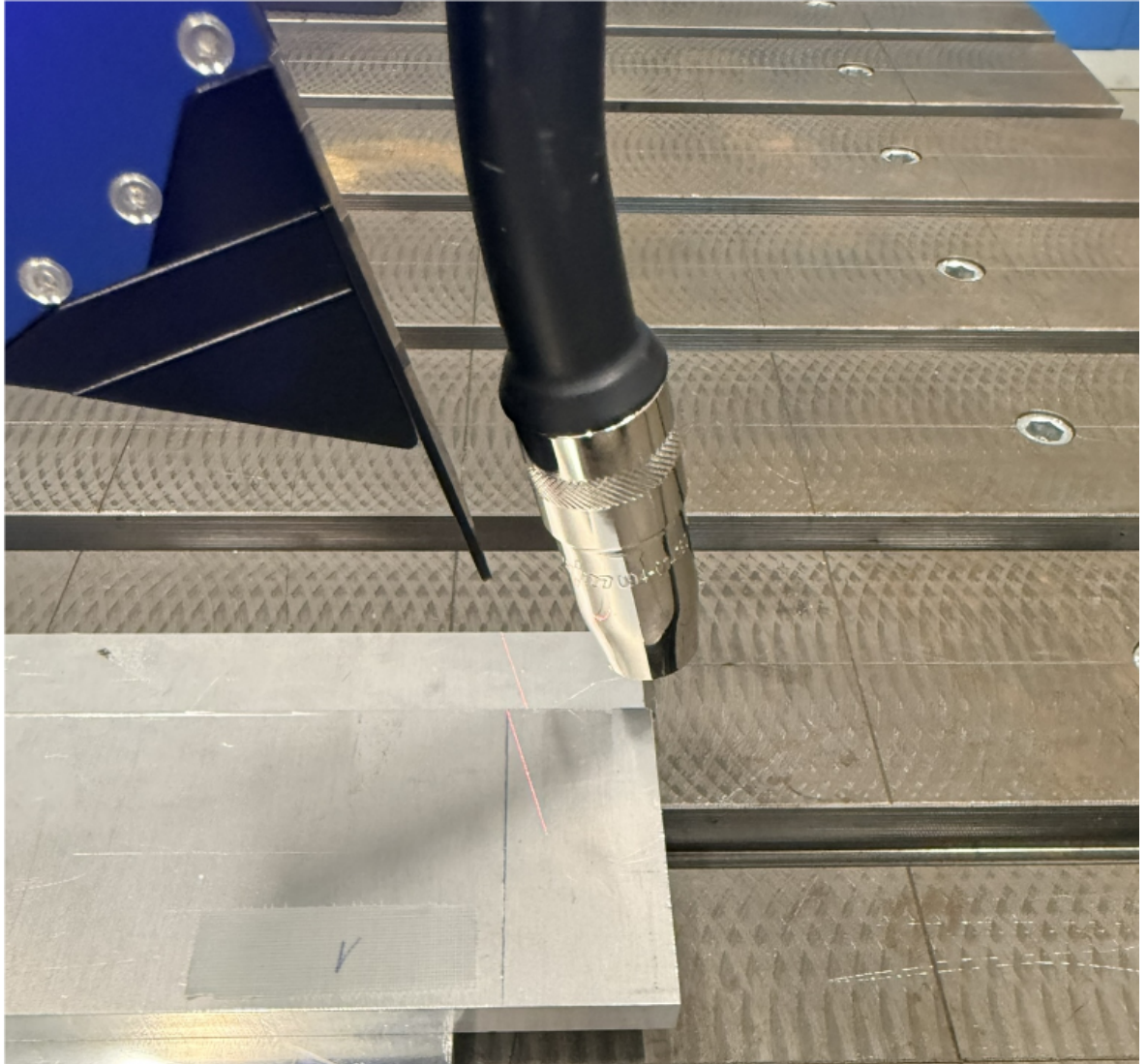
- Perform jog operation, move robot in [WORLD] back to Reference Point 2 only with X(J1), Y(J2) and Z(J3)
- Make sure that the laser line cuts precisely at Reference Point 2 and that the “Tracking Point Top” in the uniVision software is stable in the Field of View and lower than in Ref#1
- Move the cursor in the Tech Pendant over **#2 - Pair2 (+z rot.)** and while pressing [SHIFT] key, press the F3 [RECORD] key

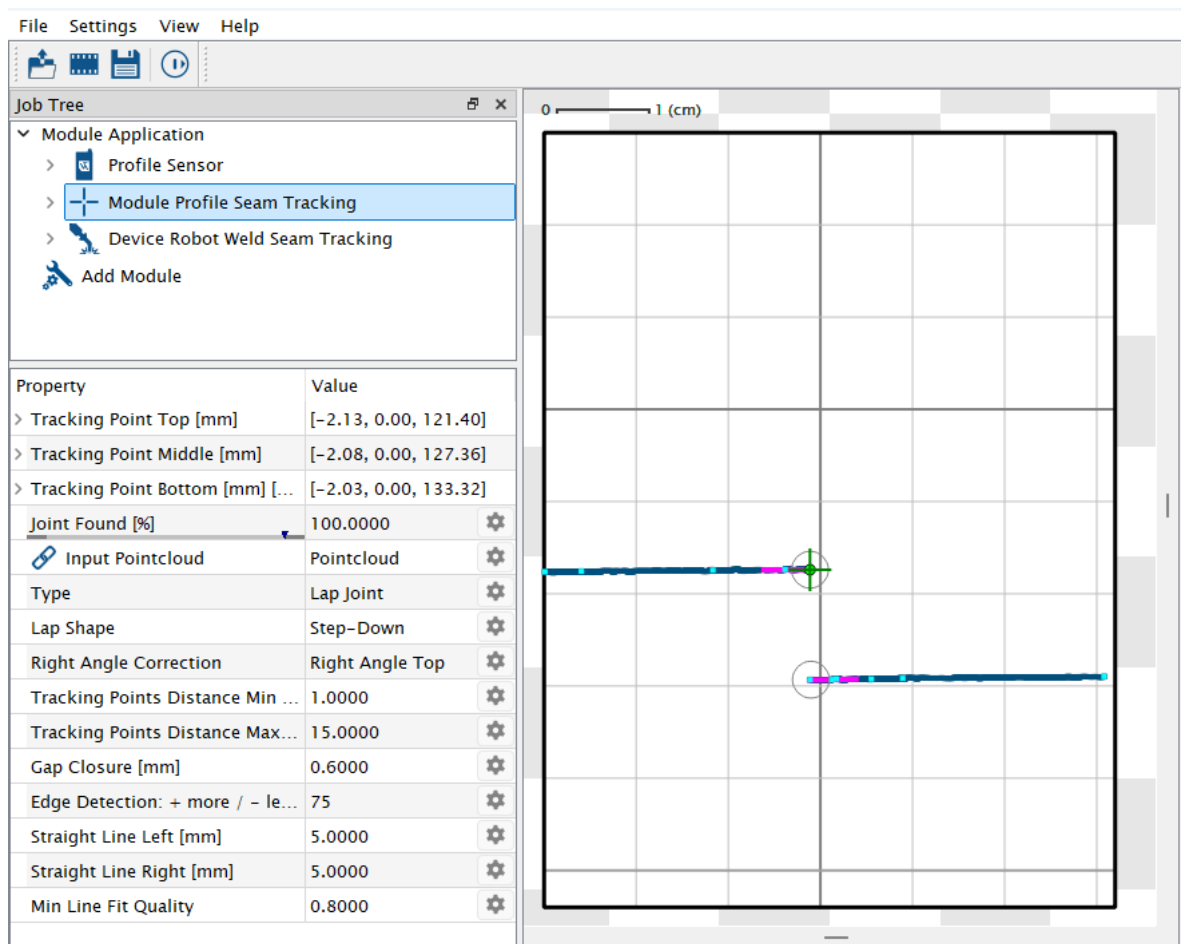




7.11 Ref#1 - Pair3 (+z/+y rot.)

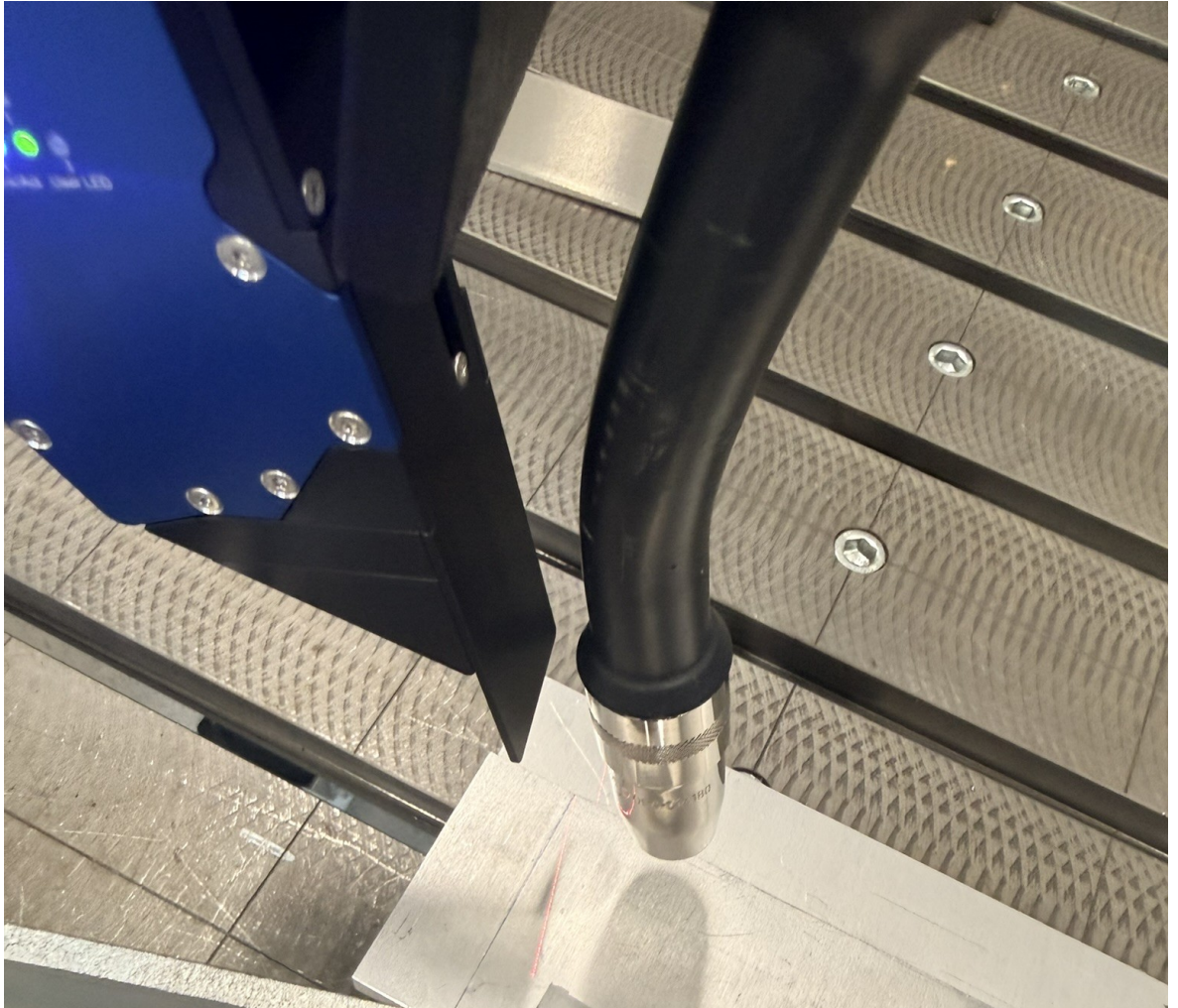
- Perform jog operation, move robot in [WORLD] back to Reference Point 1
- Change posture in [TOOL] and rotate the sensor about Y(J2) by approx. 20° in the positive range from the “Pair2 (+z rot.)” position
- Move robot in [WORLD] so that the laser line cuts precisely at Reference Point 1 and that the “Tracking Point Top” in the uniVision software is stable in the Field of View
- Move the cursor in the Tech Pendant over **#1 - Pair3 (+z/+y rot.)** and while pressing [SHIFT] key, press the F3 [RECORD] key

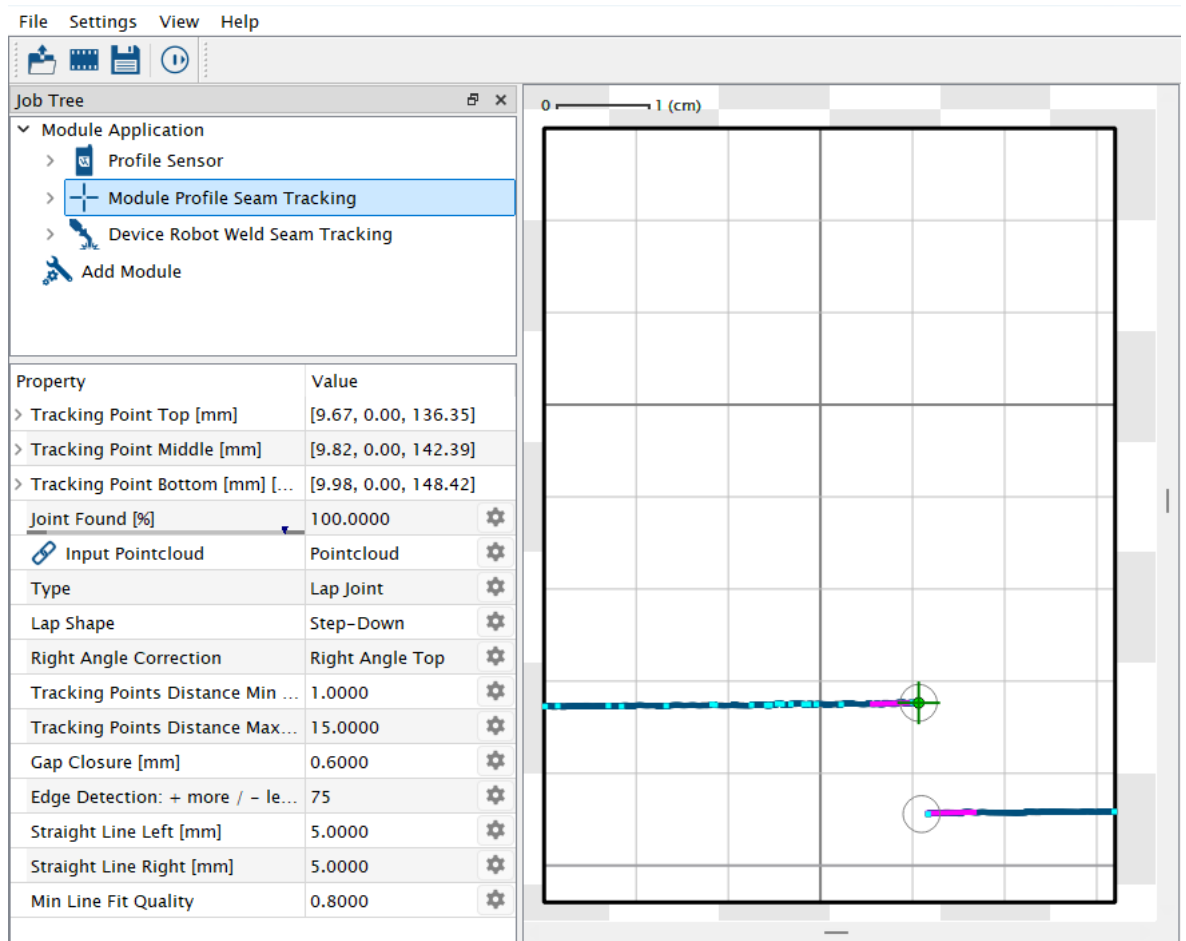




7.12 Ref#2 - Pair3 (+z/+y rot.)

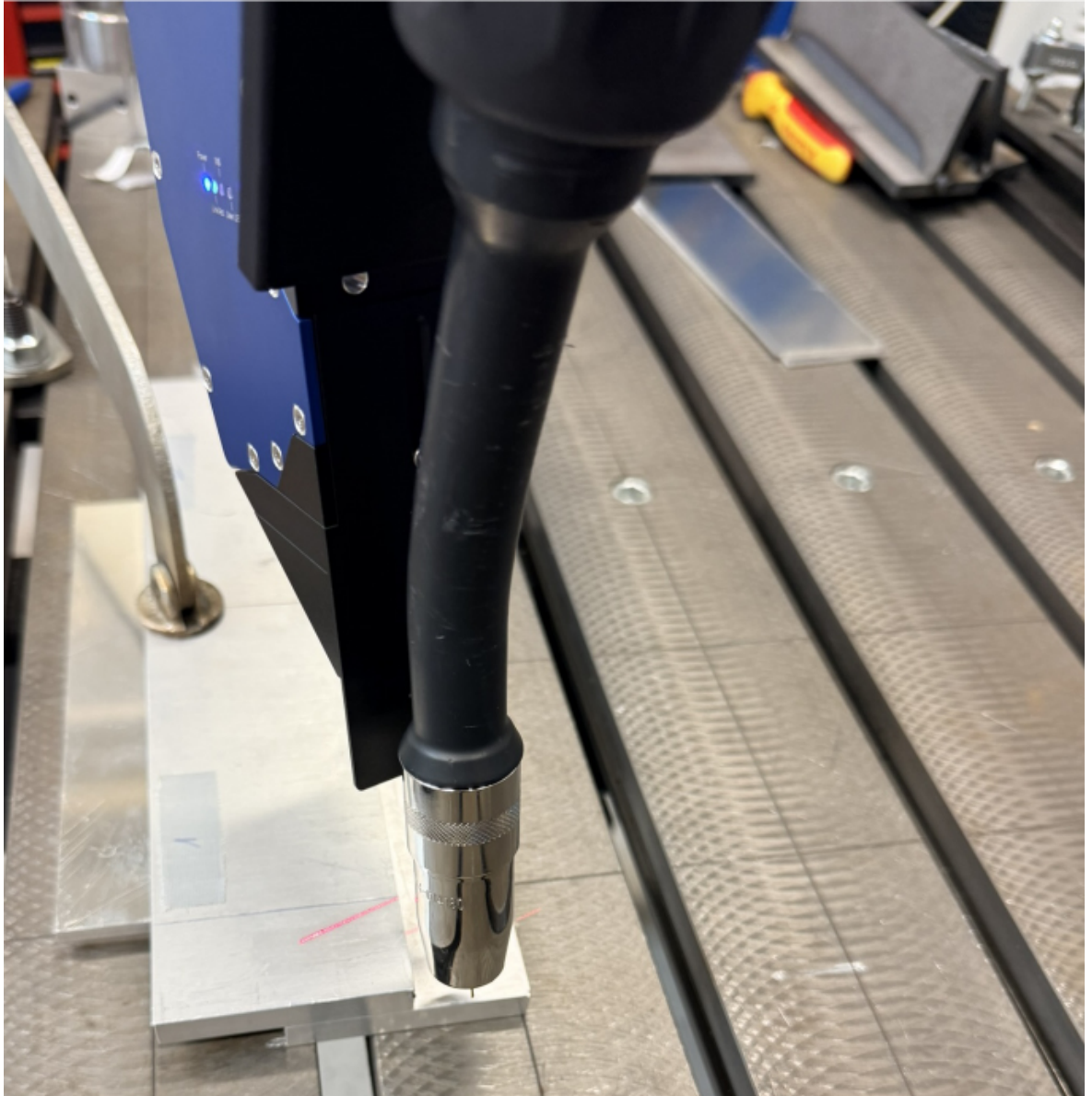
- Perform jog operation, move robot in [WORLD] back to Reference Point 2 only with X(J1), Y(J2) and Z(J3)
- Make sure that the laser line cuts precisely at Reference Point 2 and that the “Tracking Point Top” in the uniVision software is stable in the Field of View and lower than in Ref#1
- Move the cursor in the Tech Pendant over **#2 - Pair3 (+z/+y rot.)** and while pressing [SHIFT] key, press the F3 [RECORD] key

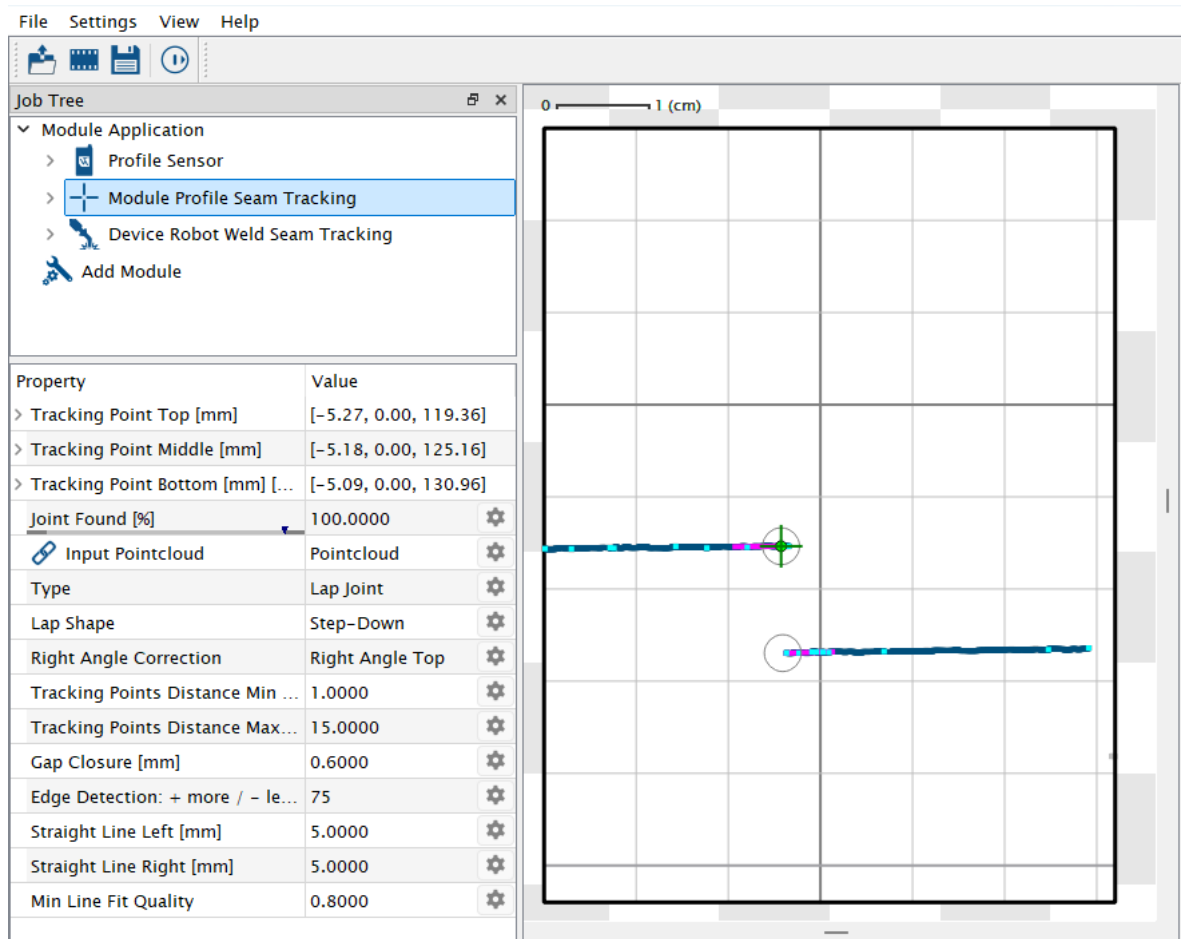




7.13 Ref#1 - Pair4 (+z/-y rot.)

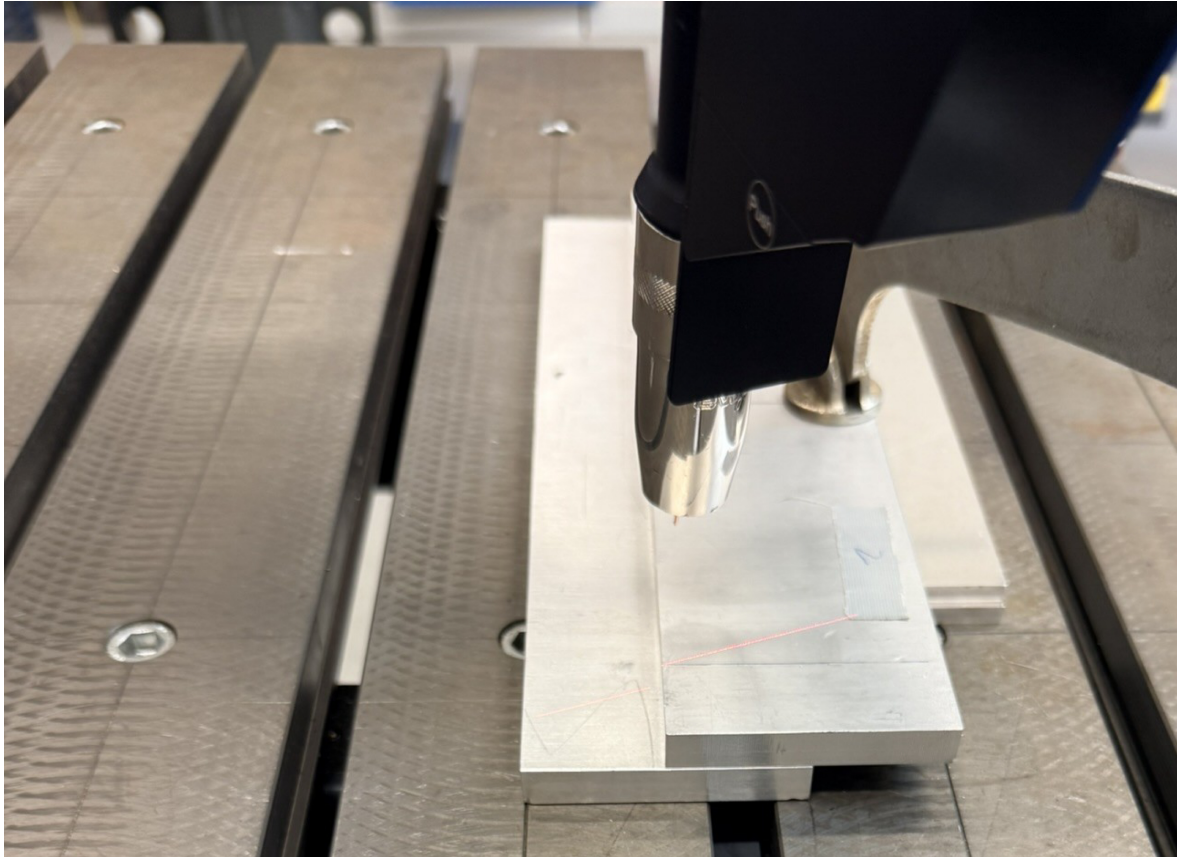
- Perform jog operation, move robot in [WORLD] back to Reference Point 1
- Change posture in [TOOL] and rotate sensor about Y(J2) by approx. 20° in the negative range from the "Pair2 (+z rot.)" position
- Move robot in [WORLD] so that the laser line cuts precisely at Reference Point 1 and that the "Tracking Point Top" in the uniVision software is stable in the Field of View
- Move the cursor in the Tech Pendant over **#1 - Pair4 (+z/-y rot.)** and while pressing [SHIFT] key, press the F3 [RECORD] key

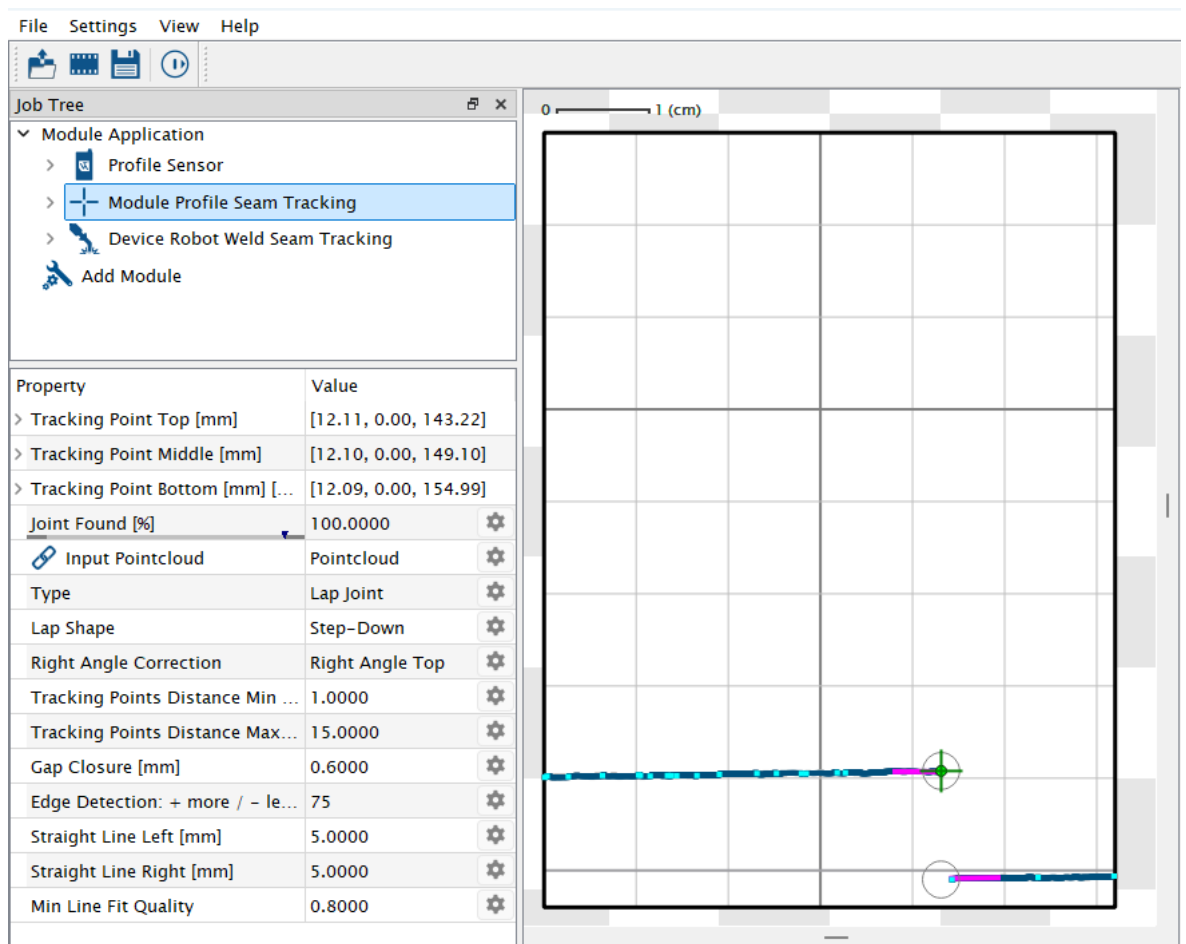




7.14 Ref#2 - Pair4 (+z/-y rot.)

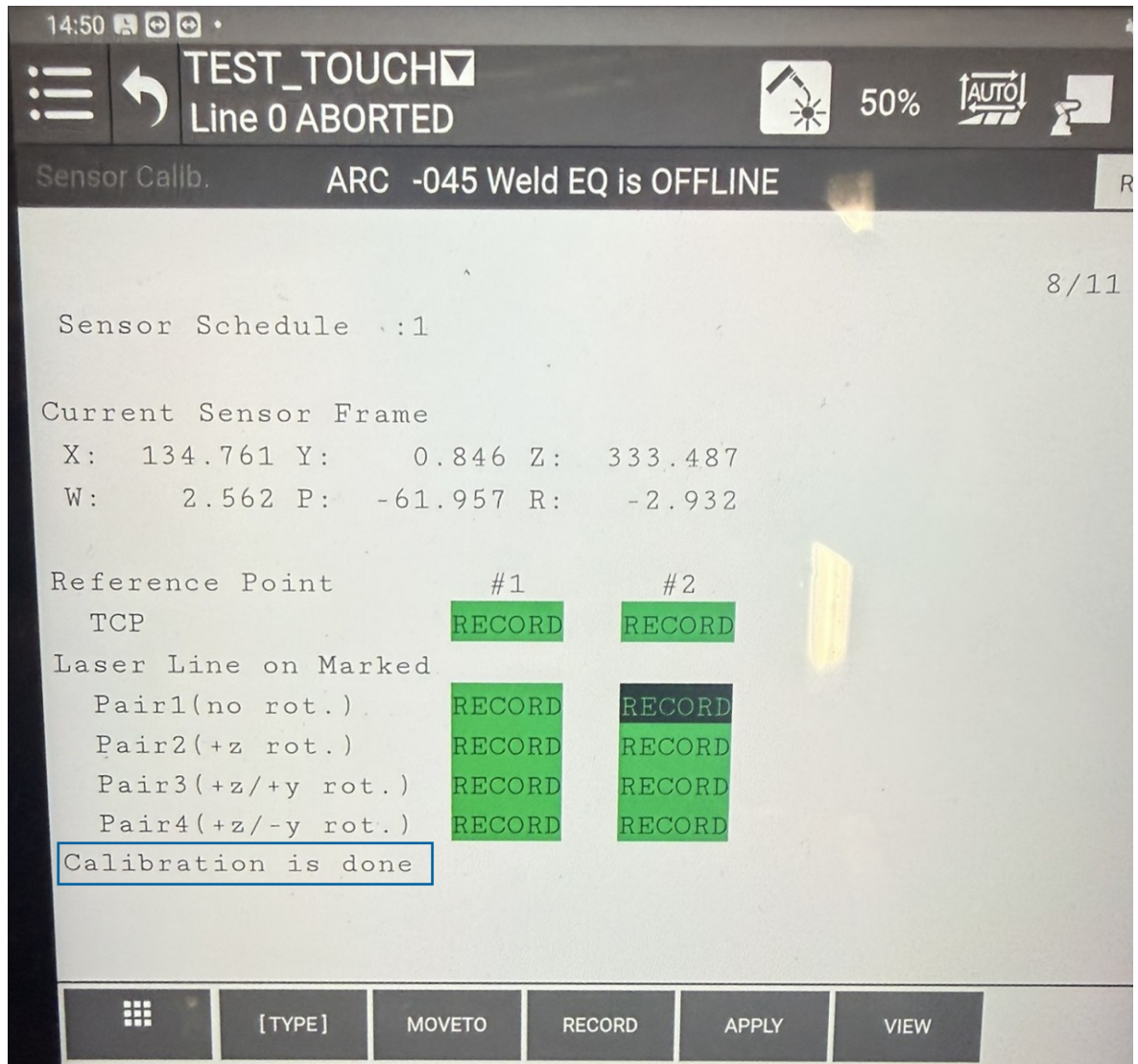
- Perform jog operation, move robot in [WORLD] back to Reference Point 2 only with X(J1), Y(J2) and Z(J3)
- Make sure that the laser line cuts precisely at Reference Point 2 and that the “Tracking Point Top” in the uniVision software is stable in the Field of View and lower than in Ref#1
- Move the cursor in the Tech Pendant over **#2 - Pair4 (+z/-y rot.)** and while pressing [SHIFT] key, press the F3 [RECORD] key





7.15 Confirmation and Calibration

- Once all recorded points have been confirmed, execute the automatic calibration procedure
- Move the cursor in the Tech Pendant over **#1 - Pair1 (no rot.)** and while pressing Deadman switch, [SHIFT] key, press the F4 [APPLY] key
- The robot automatically runs and moves to all taught points, starting at Reference Point 1 Pair 1
- Consider the speed for the first calibration procedure
- After successful automatic calibration procedure, the message "Calibration is done" appears at the bottom of the screen



8 Setting for Tracking Job

(see chapter 8.5.3.1 in FANUC OPERATOR's MANUAL B-84234EN01)

8.5.3.1 Sensor Tracking Instruction

The Sensor Tracking supports the following instructions.

- TRACK DPM [i]
- Track End

TRACK DPM [i]

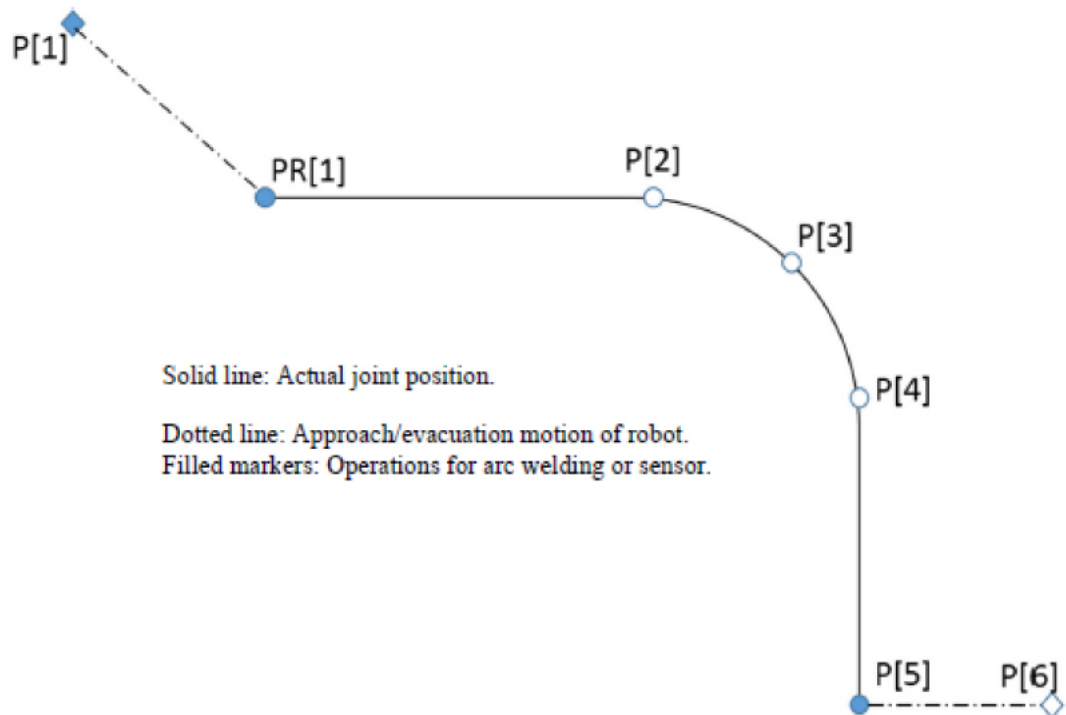
This instruction statement specifies the position to start tracking. The parameters used for tracking are determined from the specified sensor schedule.

i = Sensor schedule number

Track End

This instruction statement specifies the track end point.

8.5.4 PRACTICAL SAMPLE PROGRAM



Sample program(TRACK_ALL.TP)

```

1:J P[1] 25% FINE          !-- Move to search operation position
2: WAIT 1.00(sec)         !-- Wait to avoid effect of vibration
3: SENSOR ON[1,*,*,*]     !-- Sensor becomes ON
4: SEARCH ON[1,*,*,*]!-- Start search process
5: DETECT JOINT[2,1]       !-- Detect joint by schedule 2 and store to PR[1]
6: LOCK PREG              !-- Lock PR[1] for look-ahead execution
7: Track DPM[1]           !-- Start tracking with schedule 1
                           !-- Move to searched position (approach motion)

8:L PR[1] 100cm/min FINE
  : Weld Start [1,1] ;     !-- Start welding with weld procedure 1 and schedule 1
9:L P[2] 100cm/min CNT100
10:C P[3]
  : P[4] 100cm/min CNT100
11:L P[5] 100cm/min FINE
  : Weld End[1,1]         !-- End welding
12: Track End             !-- End tracking
13: UNLOCK PREG           !-- Unlock PR[1]
14:L P[6] 200cm/min FINE  !-- Evacuation motion

```