

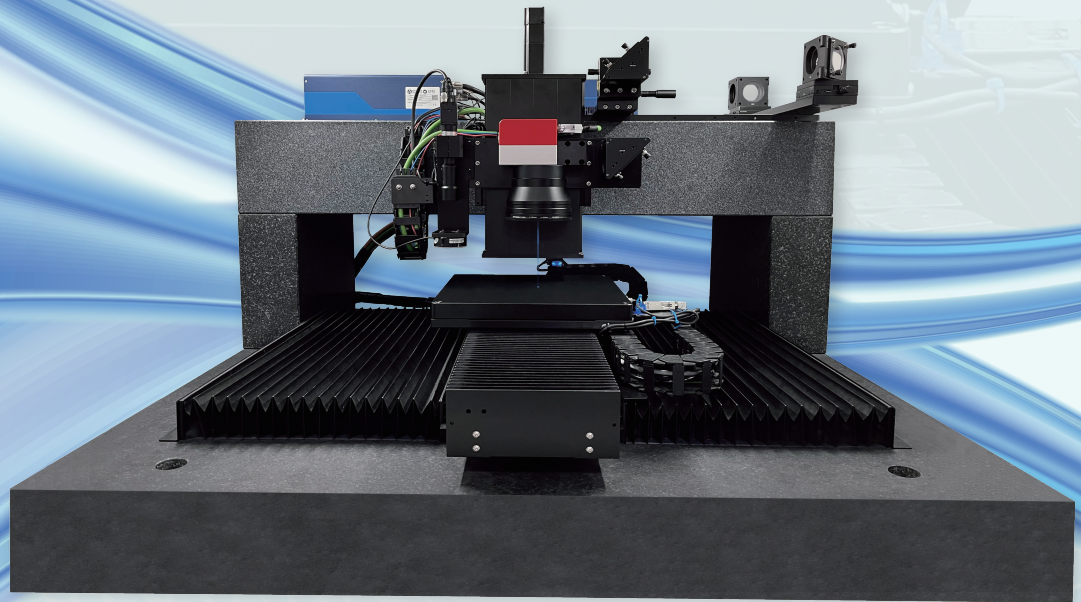
# SGS Galvo and Stage

## Synchronized Control Solution

Focus on Laser Micromachining

Cutting Ablation Marking

Welding Drilling Slicing



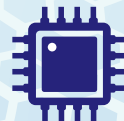
3C



New Energy



Precision  
Medical Devices



Semiconductor  
Related



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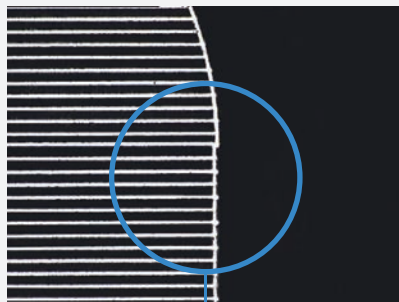
Military and  
Aerospace Components

# 0 Solution Introduction

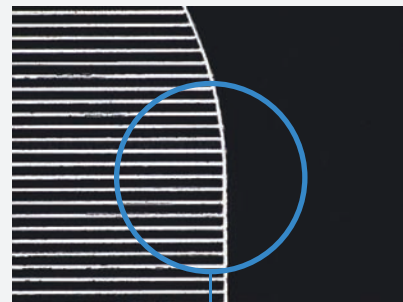
## Technical Background

Akribis' Synchronized Galvo and Stage (SGS) solution enables galvos and motion stages to be controlled in sync, expanding the galvo's scanning field of view and revolutionizing traditional stitching process. The SGS solution eliminates stitching error, and the coordinated motion significantly improves the overall processing efficiency. Additionally, this solution employs EtherCAT communication, allowing for flexible expansion of galvo and motion axis numbers, making it suitable for multi-axis, multi-galvo applications and meeting the high-efficiency, high-precision requirements of large size laser precision processing.

### Machining Accuracy Comparison



Stitching Process



SGS Process

### Precision Drilling Efficiency Comparison

#### Processing parameters

Hole size: 1mm Hole distance: 2mm

Number of holes: 1764

Processing field of view 30X30mm

Processing speed 300mm/s

Jump speed 1000mm/s

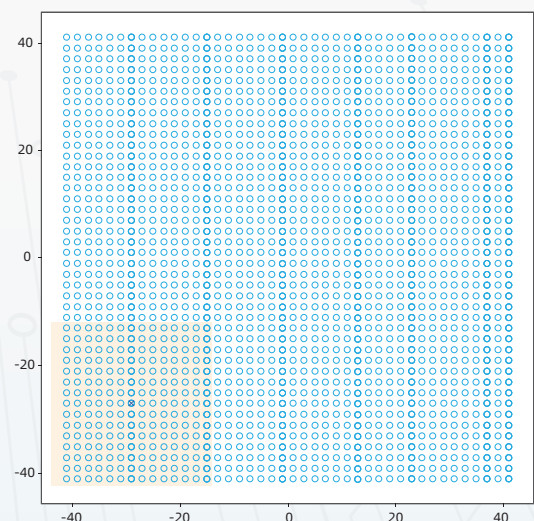
#### Processing time comparison

Stitching process  
41400ms

VS

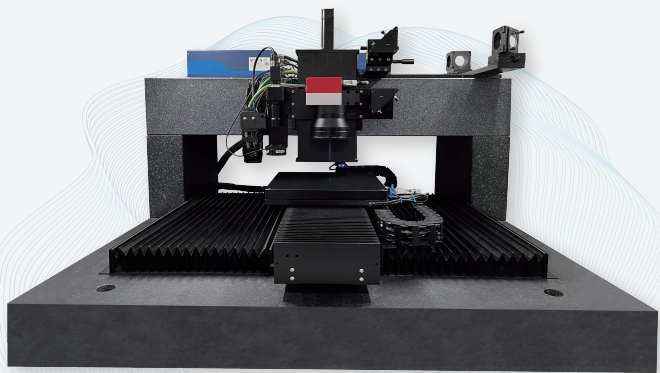
SGS process  
22500ms

45% increase in efficiency



# ○ Solution Introduction

## Product Features

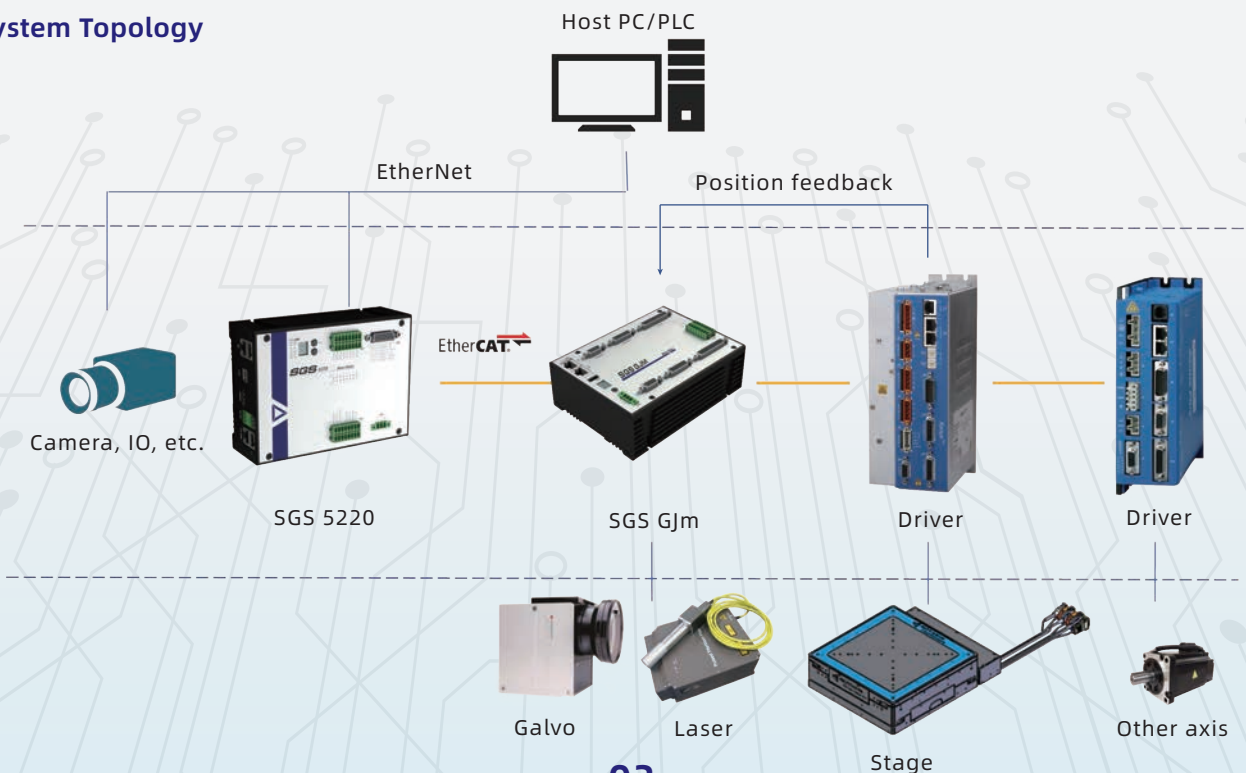


- High-precision linear motor motion stage
- Synchronized control of galvo and stage
- Galvo compensates for the stage following error in real time, achieving high-speed and high-precision scanning
- Laser pulse position synchronized output function (PSO)
- Optimized trajectory planning algorithm to achieve better processing efficiency
- Uses EtherCAT communication network, supports up to 32 axes
- Supports GUI software customization

## System Configuration

Project	Optional modules	Brand	Standard	Optional
Software	GUI software	Akribis		○
Mechanical	Precision motion stage	Akribis	●	
Control	SGS motion controller + EtherCAT driver	Akribis	●	
Optical components	Laser Optical System	3rd party		○
	Galvo	3rd party		○

## ● System Topology



# 0 Solution Introduction

## SGS Motion Controller

Mainly includes embedded master controller and galvo controller

### ● Embedded Master Controller



#### SGS 5220 Specification

Processor	Intelx86 processor, 2.00GHz, 4 cores
Graphics	Intel integrated graphics
Memory	2GB, DDR3
Harddisk	32GB (8GB user visible)
System	Linux
Serial Port	2xRS232, baud rate 300~115200kbps
Network port	2x1000BASE-T standard Gigabit Ethernet
USB	2xUSB2.0
Show	1xHDMI
Expansion port	1xRS485, 1xCAN (optional)
Software	SimaSys: Supports RTOS, motion control, EtherCAT master
EtherCAT	2x100BSAE-T, expandable EtherCAT slave
Digital Input	8xDI, isolated, supports NPN input
Digital Output	8xDO, isolated, NPN output, 0.5A per channel
Analog Input	2xAI, ±10V, 12bit, maximum 1MHz sampling rate
Analog Output	2xAO, ±10V, 12bit
Handwheel interface	1xA/B, 7xDI, 1xDO, 4xPWM
power supply	DC 24V, 0.5A, anti-reverse, internal protection
UPS	3 seconds, internally integrated, supports power-off protection function
Size	163x121x60 (mm)
Installation	DIN35 rail or screws
Weight	0.9Kg
Work Environment	Working temperature 0~60°C, humidity 95%

### ● Galvo Controller



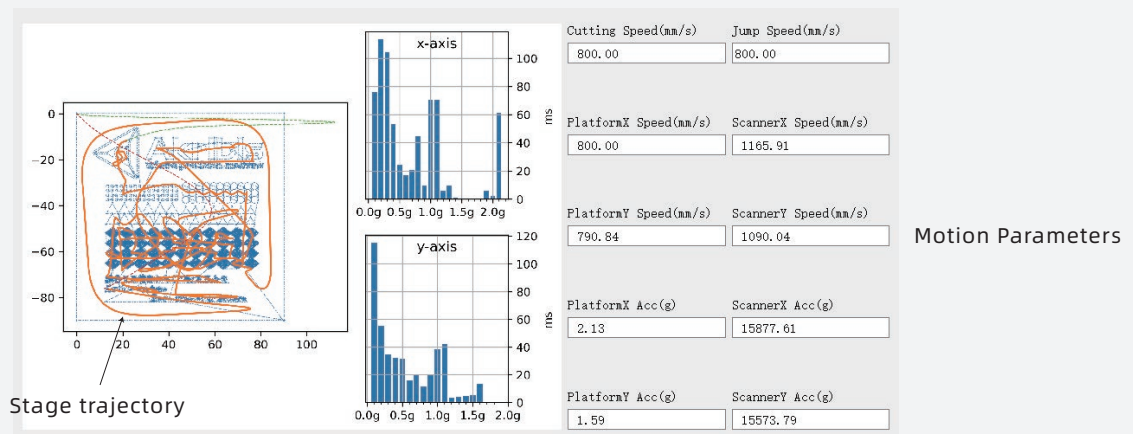
#### SGS GJM Specification

EtherCAT	EtherCAT bus, supports minimum 250us synchronization cycle, supports SDO/PDO communication, and can be cascaded
Galvo control	Dual channels, XY2-100 digital protocol, 10us refresh cycle
Laser control	Dual channels, digital and analog control interface, including laser switching, repetition rate, laser waveform and power control functions
Encoder input	Dual channels, incremental, EIA-422 standard, maximum frequency 20MHz (4 times frequency)
Digital Input	8 channels, with isolation and protection, supporting NPN or PNP input
Digital Output	6 channels, with isolation and protection, NPN output, 0.5A per channel
Control functions	Laser power following, energy segmentation; galvo distortion correction, frequency following;
Power Input	200mA @24V (-15% ~ +20%), overcurrent protection, isolation, internal reverse connection protection
Size (width*height*length)	121x60x163 (mm)
Installation	Screw fastening
weight	About 0.9Kg
Work Environment	-5°C~60°C, 95%, no condensation

# Key Features

## Trajectory Planning for Stage and Galvo Coordinated Motion

The interpolated points of laser trajectory are splitted into two parts :high-frequency part and low-frequency part. The high-frequency part is executed by the galvo and the low-frequency part is executed by the stage, thereby improving processing efficiency.



## Skywriting

By adding a laser idling path between adjacent marking vectors, the acceleration and deceleration of the galvo at the corners is avoided, ensuring that the laser moves at constant speed throughout the entire route.

### Main parameters

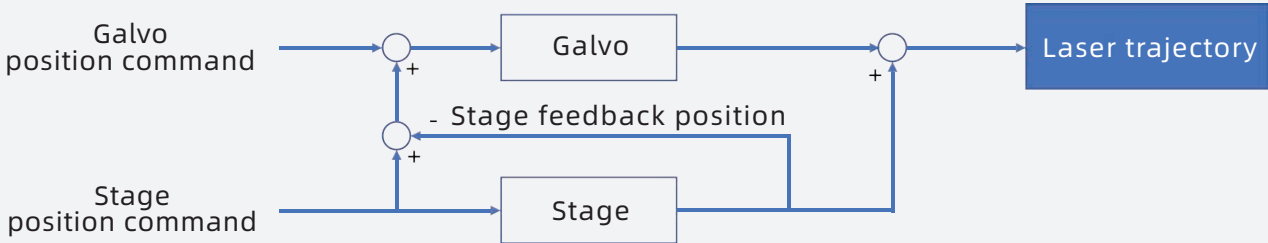
- **Lead in time:**  
Total time entering the marking vector
- **Lead out time:**  
Total time leaving the marking vector
- **Corner restrictions:**  
When the angle between adjacent marking vectors exceeds the set value, start Skywriting function



# 0 Key Features

## Real-time Compensation of Stage Following Error

The dynamic response of galvo is much higher than that of the stage, the SGS controller captures the feedback of the stage in real time, and compensates for the following error using galvo, greatly improving the trajectory accuracy of the laser. The control block diagram is shown as below.



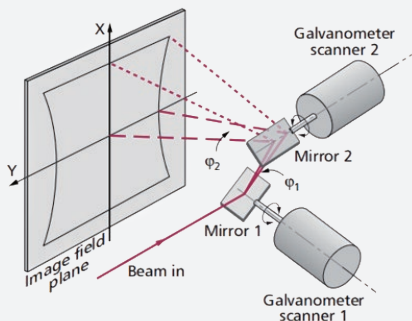
## Position Synchronized Output (PSO)

The PSO function can feed back the position of the stage to the galvo controller in real time. The galvo controller triggers the output of the laser pulse according to the laser position. This avoids the phenomenon of laser energy concentration due to the deceleration at the corner.

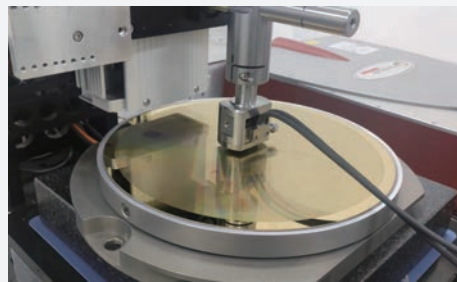
# Key Features

## Position Error Compensation

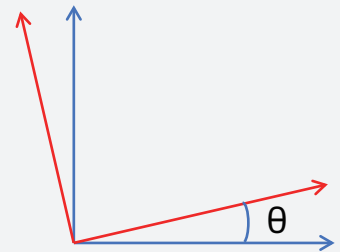
Both the stage and the galvo have static position errors. The SGS control solution provides galvo correction, stage 2D error compensation, and the coordinate angle compensation between the galvo and the stage, ensuring good static accuracy.



Galvo distortion correction



Stage 2D error compensation

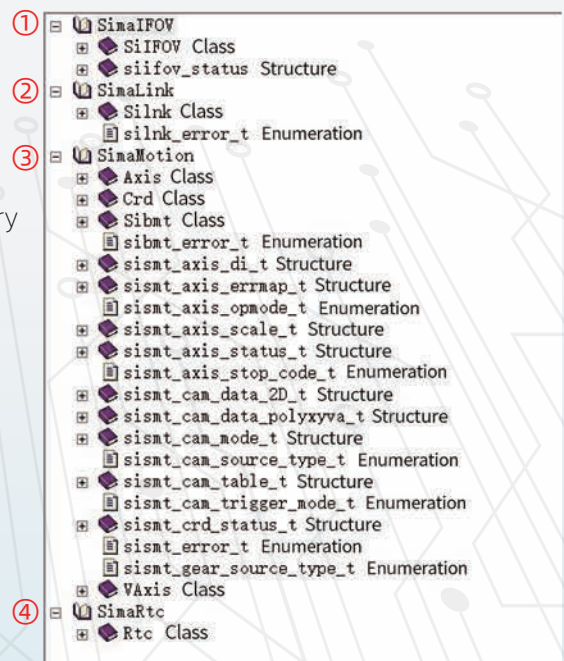


Angle compensation between stage and galvo coordinate system

## Software Development

Provide a powerful API interface library to support secondary development according to application requirements

- ① **SimaIFOV**: Galvo and stage synchronized motion library
- ② **SimaLink**: Host computer and controller communication library
- ③ **SimaMotion**: Axis Motion Library
- ④ **SimaRtc**: Galvo control library



# Key Features

## Software Development

LMC laser micromachining software

Software Functions:

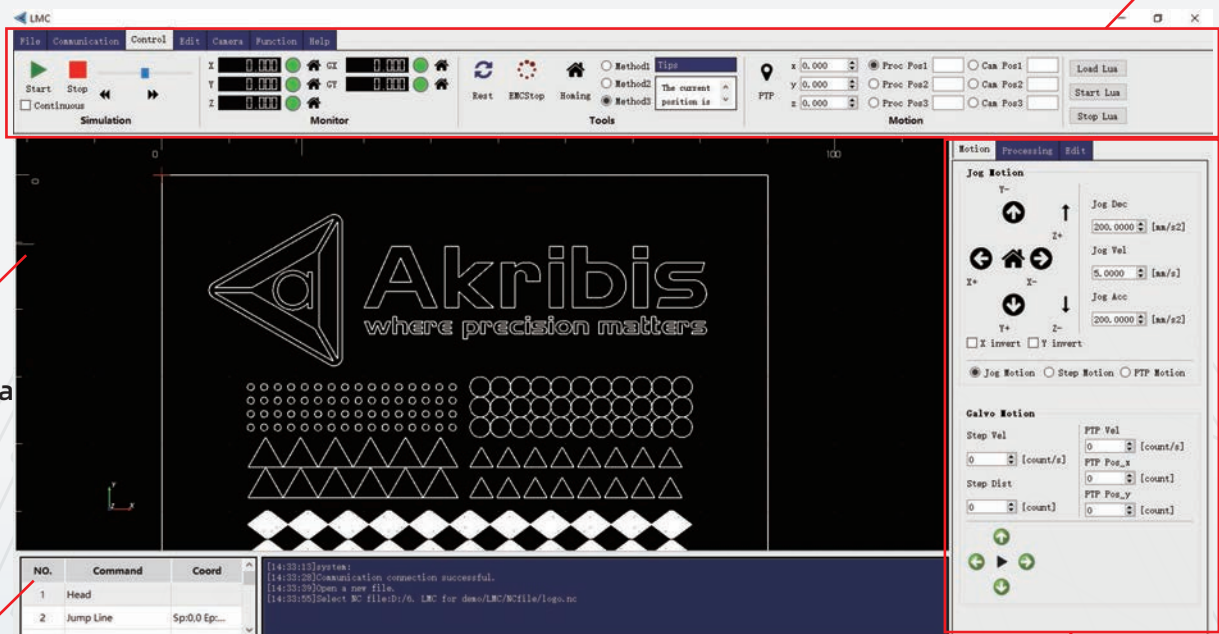
- **File processing :**  
DXF, TXT and other formats
- **CAD/CAM :**  
Draw line, circle, polyline, etc.  
Hatching, rotate, shift transformation  
Layer control  
Partition and sort
- **Galvo motion control :**  
Manual and automatic control  
Trajectory planning
- **Stage motion control :**  
Manual and automatic control
- **Laser control :**  
Laser machining setting  
Laser gate, trigger mode
- **Camera, IO control :**  
Auto focusing  
Graphic recognition

Functional module area

Graphic display area

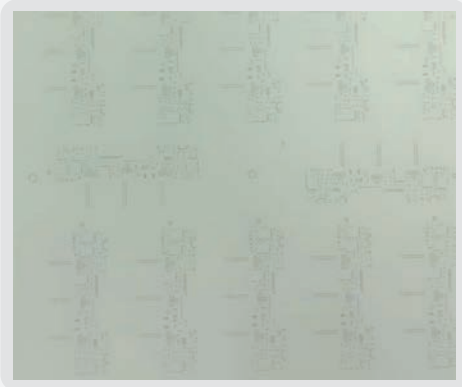
Control information printing area

Control and parameter setting area

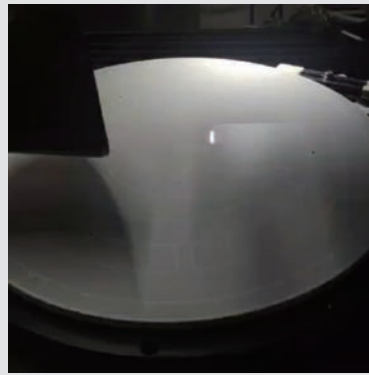


# ○ Typical Applications

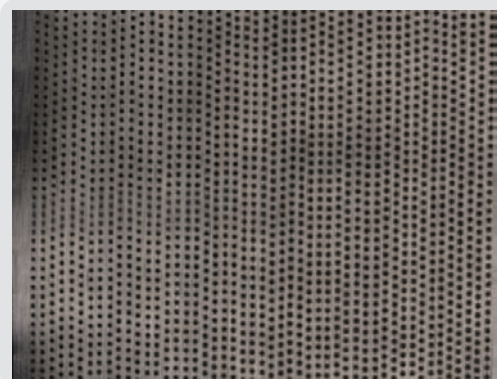
PCB Laser Drilling >>>



Ceramic Wafer Chuck Engraving >>>



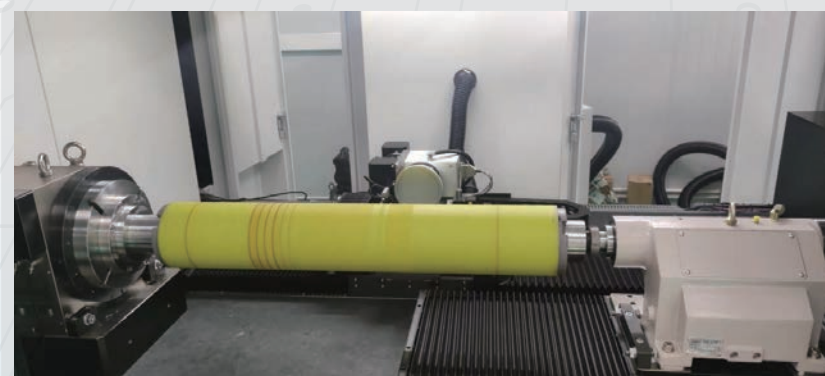
Laser Drilling of Metal Sheet >>>



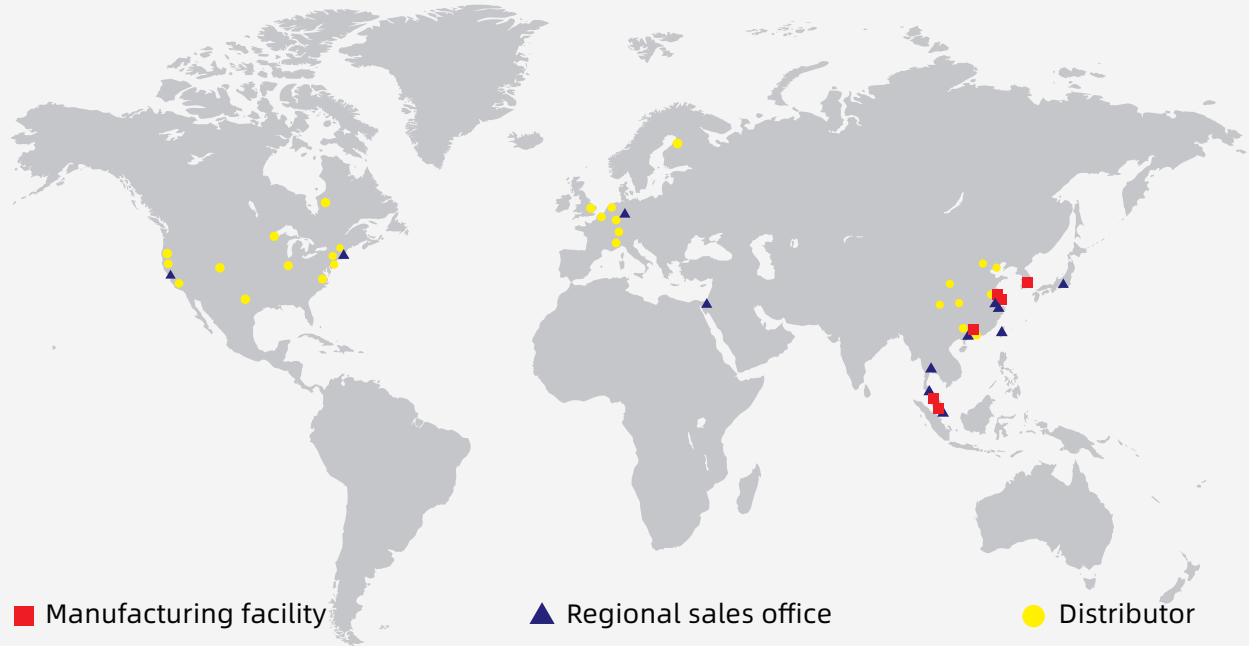
Multi-galvanometer Laser Processing >>>



Laser Grooving of Rollers >>>



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