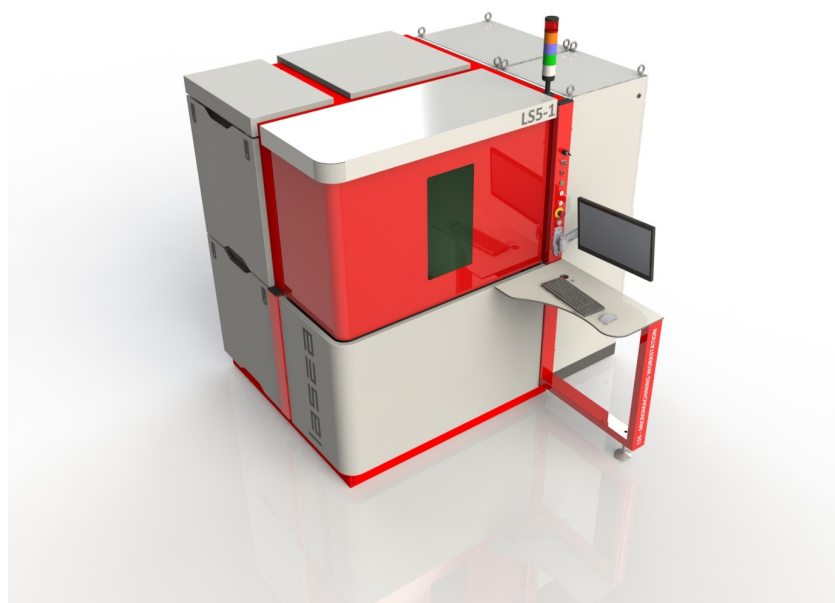


LSX- - Manuel Utilisateur [MODIFIER] LSX-0xx [MODIFIER]

July 2018 [MODIFIER]

v 1.0



CONTENTS

CONTENTS	2
1 SAFETY	3
1.1 Safety Standards	3
1.2 Laser Danger	4
1.3 Safety Stickers	5
1.4 Mechanical Safety Instructions	6
1.5 Others	6
1.6 Updates	7
2 DESCRIPTION OF THE EQUIPMENT	8
2.1 LS5-1 Machine	8
2.2 General	8
2.3 Security equipment	9
2.4 Control Panel	11
2.5 Stack light	11
2.6 Electrical Panel	12
3 OPERATING THE SYSTEM	13
3.1 Powering On	13
3.2 Launch Kyla software	14
3.3 Opening a Job	15
3.4 Modify laser parameters	17
3.4.1 Colors tab	17
3.4.2 Pens Tab	18
3.5 Use the generic IO of the laser system	18
3.6 Starting the Micro-machining	18
3.7 Powering off	19
3.8 Preventive Maintenance	19
3.8.1 Removing the dust	19
3.8.2 Definition tools verification	20
3.8.3 Tools definition	20
Tools main definition	20
Scan head definition	20
Camera definition	21
4 APPENDIX : SPECIFIC TO THE MACHINE	22
4.1 list of materials and options dedicated to the machine	22
4.2 Documents As-built	22
4.3 Proper to the machine parameters	22
5 CONTACTS	24

1 SAFETY

1.1 Safety Standards

The use of high power lasers may cause severe skin and eye injuries. Particular precautions must be taken.

The laser risks correspond to a class 4 laser (Class IV according to the IEC60825-1: 2007 Safety of Laser Products), but have been attenuated through the following elements:

- ▶ Moving parts with door interlock
- ▶ Moving enclosure with safety interlocks
- ▶ Risk labeling
- ▶ Laser shutter
- ▶ Class 1 enclosure

The final system meets the Class 1 laser standards.

The following directives are respected for the selected equipments:

- ▶ 2004/108/CE - CEM Directive
- ▶ 2006/95/CE - Low Voltage Directive
- ▶ 2006/42/CE - Machinery Directive

The following standards are respected:

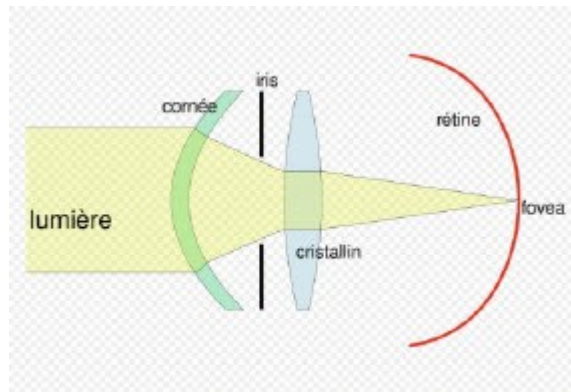
- ▶ EN 60204-1: Safety of machinery - Electrical equipment of machines - Part1: General requirements
- ▶ ISO 13849-1: Safety of machinery - Safety-related parts of control systems
- ▶ ISO 12100: Safety of machinery - General principles for design - Risk assessment and risk reduction

LASEA can never be held liable for potential damages and injuries due to the bad use of the system.

1.2 Laser Danger

PARTICULAR RISKS FOR THE EYES

When a laser beam reaches an eye, the eye-lens focuses the light, which is already highly concentrated, in a single point of the retina. Therefore, a beam of a few thousandth of watts (mW) can cause ocular damage, whereas a 100 watt lamp is, according to our experience, harmless. The retina injuries are particularly serious because the sensory cells cannot regenerate.



Most of industrial laser applications involve the infrared range. This radiation is particularly dangerous in the near infrared (between 700 and 1400 nm). Despite the fact that it is invisible, the eye-lens focuses it on the retina like it does for the visible part. Weak reflections (a few milliwatts) may cause irreversible damages on the retina. Therefore, these lasers must be used with a shielding, as 1 class lasers. If this requirements cannot be met, construction and/or organization measures must be taken in order to ensure the machine works in a defined nominal value of optical risk with controlled access.

SAFETY LASER GOGGLES

You must not wear safety goggles for the normal use of the machinery (closed doors and enclosure). In this case, the machine is considered as class 1.

You must wear safety goggle if the securities are bypassed (advanced user feature). In this case, the machine is considered as class IV. Some precautions are required, such as:

- ▶ Restriction to the access of the room
- ▶ Installation of protective screens
- ▶ Permanent use of safety laser goggles

Operations on Class IV machinery must be made by personnel trained on laser risks only.

The type of safety goggles must be chosen according to the type of laser. We advise goggles with the following features:

- ▶ Optical Density
 - 200-400 nm OD>8
 - 401-415 nm OD>5
 - 800-825 nm OD>6
 - 920-1064 nm OD>6

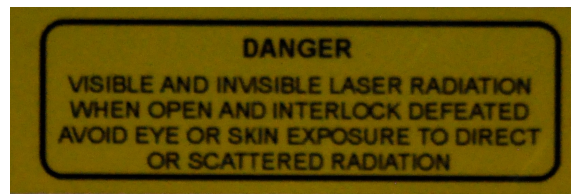
- 10600 nm OD>6

► Certification EN207 :2009

Wavelength nm	D LB	I LB	R LB	M LB
315 - 400	4	4	4	4
800 - 825	6	6	6	-
>825 - 835	5	5	5	-
>920 - 1064	6	6	6	6
10600	3	3	-	-

1.3 Safety Stickers

LASER SOURCE WARNING LABEL



WARNING: CLASS 4 INVISIBLE-BEAM LASER IS EMITTED WHEN THE COVER IS OPEN.
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED LASER LIGHT.

LASER WARNING LABEL

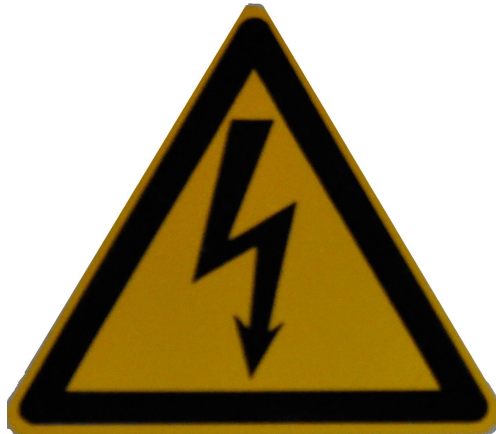


INVISIBLE-BEAM LASER EMITTED. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR
SCATTERED LASER LIGHT. CLASS 4 LASER.

LASER APERTURE LABEL



LASER APERTURE



1.4 Mechanical Safety Instructions

The mechanical risks involved are related to moving parts, removable parts, rotary axes, etc. They can cause pinching, cuts of fingers, hand or arm.

In order to prevent these dangers, danger signs are placed. The rollover and the safety door prevent access to the inside of the machine while it is in use. Finally, the movements of the axes are not possible when the door is open, to avoid any risk of jamming.

1.5 Others

MECHANICAL HAZARDS

Mechanical hazards are linked to moving parts, removable parts, revolving axes... They may cause pinching, finger cut, hand cut or arm cut.

In order to avoid those hazards, danger signs were put. The enclosure and the safety door prevent the access to the inside of the machine and resolve the mechanical hazards.

TOXIC STEAM AND SMOKE

Marking material with laser beams releases toxic steam and smoke. Some of them are carcinogenic. The settings of laser markings must be equipped with an efficient extraction system.

HIGH VOLTAGE OR ELECTRIC CURRENT

There are 230 V in the electrical cabinet.

Electrical hazards are avoided through:

- ▶ Pictograms representing the electrical hazard
- ▶ Possibility to lock the main circuit breaker
- ▶ Lock the doors of the electrical cabinet though specific tools

Only authorized personnel (in Belgium, members owning a BA4 or BA5 certificate) can open the electrical cabinet.

Some lasers work with high voltage if the laser diodes are powered by high current. Any unappropriated intervention, notably on high-power lasers, can be fatal.

FIRE

High-power lasers may start a fire.

1.6 Updates

KYLA SOFTWARE

Kyla software can be updated when LASEA gives new software.

COMPUTER UPDATES

We highly recommend to deactivate Windows update on production machine. These updates may introduce compatibility issues and some hardware may stop working.

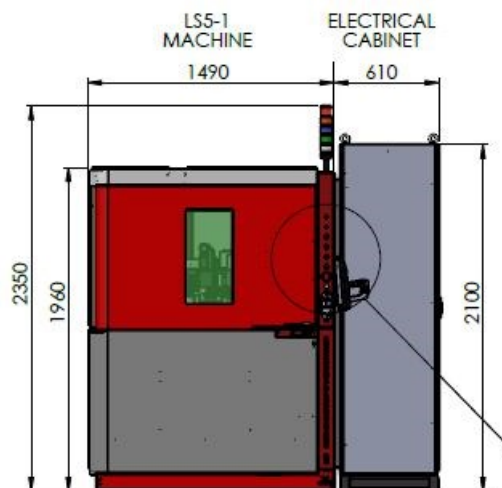
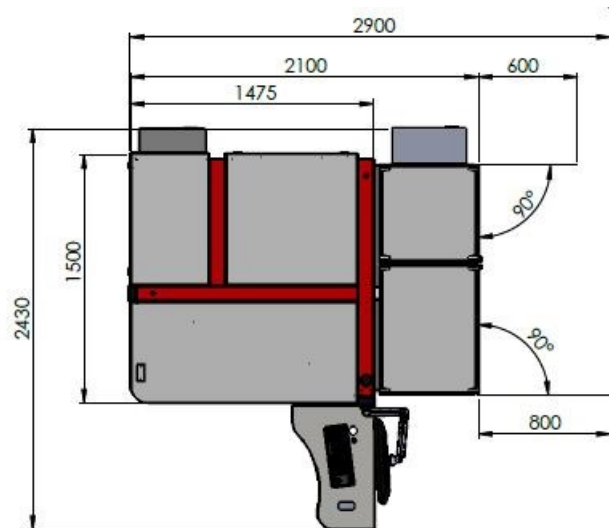
AXES AND VISION SOFTWARE UPDATE

Kyla software use a specific version of the axes software and vision software. Some updates can modify the reliability of our software and some hardware may stop working.

2 DESCRIPTION OF THE EQUIPMENT

2.1 LS5-1 Machine

The following figures shows the dimensions of an LS5-1 system The weight of an LS5 is between 1200 and 1500 kg.



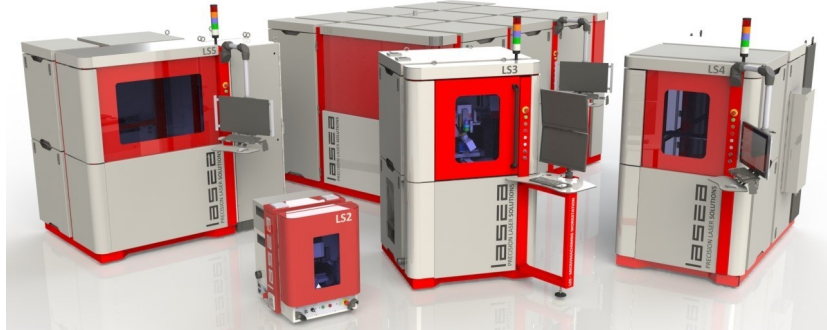
It is recommended to provide a space of 800 mm around the machine to allow access thus in case of maintenance.

2.2 General

This micro machining machine is composed of several main elements:

- The power supply area

- ▶ The optical path area
- ▶ The user area
- ▶ The loading area



The machine is equipped with removable panels allowing easy access to allow maintenance of the machine. The removable panels and the door are equipped with safety interlock, guaranteeing the safety of the operator when the enclosure is opened.

All the connection (power supply, compressed air, ethernet connection) are done on the electrical cabinet .

2.3 Security equipment

AUTOMATIC DOOR WITH LASER SAFETY GLASS

This door allows easy access to the loading area, and is provided with a safety glazing protecting the operator from laser radiation. It allows to see the machining area when in the closed position. It is equipped with interlock, to put the machine in safety when the door is open.

SAFETY PANEL

The safety panels allow maintenance access inside the machine. They are also equipped with sensors that are part of the interlock loop. The machine is safe when a panel is positioned in the closed position.

EMERGENCY STOP BUTTON

Two emergency stop buttons are positioned on the machine. They allow to secure the machine as soon as one of them is pressed. To exit the emergency stop mode, it is necessary to disengage the button, and acknowledge the fault with the acknowledgment button. The locations of the emergency stop buttons are as follows:

- ▶ Near the user area



- ▶ On the electrical panel



2.4 Control Panel

The control console has the following commands:

- ▶ Emergency stop button: allows the safety of the machine
- ▶ Acknowledge button (power on the machine): allows the machine to be used after a prolonged stop, or after an emergency stop
- ▶ Start button: allows the launch of an automatic production sequence
- ▶ Door closing button
- ▶ Door opening button
- ▶ Laser key: allows laser powering

2.5 Stack light

The stack light or light tower is composed of five colors, allowing to have a fast visual of the state of the machine

- ▶ Red: The machine is in emergency stop.
- ▶ Orange: The machine is in maintenance, the safeties are therefore deactivated.
- ▶ Blue: The shutter is open, allowing laser shooting.
- ▶ Green: Kyla is in "Ready" state, allowing the launch of a machining job
- ▶ White: Laser Shot in Progress



2.6 Electrical Panel

The control cabinet contains all the protection and control devices. It is maintained at temperature by an integrated air conditioning system (set point 22-23 ° C). Access inside the electrical cabinet is limited to trained personnel (Belgium: holder of BA4 or BA5 certifications), its access requires the use of a double-headed key.

The interior layout of the cabinet is divided into several areas for ease of maintenance.

- ▶ Axis controllers
- ▶ Circuit breakers and electrical protection devices
- ▶ Laser controllers
- ▶ Electronic boards, PLC, specific controllers

3 OPERATING THE SYSTEM

3.1 Powering On

The first powering ON and the connexion are made during the installation of the machine. After the installation, the following steps allow to power ON the laser system.

1. Switch ON the main switch of the laser system on the electrical panel.



2. Switch on the screens with the button in front of the screens
3. Check if the emergency stop buttons are released
4. Acknowledge faults by pressing the green acknowledgment button

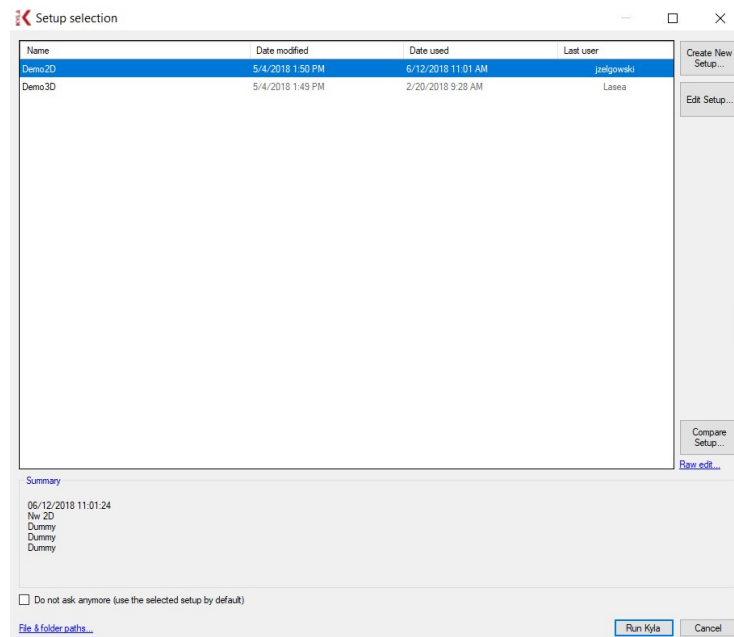


5. Open the session with your login
6. Open the door with the button on the console
7. Check that nothing can interfere with the movement of the axis in the machining area. Clear the machining area if necessary.
8. Close the door
9. Launch Kyla Software
10. Turn ON the laser on the Kyla software

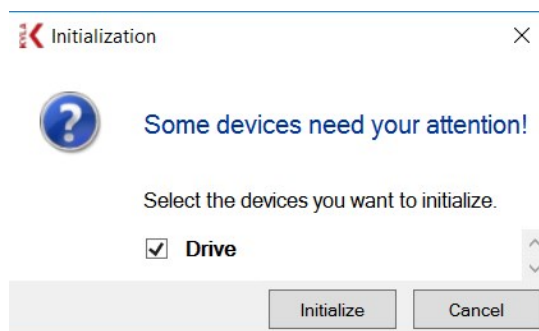
The laser system is now ON.

3.2 Launch Kyla software

1. Click on the shortcut to launch Kyla Software
2. Setup Selection window appears. Choose the needed setup of your system.



3. Initialization appears : Check/uncheck devices. Click on the Initialize button.

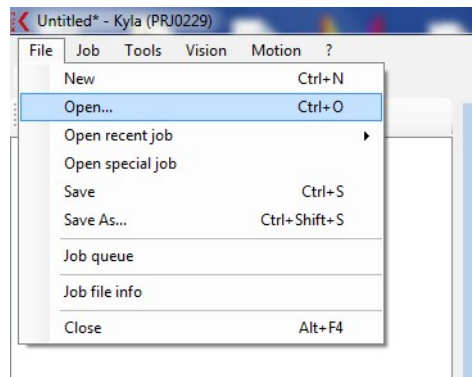


The laser system is ready to be used.

3.3 Opening a Job

From KYLA:

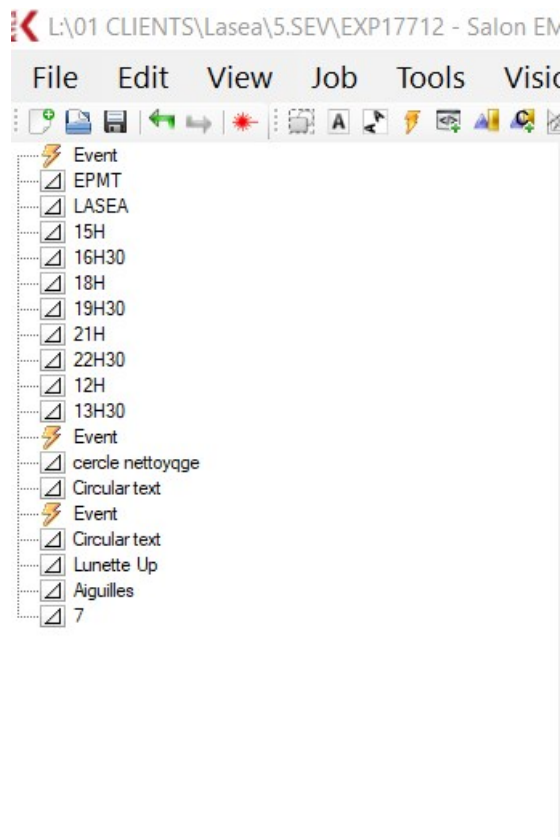
1. Click on **File** in the top menu.
2. Click on **Open....**



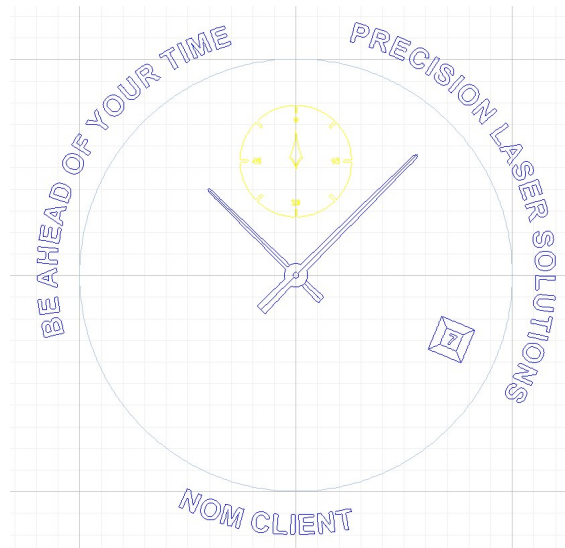
3. Search the job on the computer browser.

4. Click on **Open**.

The different sequences that compose the job are displayed at the left of the screen in the order of their execution.



The trajectory defined by the job appears in the middle of the screen into a 3D graphic view.



3.4 Modify laser parameters

When the object is present in the tree on the left of the screen, it is possible to assign a "pen" and a "color". The parameters for these two tools are in the corresponding tabs on the right of the Kyla screen.

3.4.1 Colors tab

The colors tab lists all user-defined set of parameters.

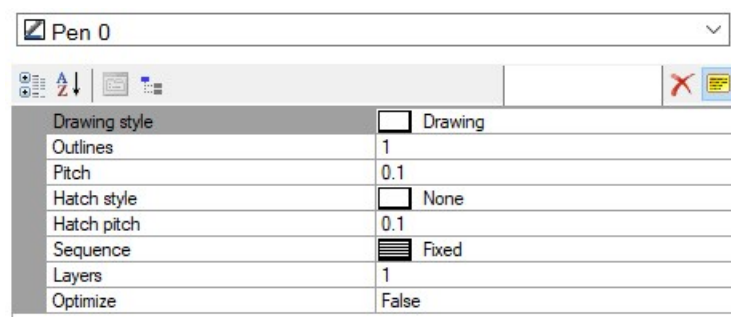
Color 0	
Delays	
LaserOn Delay	0
LaserOff Delay	0
Jump Delay	0
Mark Delay	0
Polygon Delay	0
Layer Delay	0
Design	
Color	Red
Global	
Speed	2000
Jump Speed	2000
Burst Rate	25000
Burst Time	10
Repetitions	0
Sky Writing	False
Laser	
Pulse Rate	500000
Pulse Width	0.001
Power Rate	5000
Power	70

Editable parameters are following :

- ▶ Delays
 - These are the trajectory parameters of the laser beam. Their value is predefined during the installation of the machine, and their modification is not recommended only in very specific cases. They then allow the optimization of aesthetic criteria or machining speed.
- ▶ Design
 - Allows to modify the color (here red) of the laser parameter color.
- ▶ Global
 - Allows the modification of the machining speeds (Speed), to add several passes to the machining (Repetition), to control the method of shooting (burst). It is interesting to modify the machining speed parameter to better control the way the material is ablated by the laser (speed, depth, width, ...)
- ▶ Laser
 - Allows to modify laser parameters. The Pulse rate parameter will set the laser's repetition rate (by default, 500 000 Hz). Power can be ordered by the power parameter. These are two interesting parameters to obtain the desired machining.

3.4.2 Pens Tab

This tab allows the control of the texturing parameters of the job. You can define a hatching style (Hatch), as well as the pitch of the hatching.



This tool is particularly useful for solid shapes because it allows you to texture the marking.

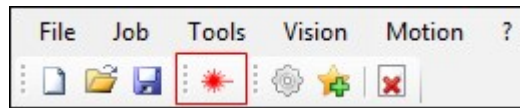
3.5 Use the generic IO of the laser system

The "Generic IO" tab of Kyla allows for the user to modify manually the inputs/outputs. The definition of the Generic IO for the machine is described in annexes.

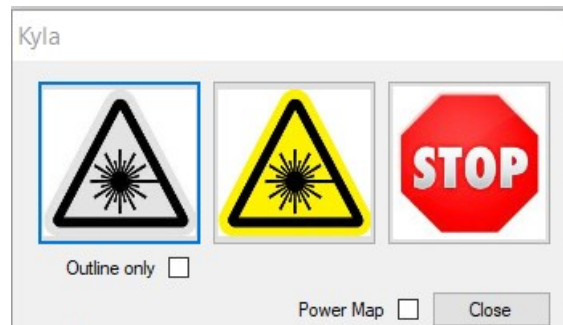
3.6 Starting the Micro-machining

From KYLA software:

1. Click on the start laser icon



The following window appears:



- The gray icon allows to launch the job using the laser pointer.
- The yellow icon is set to launch the job using the laser.
- The stop button stop the job.
- If outline only is checked, the job will be done using the outline only.
- Power map allows to shoot at the center of the scan head without any movement.

3.7 Powering off

The following steps allow to switch OFF the laser system..

1. Raise the Z axis to free the access to the working area
2. Empty the samples in the working area
3. Close the door
4. Switch OFF the laser in the Kyla software
5. Close Kyla software
6. Turn off the computer
7. Turn off the screens
8. Switch OFF the main switch on the electrical cabinet

3.8 Preventive Maintenance

3.8.1 Removing the dust

It is advisable to dust off the inside of the machine with a vacuum cleaner each week.

It is recommended to check if the lens is clean every week. If there is some dust on the protective glass of the lens, the use of a clean airspray to quickly spray the dust is advised.

3.8.2 Definition tools verification

Verification of the tools can be performed if a deviation in the positioning accuracy of the machine is detected. For example, a shock on a tool can significantly alter its alignment, which can therefore no longer be in phase with its parameterization. It is possible to check the tools by following the procedure below:

1. Define a reference point to mark a cross
2. Use in turn the different tools present to view / measure the cross
3. If a misalignment is found in relation to the marked cross, measure this defect
4. The user can read the chapter relating to the definition of the tools if it is necessary to redefine a tool.

3.8.3 Tools definition

Tools main definition

The steps for defining tools are systematically the same, and consists of defining a "tool center", which represents the origin of the coordinate system of the tool in question. The definition of a "tool center" for each tool allows Kyla to take into account the spatial arrangement of the tools when it is desired to reach a point of space with a selected tool.

The reference tool is the scanner. That is, the coordinates of the points defined in the "position" tab are the coordinates of the scanner at the time of defining the point.

Be careful, redefining a tool is an action only to be performed by an informed user. To define the center of a tool, open the "Motion" tab of Kyla, click on "Define zero for" and select the tool to define.

Scan head definition

To define the center of the scanner, the procedure is to find the point of focus of the laser, and to make it follow the surface to be marked. The procedure is as follow:

1. Place a silicon wafer in a fixed way on the machining area
2. Open a focus point search job (job consisting of lines marked in different z's)
3. Mark the sample, to determine the z for which the line width is the weakest (= corresponding to the focal point).
4. Position with the Z axis at the z of the focus point
5. Set the center of the scanner at this point

Camera definition

This procedure is valid for all cameras installed in the machine:

1. Place a silicon wafer in a fixed way on the machining area
2. Make sure the scanner center is well defined
3. Carry out the marking of a cross using the scanner, on the silicon sample
4. Move the axes until the camera pattern follows the center of the marked cross
5. Set the center of the camera
6. The center of the camera then matches with the center of the scanner.

4 APPENDIX : SPECIFIC TO THE MACHINE

4.1 list of materials and options dedicated to the machine

This machine is realised according to the following options:

- ▶ Suplyer Laser XXX
 - ▶ SY-xxxx
- ▶ Precision axes 500 mm;300 mm; 200 mm
 - ▶ SNxxx;SNxxx; SNxxx; SN1xxx; SNxxx
- ▶ LS-Scan IR xxmm
 - ▶ SCXY3.50-xxx
- ▶ LS-Shape IR with Motorized Beam Expander (x3-x5)
 - ▶ SH1.81-xxx
- ▶ F-thêta telecentric lens xxmm for 1030 nm wavelength
 - ▶ xxx
- ▶ Visualisation camera

4.2 Documents As-built

The following documents are parts of the as-built folder of the machine:

1. Certificat CE
2. User Manual
3. Electric panel
4. spare parts list
5. Supplier documentation

4.3 Proper to the machine parameters

- ▶ Laser System Serial number :LSX-0xx [MODIFIER]
- ▶ 100 mm telecentrique lens IR: XXXX [A MODIFIER]
 - Field size : 63.196 XXXX [A MODIFIER]

- Ring thickness : 20 mm XXXX [A MODIFIER]
- Focal spot size : 30-40 μm XXXX [A MODIFIER]

- ▶ Generic IO
 - Activation/ deactivation of the smoke extractor XXXX [A MODIFIER]
 - Activation/ deactivation of inside lights XXXX [A MODIFIER]
 - Activation/ deactivation of the camera light XXXX [A MODIFIER]
 - Check of circuit breaker status (allows to see if a circuit breaker is disabled)

- ▶ Warranty end : XX/XX/XXXX

5 CONTACTS

Your contact:

- ▶ Jean Christophe Wauters, Sales responsible: jcwauters@lasea.com
- ▶ After sales services: Support@lasea.com
- ▶ Axel Kupisiewicz, CEO : akupisiewicz@lasea.com
- ▶ Head office,

Lasea,

Liège Science park,

Rue des chasseurs ardennais 10,

4031 Angleur,

Belgique.

Tél.: +32 (0)4 365 02 43

E-mail : info@lasea.eu

website : www.lasea.eu

