LABORA
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tutorial for using the laser plotter

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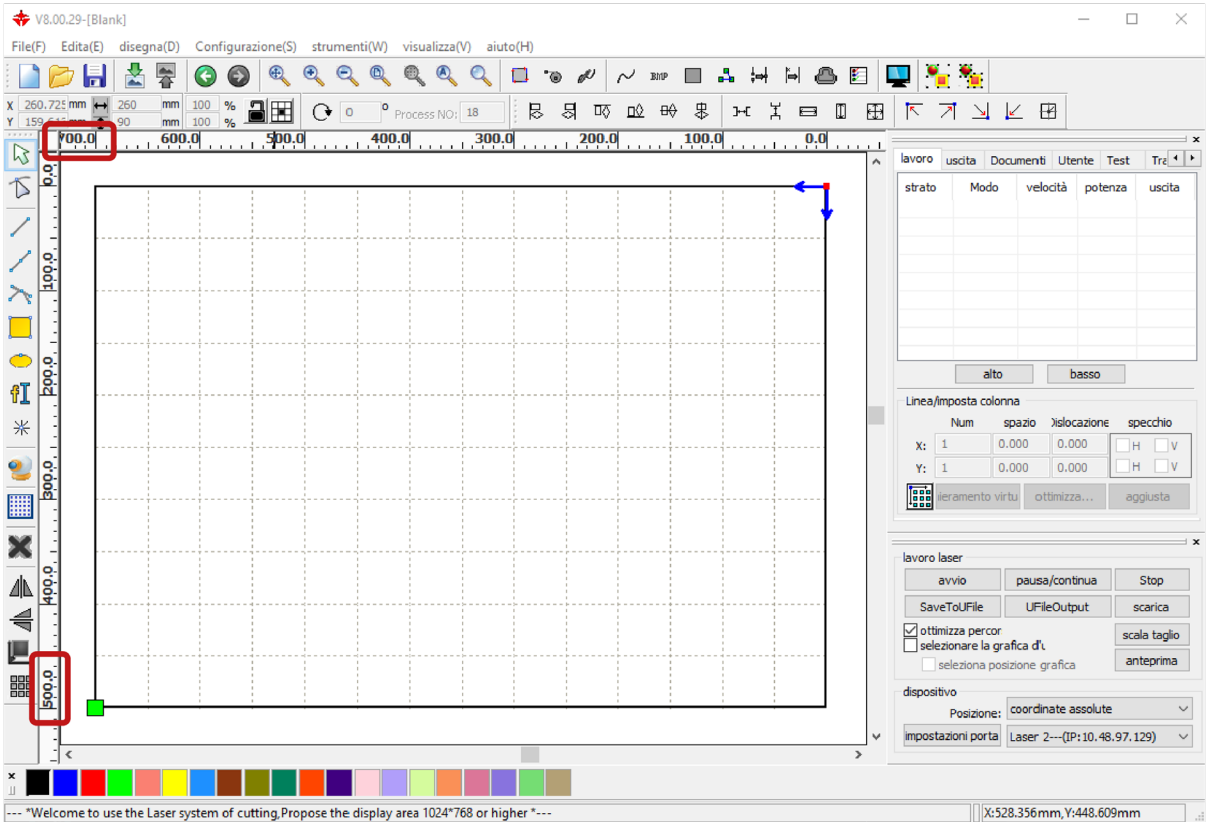
1. checking that the cutting file is suitable for the dimensions of the laser plotter

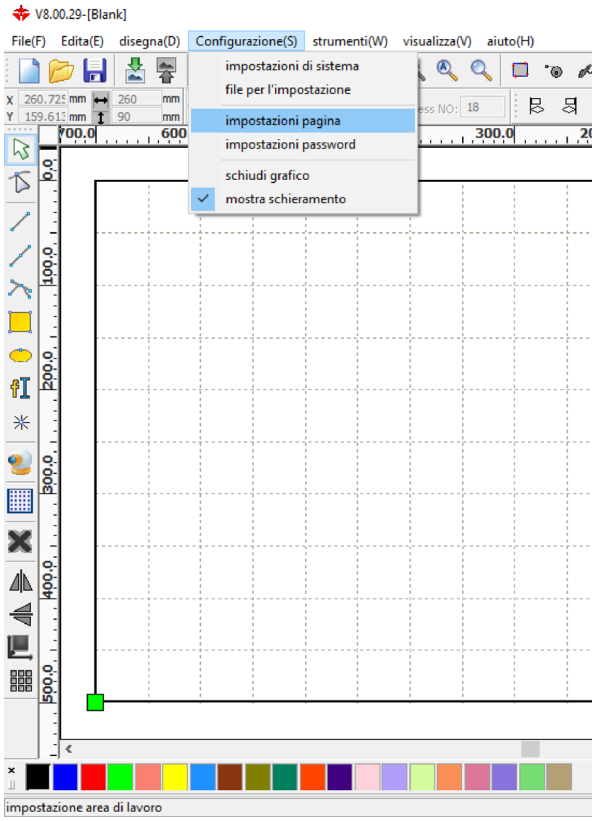
On the computer connected to the machine, start the **software *RDWorks*** by clicking on the icon:

When the software opens, it is presented with a frame containing a **square grid** which corresponds to the representation of the machine **working area**. This working area must have a **dimension of 700 x 500 mm** in ***lasers 1*** and ***2*** and of **1000 x 700 mm** in ***laser 3***.

Check that the **working area** of the software *RDWorks* connected to the plotter that you intend to use has the **correct dimensions**.

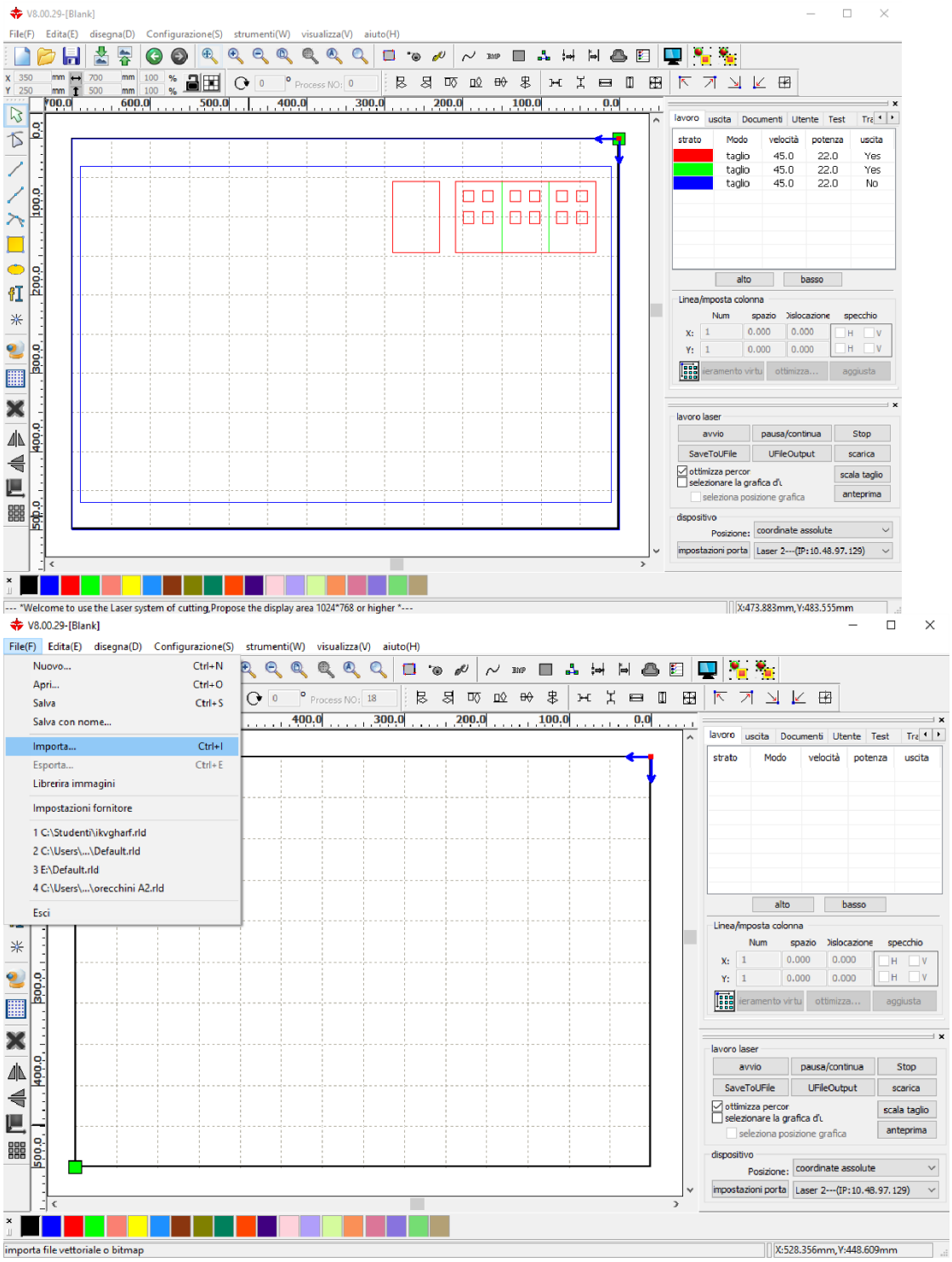


If that is not the case, it is necessary to **change them** from the main menu of the software *Configurazione(F) > Impostazioni pagina* (Configuration > Page settings).



To import the file containing the geometries to be cut, which must be in **.dxf 2000 format**, from the main menu of the software select ***File(F) > Importa...***

As shown in the page ***laser cutting*** form, the drawings of the **pieces to be cut** must be placed **inside two or three blue frames**: the **outer frame**, if drawn with the correct dimensions in relation



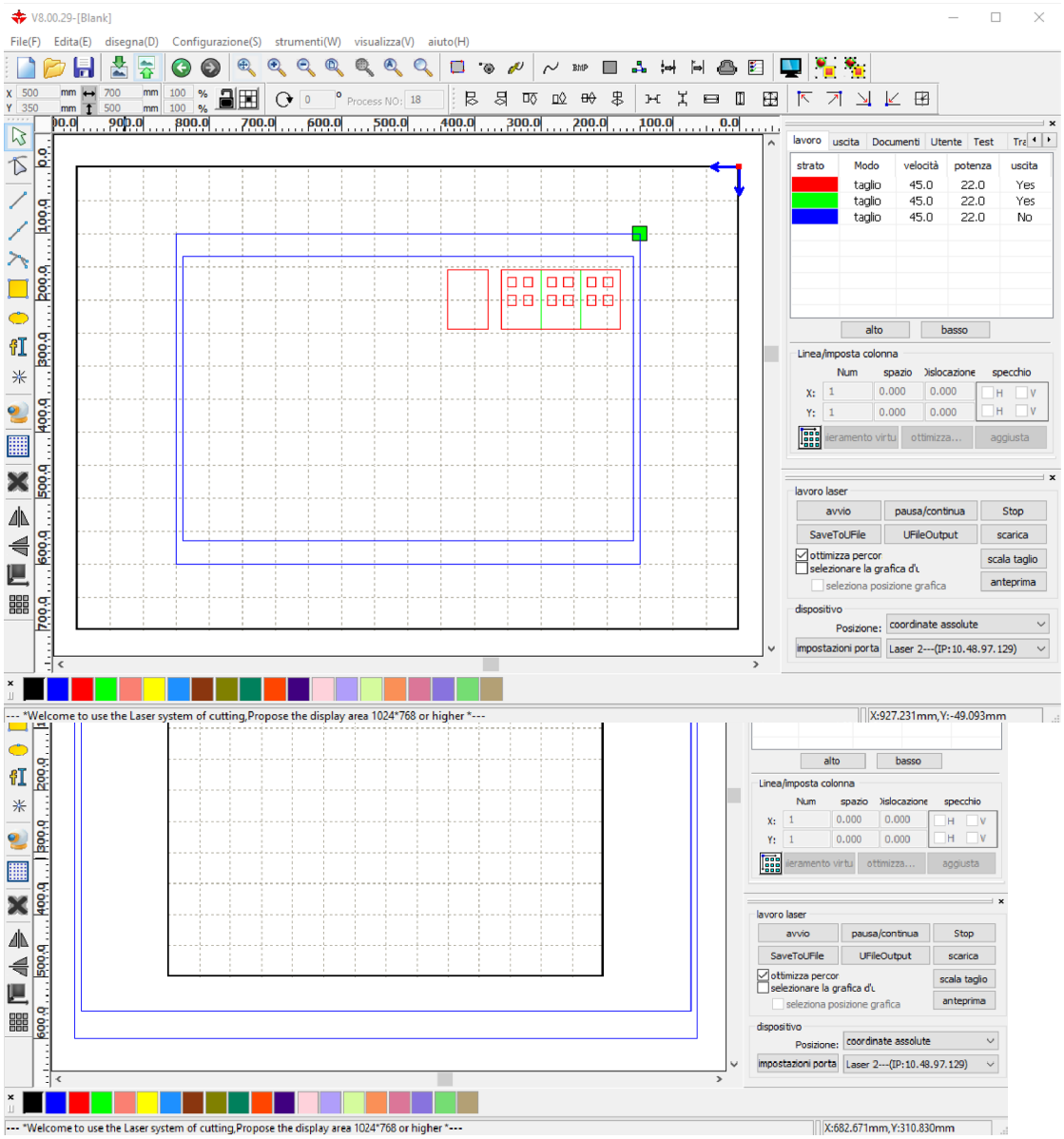
to the plotter you intend to use and if the dimensions of the working area are correct, **should**

match the outline of the squared grid/working area. In this case, the **second frame** delimits the **cutting area on the honeycomb plane**

If, on the other hand, the **outer frame** appears **larger than the working area**, it means that the **file was set up** to be cut with the ***laser 3***.

In this second case, either **edit the drawing file** and place the pieces inside a 700 x 500 mm frame **or** (if available) **use *laser 3*** to cut the pieces.

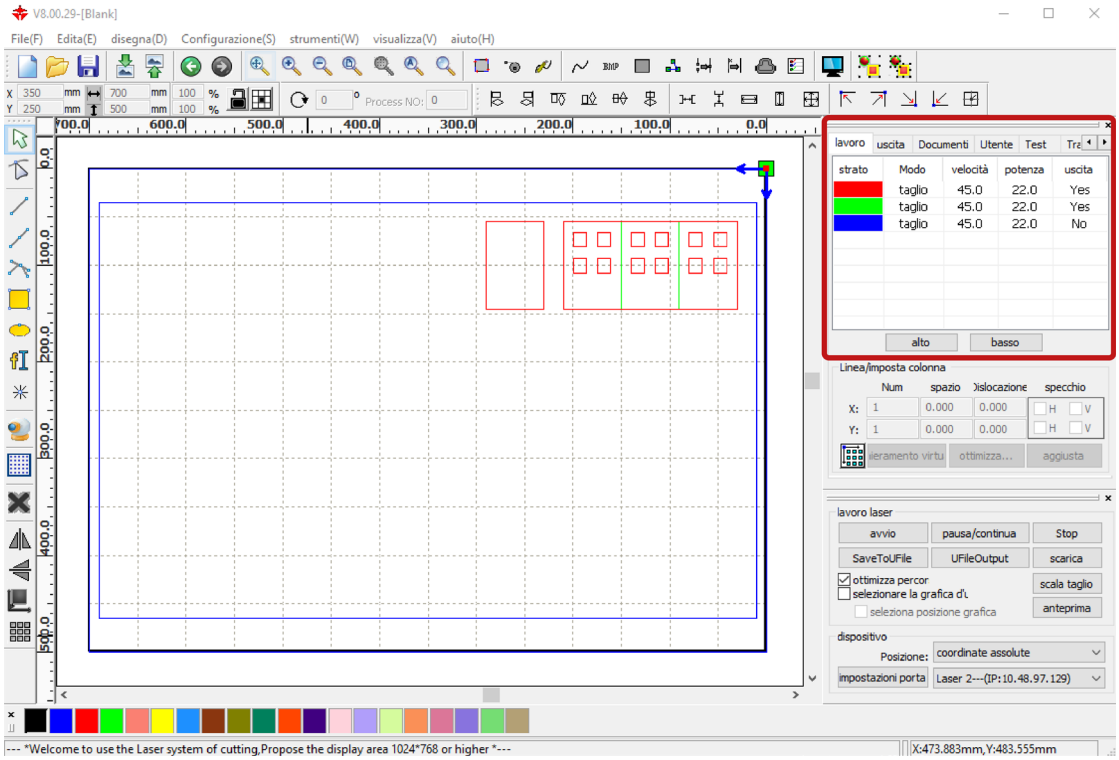
If, once the drawing file has been imported into the *RDWorks* software, the **outer frame** appears **smaller than the working area**, it means that the file was imported on the computer connected to laser 3, **but the drawing file was set up** to be cut with ***lasers 1*** and ***2***.



In this case too, it will be necessary to **edit the file** and place the pieces inside a 1000 x 700 mm frame **or** (if available) **use *lasers 1*** and ***2*** to cut the pieces.

2. managing the layers

The *RDWorks* software **automatically assigns different layers** (called *strati*) to the drawing elements, **based on their source colour**.

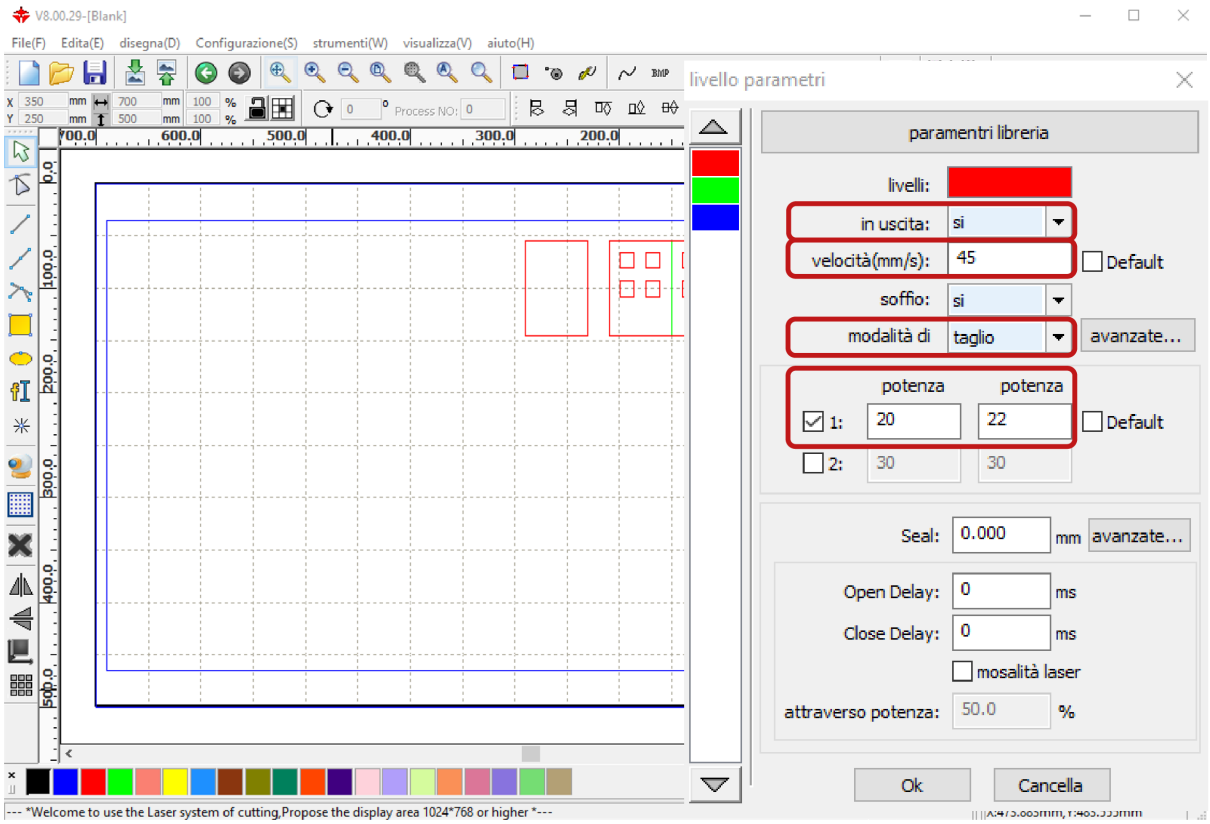


In the top right panel, in the ***lavoro*** (work) section, the layers created by the software are presented with the **processing parameters**: ***Modo*** (method), ***velocità*** (speed), ***potenza*** (power) e ***uscita*** (output), that were set for that colour in the last working session.

To change these values, **double-click on the assigned layer**. In the window ***livello parametri*** the item ***modalità di*** determines the type of processing ***taglio*** (for cutting and engraving) and ***scansione*** (for filler engravings). The item ***in uscita*** determines whether or not the processing is sent to the plotter. The items ***velocità*** and ***potenza*** determine the cutting or engraving of the material according to its type and thickness.

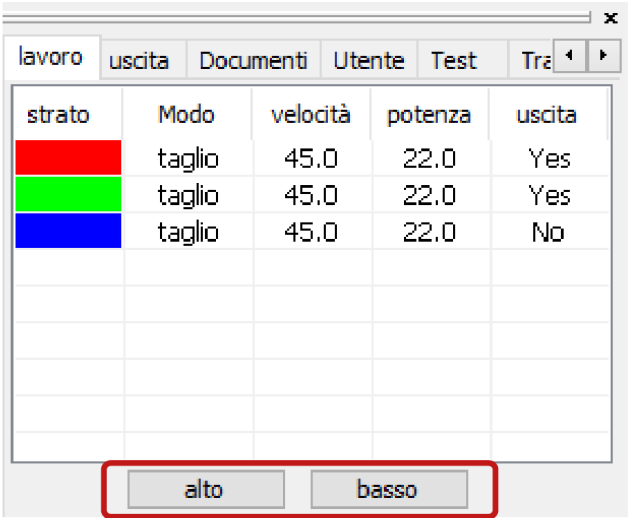
3. defining the cutting order of the layers

The automatic definition by *RDWorks* of **layers** also determines their **processing order**, starting **from the first one at the top of the window *lavoro***.



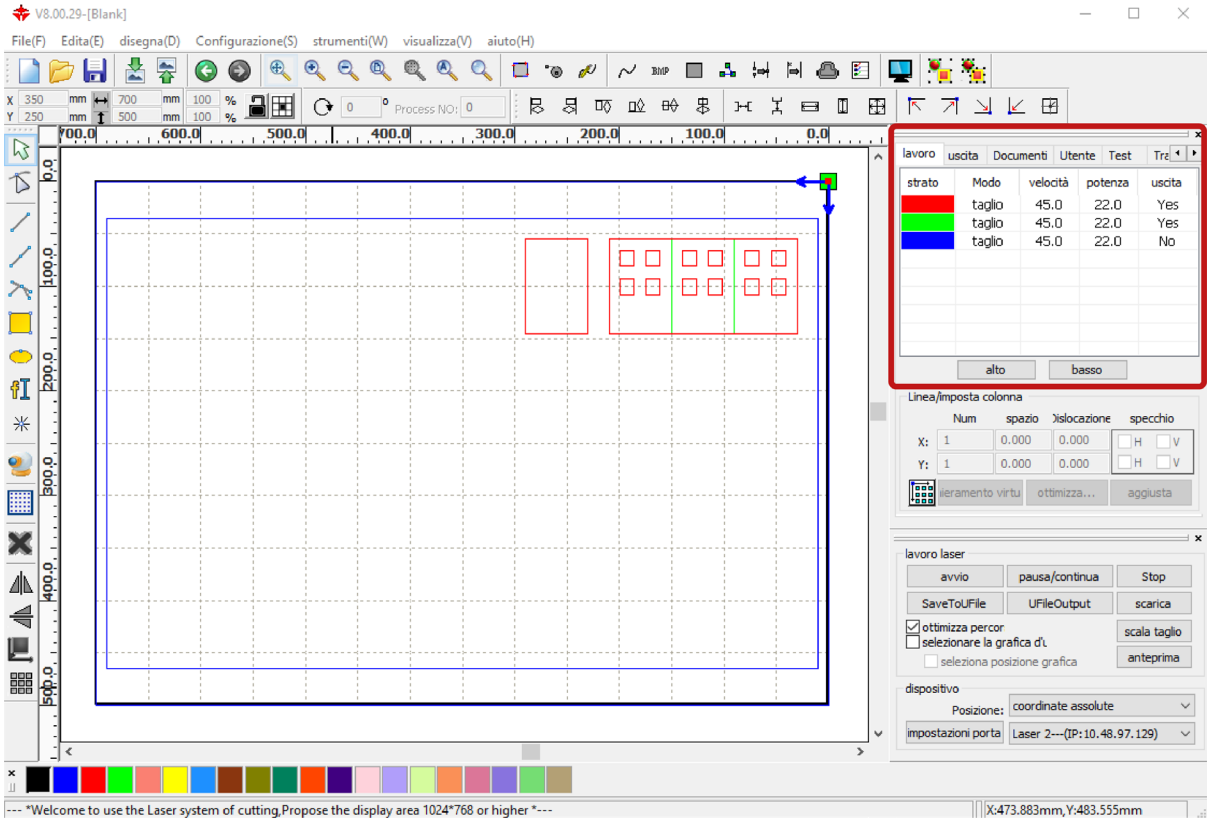
If necessary, you can either **change this order by selecting the layer and dragging it to the desired position**, or by using the buttons *alto* and *basso* at the bottom of the window.

Defining the cutting order is necessary, for example, if **engravings** are to be made: these must be realised before the cuts, to prevent the pieces from moving during the incision.



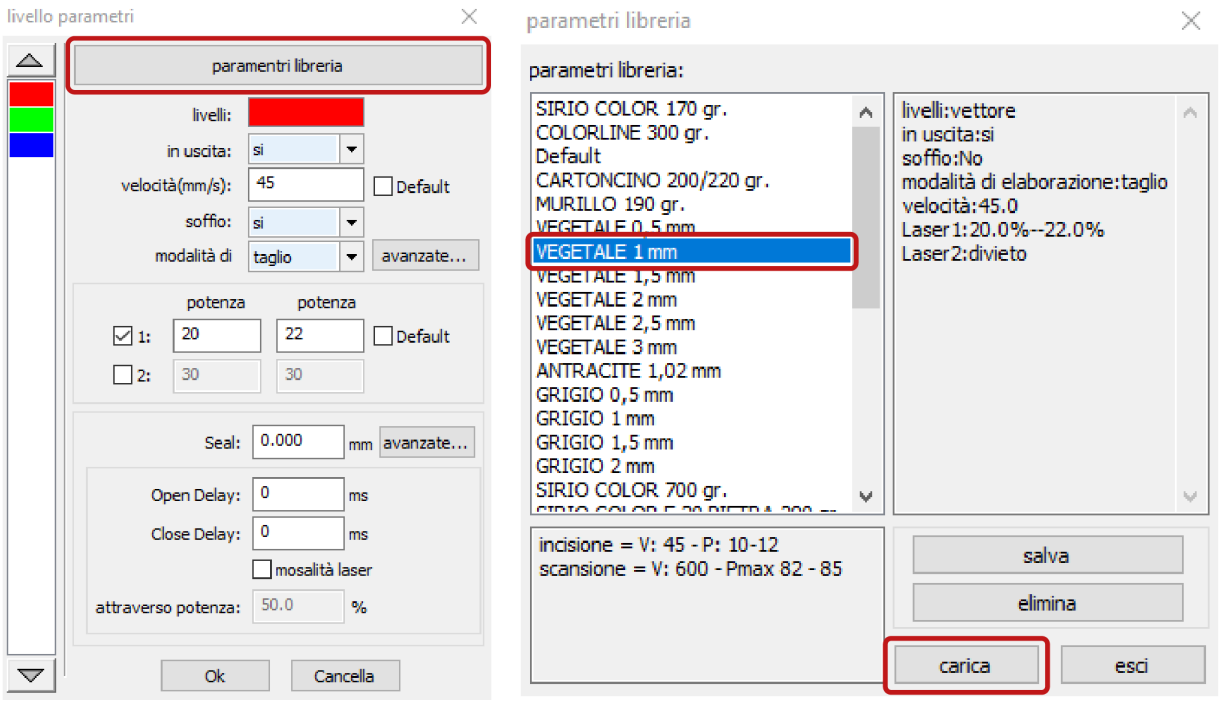
4. setting the parameters for cutting and/or engraving

To **cut or engrave different materials**, or the same material in **different thicknesses**, it is necessary to **assign appropriate speed and power parameters** to each of the layers. This is so that the cut turns out as clean as possible without causing excessive burning.



In the top right panel in the section ***lavoro***, **double-click on one of the layers** to open the related window ***livello parametri***.

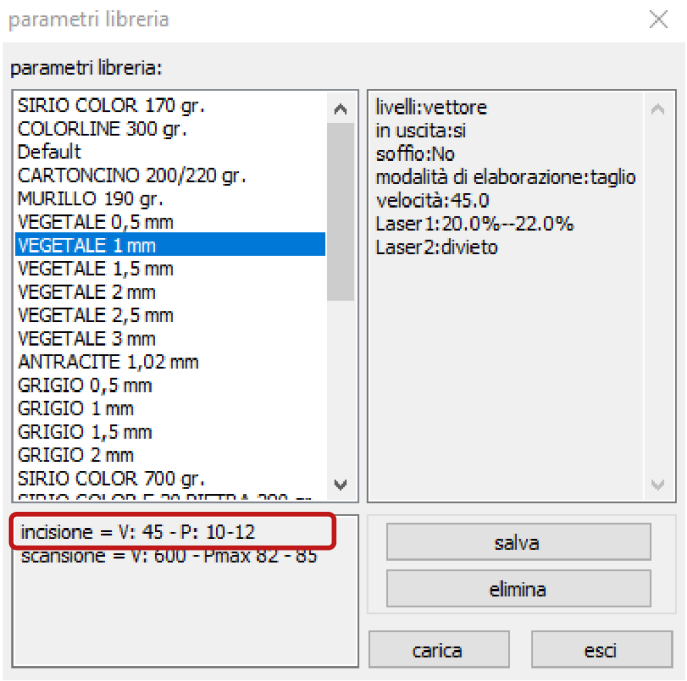
To **select the material to be cut according to its type and thickness**, click on the button ***parametri libreria*** and in the window *parametri libreria* **confirm the choice with the button** ***carica*** (load).



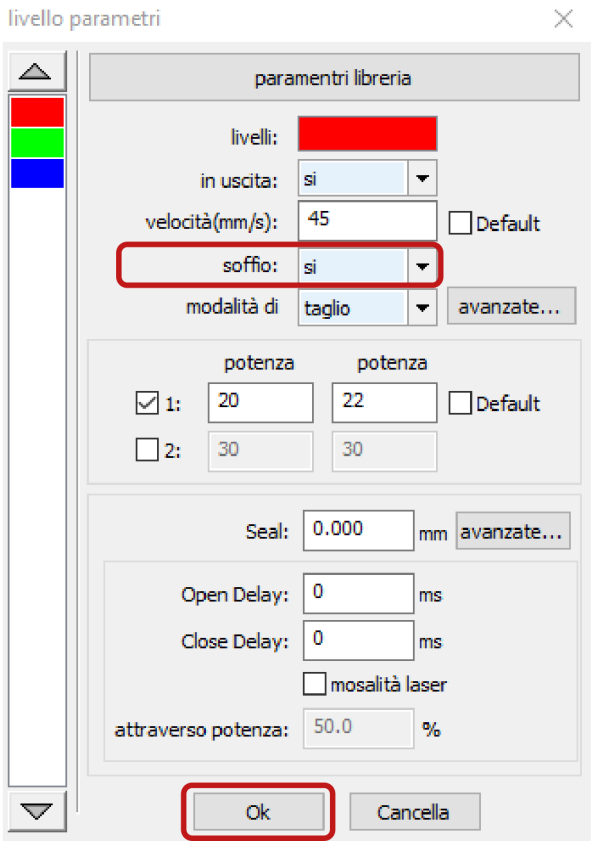
This choice only concerns the assignment to a layer of the **cutting** parameters of a **given material of a given thickness**.

In the case of engraving, the parameters ***velocità*** and ***potenza,*** which can be found in note in the same window ***parametri libreria***, **must be assigned manually** to the layer in the respective boxes.

If the **parameters** for engraving **are not present**, it is necessary to identify them following the instructions in the next **chapter 13 paragraph a. OPERATORS AND STAFF ONLY** and add them as a note to the material in the window *parametri libreria*.



In the **window *parametri libreria***, in addition to the parameters of speed and power, you need to check the **parameter *soffio*** (blow), which in the case of materials such as: **cardboards and similar**, must be set to ***sì***. While in the case of **methacrylate**, it must be set ***No***.

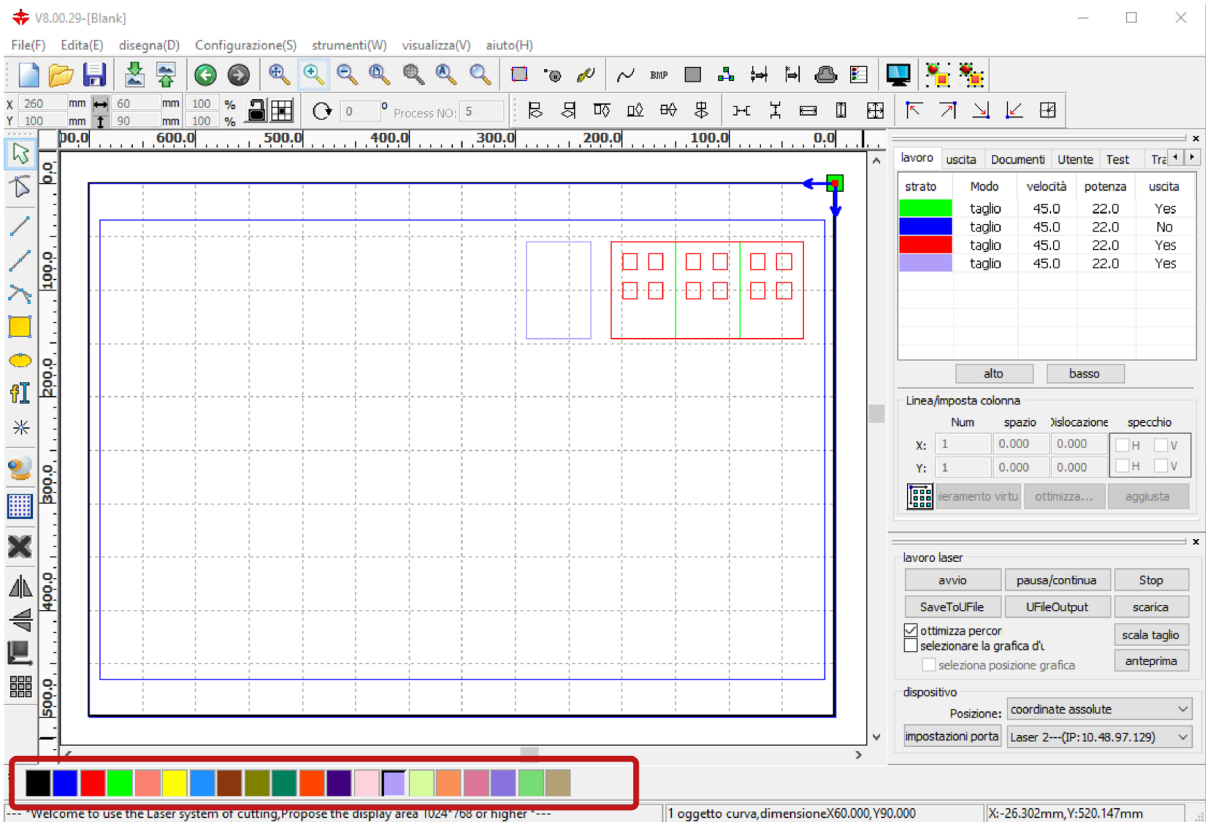


Confirm the choices in the window ***livello parametri*** with the ***Ok*** button.

If, once the cutting **parameters** saved in the window *parametri libreria* **have been loaded**, **the material is not cut**, it is necessary to **gradually increase the power or decrease the speed**. But **if the cutting parameters deviate too much** from the saved ones, it may be necessary to **clean the lens**, to be requested **TO OPERATORS AND STAFF ONLY**.

5. creating a new layer

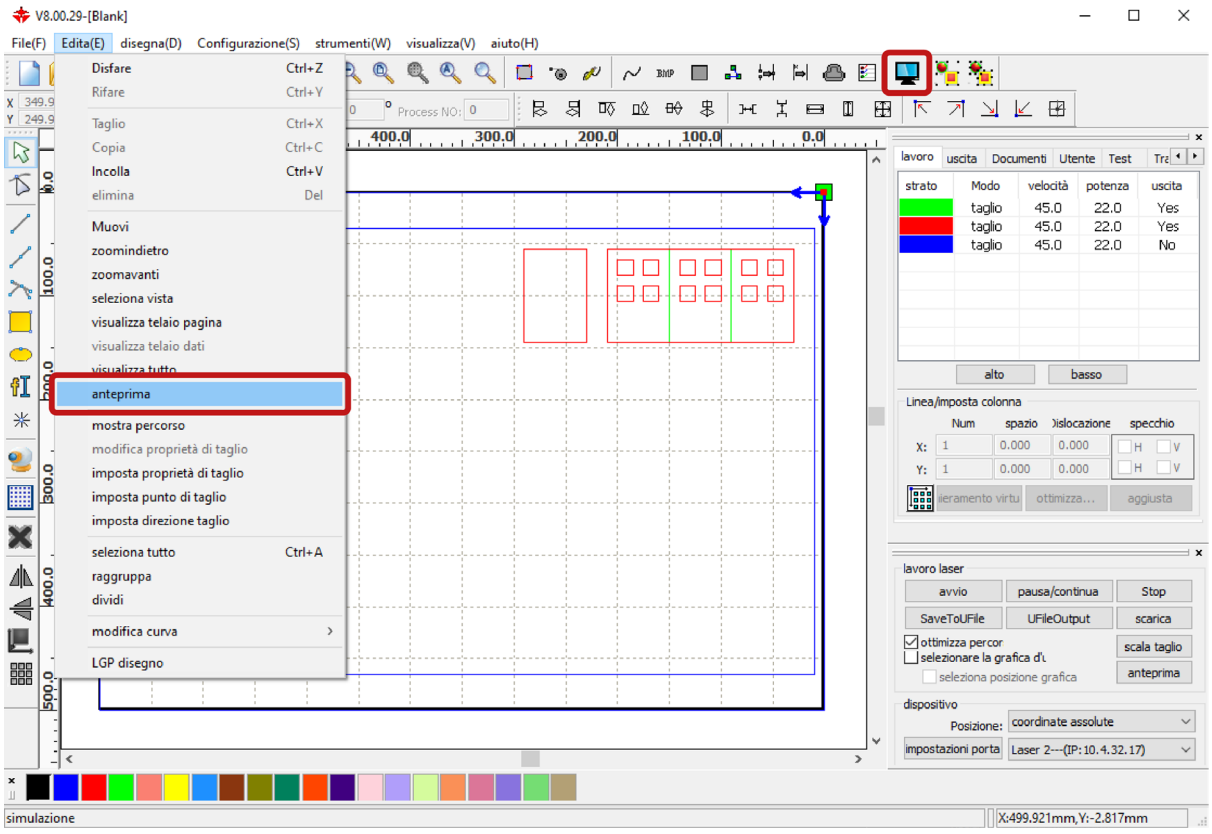
To set **different cutting/engraving parameters for certain elements** of the drawing, it is necessary to **create a new layer** containing these elements and assign the desired parameters to the layer. The **creation of a new layer occurs automatically** when, after selecting the elements of



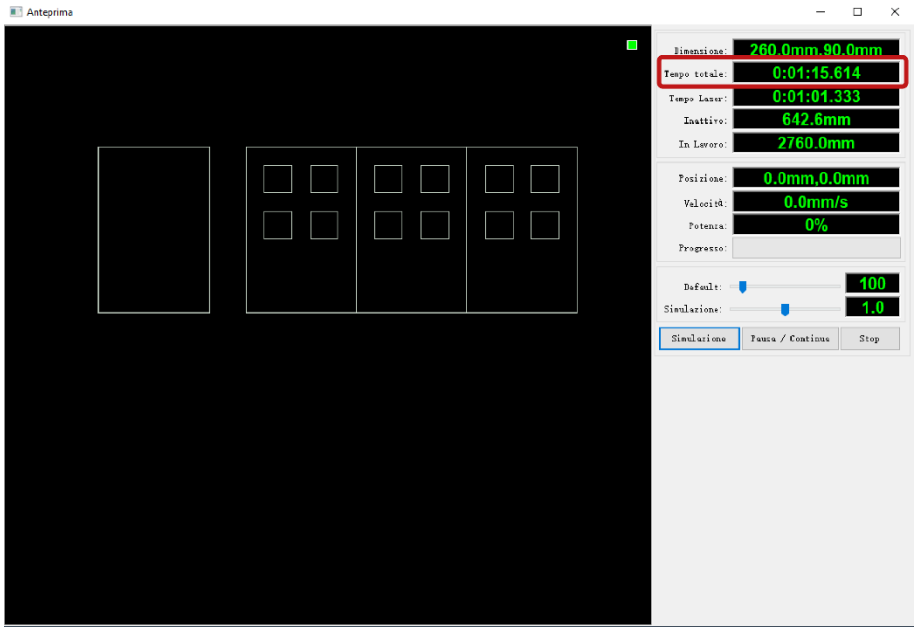
the drawing, you assign them **a new colour** by choosing it in the **bar at the bottom left** of *RDWorks.*

6. check cutting times

To **check the time taken by the plotter for cutting**, based on the set parameters, **preview the processing** by clicking the icon from the main menu.



The ***Anteprima*** window will open.



The ***Tempo totale*** to take into account for scheduling appointments is displayed in the top right panel. By starting the ***Simulazione*** it will be possible to visualize the path of the cutting head.

7. turning on the plotter

To **turn on the laser plotter**, **first** electrically power the machine by turning the **red handle** on the left side and **then** start it by turning the **key** on the right side.

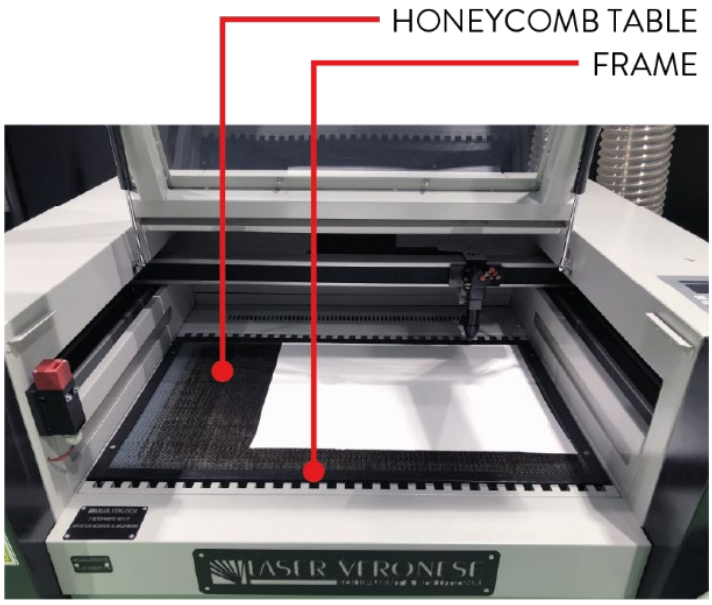
8. inserting the material into the machine

Insert the material into the machine by **opening the upper door**.

Materials such as: **cardboard and similar**, must be **layed on the honeycomb panel** by placing the **sheet** in the **upper right corner** inside the metal frame.

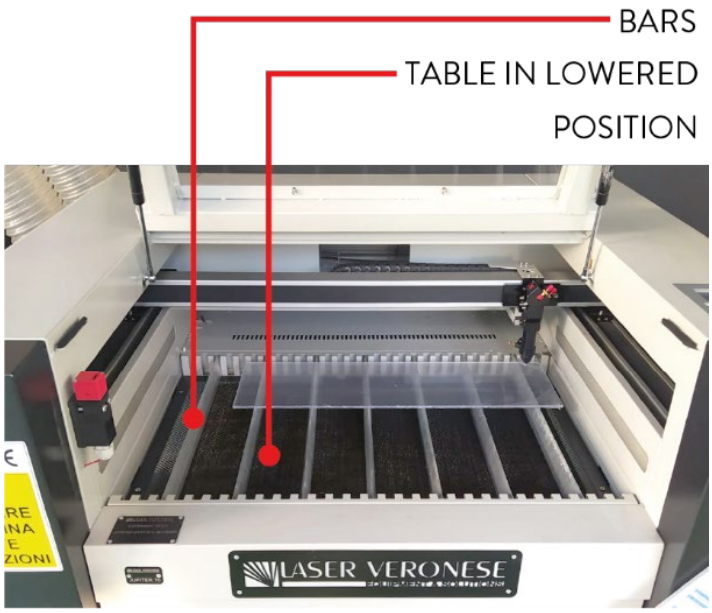
The **honeycomb panel** inside the metal frame has **dimensions of 700 x 430 mm in *lasers 1* and *2*** and **dimensions of 1000 x 630 mm in *laser 3***.

The **material to be cut** must therefore not exceed **these maximum dimensions** in order to lie flat without overlapping the metal frame.



To cut **rigid sheets**, such as **methacrylate**, and achieve the best cutting cleanliness, it is necessary to **place the material on bars** and not on the honeycomb panel.

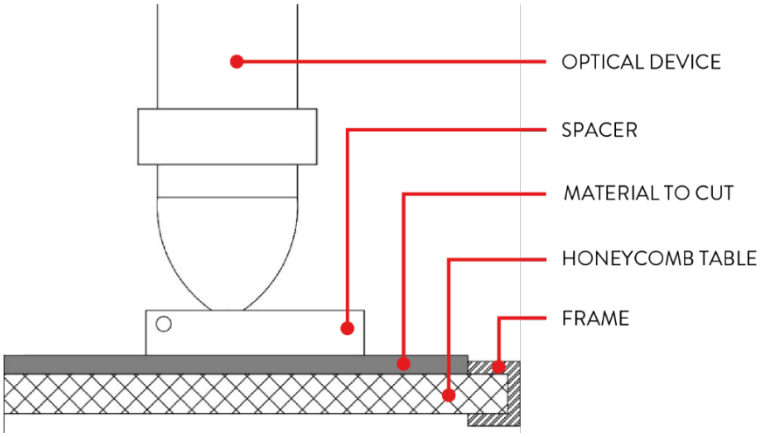
Please **contact the staff to arrange this type of support**.



9. focusing

Before proceeding with cutting or engraving, the lens inside the laser head must be **focused on the surface of the material**.

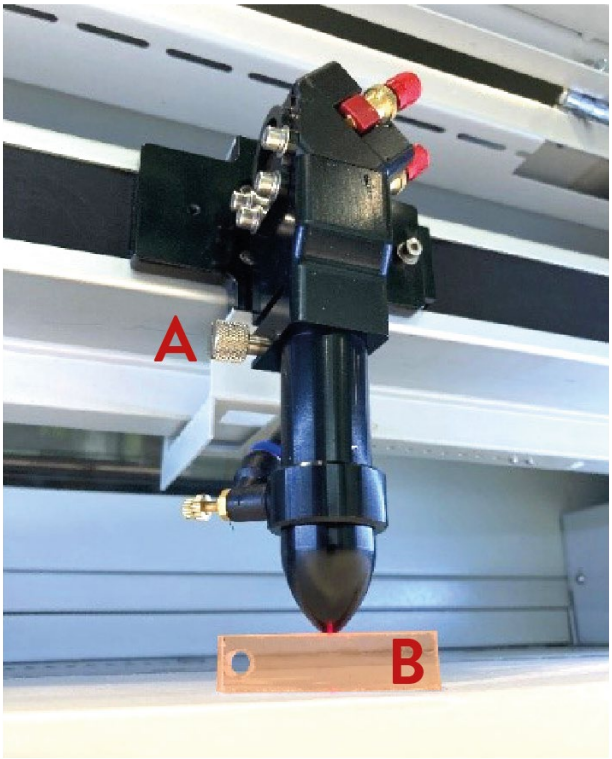
Move the laser head towards the centre of the material, to a position where it does not interfere with the metal frame, using the **arrows** on the **control panel** of the machine.



Take the **spacer** *(B)* that is found next to the control panel of the machine and **place it under the tip of the laser head**.

Manually loosen the screw *(A)* on the left side of the laser head to **allow the tube** containing the lens to **move vertically until it leans against the spacer**.

With the tube still resting on the spacer, **tighten back the screw** *(A)*, **remove the spacer**, **press the red *Esc* button on the control panel** and wait for the laser head to return to the resting position in the upper left corner.

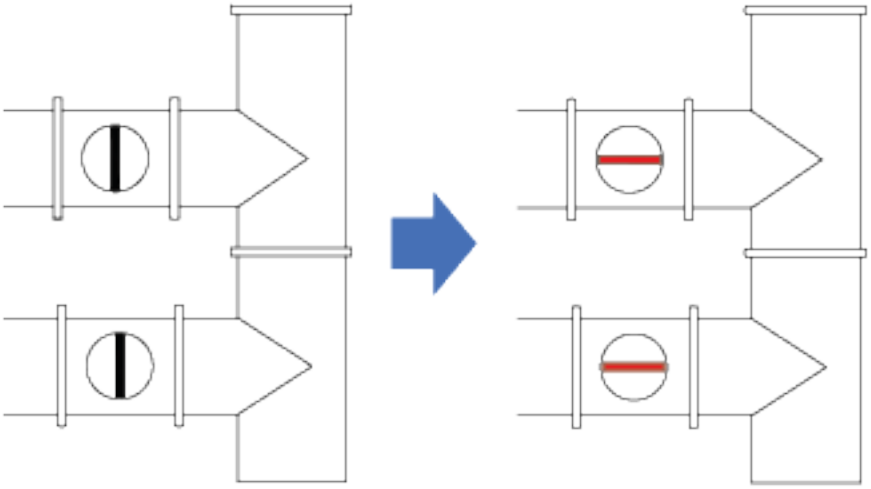


10. turning on the fumes aspiration system

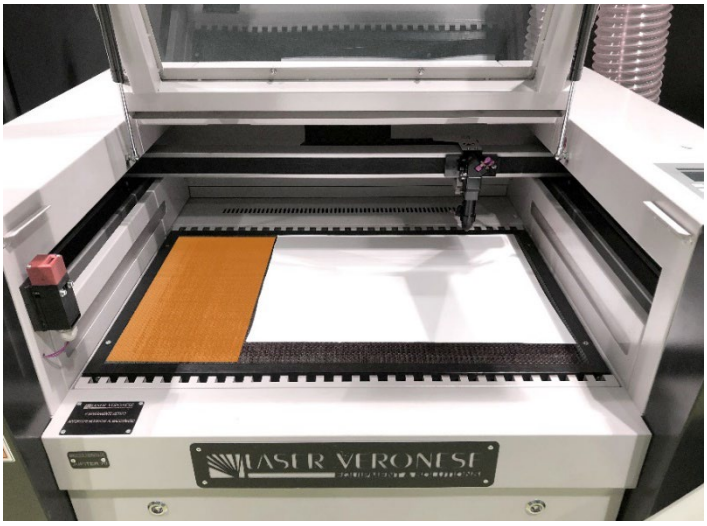
Before starting the cutting operations turn on the fumes aspiration system or check that it is already turned on and open the aspiration damper connected to the plotter you intend to use.

Press in position **I** the two switches on the right of the CNC LAB door.

Every laser plotter is equipped with **two aspiration pipes**, to **open the dampers** turn them both, **placing them in a horizontal position**.



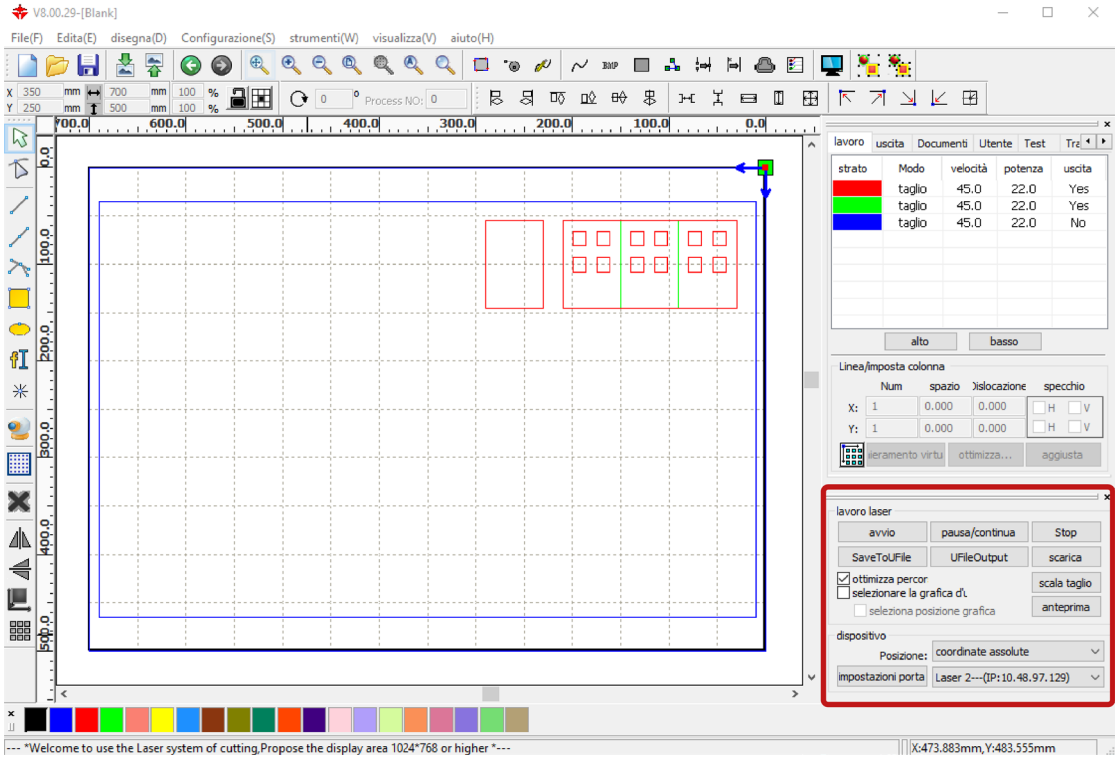
In the case of laser plotters, **the air system** not only eliminates cutting fumes, but also **helps to keep the material still and adherent to the honeycomb panel**, preventing the laser beam from going out of focus and and the cut pieces from moving. Therefore, to ensure the **best possible aspiration**, check that the **dampers** on the pipes connected to **machines** that are **not in use are closed**, including the *hot wire cutter*.



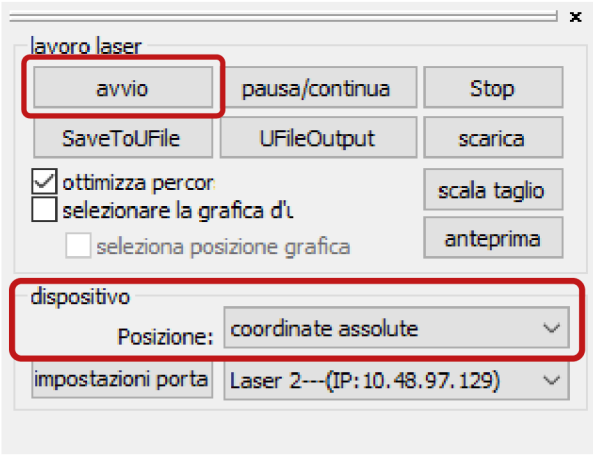
If the **material** to be cut is **smaller than the honeycomb surface** and the aspiration is insufficient to hold it in place, **cover the remaining part of the top with other cardboard**.

11. starting the cut

The cut is managed directly by the *RDWorks* software in the panel ***lavoro laser*** located at the bottom right of the main screen.



In this panel, before starting the cut, you must define the **starting point** by setting the item ***Posizione*** (position) in ***coordinate assolute*** (absolute coordinates) in the section ***dispositivo*** (device).



To start the cut, close the upper door of the machine and in the **menu *lavoro laser* click *avvio*** (start).

DURING CUTTING REMAIN NEXT TO THE MACHINE TO MONITOR ITS CORRECT OPERATION.

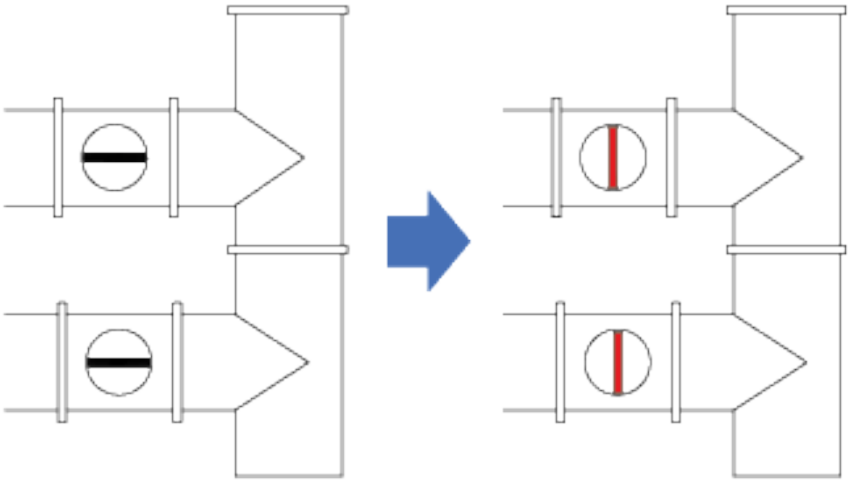
12. at the end of the cut

The **end of the cut** is signalled by the plotter with a **buzzer**, at which point open the upper door and **retrieve the cut pieces**.

CLEANING THE PANEL: remove the residues from the honeycomb panel.

TURNING OFF THE MACHINE: first turn the key and then switch off the voltage by turning the red knob: opposite procedure from turning it on, chapter 6.

CLOSING THE DAMPERS: close both dampers on the exhaust pipes connected to the plotter, returning them to a vertical position.



TURNING OFF THE AIR SYSTEM: return in position **O** the two switches on the right of the CNC LAB door.

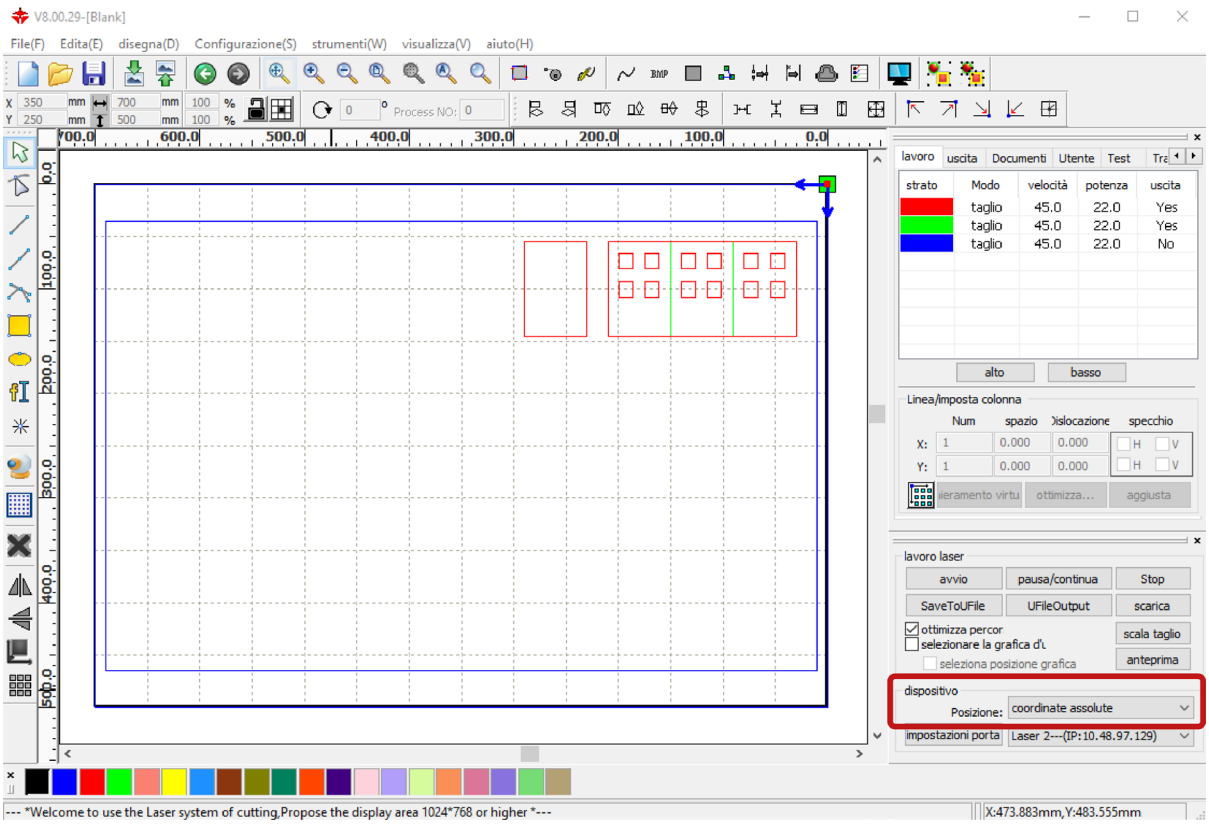
LEAVE THE SYSTEM TURNED ON IF THERE ARE OTHER LASER PLOTTERS OR THE HOT WIRE PLOTTER IN OPERATION IN THE CNC ROOM: BOTH SWITCHES IN POSITION "I"

IN THE EVENT OF MALFUNCTION, PRESS THE EMERGENCY STOP BUTTON ON THE FRONT RIGHT OF THE MACHINE AND CALL THE STAFF.

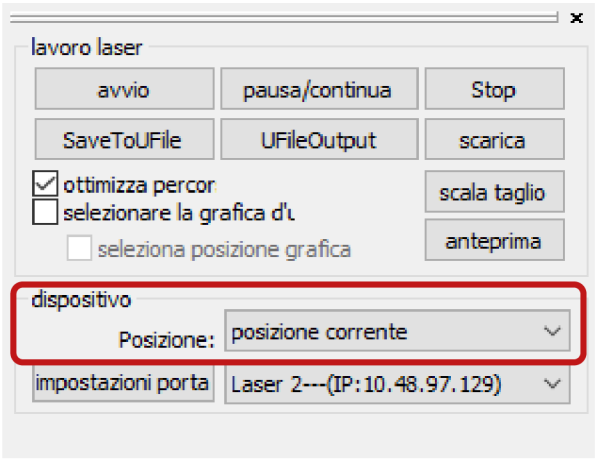
13. advanced procedures – staff operators only

a. changing the starting point of the cut

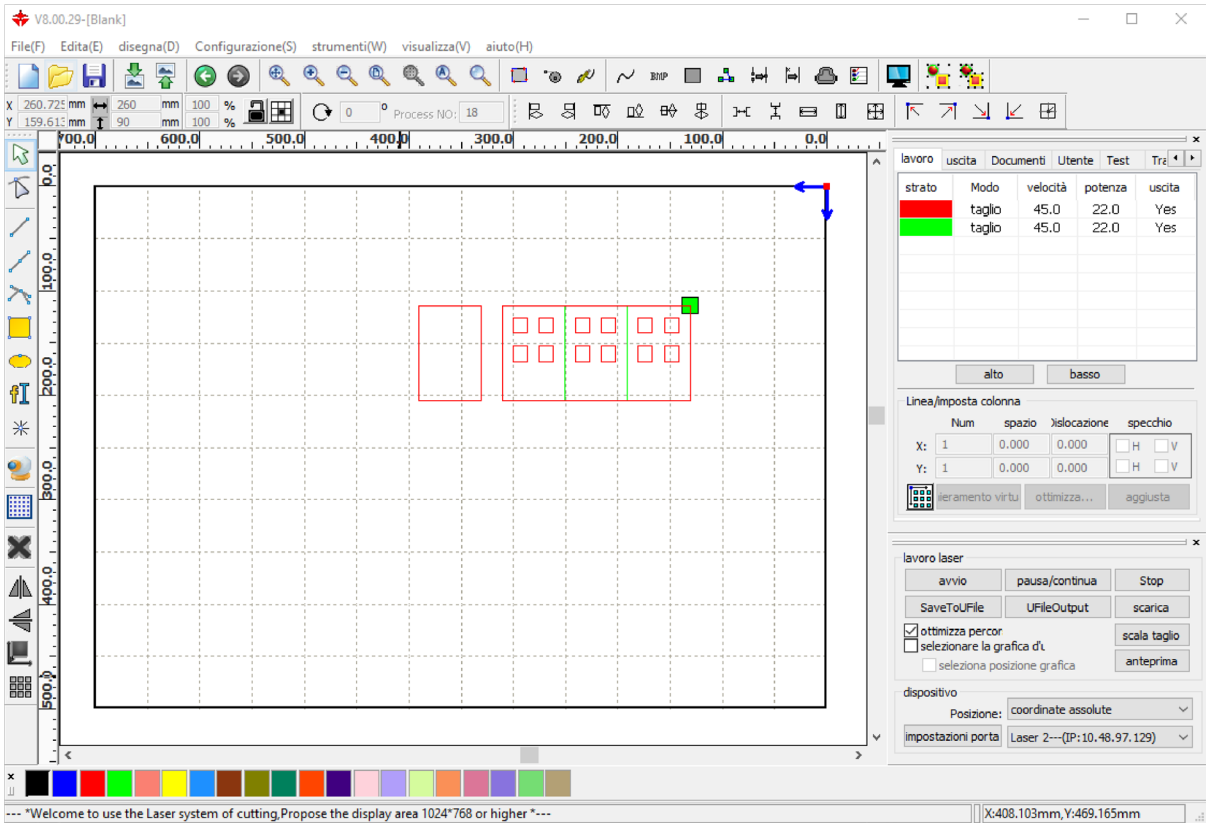
The **starting point of the cut**, displayed in the drawing area with a **green square**, is usually set in ***Posizione: coordinate assolute*** and corresponds to the upper right corner of the plotter's working area.



For some cuts, however, it may be useful to set a **starting point of the cut** relatively to the drawn geometries, by setting in the panel ***lavoro laser***, on the bottom right, the item ***Posizione:*** in ***posizione corrente*** (current position).



In order to determine the current position, the software considers all drawn elements, even if they are placed on layers that will not be cut, such as **frames**, which is why **they must be deleted directly in *RDWorks***.



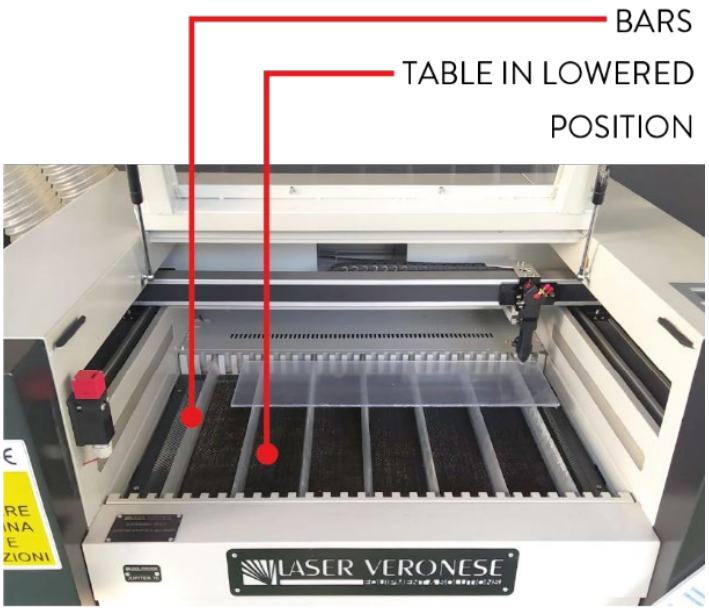
Before starting the cut in the software, it is necessary to **set the starting point in the plotter**.

On the **control panel** of the machine, **move the laser head with the arrows** until you reach the desired point for the **start of the cut**, then press the ***Origin*** button to record it as ***posizione corrente*** (current position). This relative origin **remains valid** for all the following cuts that are set in *posizione corrente*, until the input of a **new *Origin*** or until the plotter is turned off.

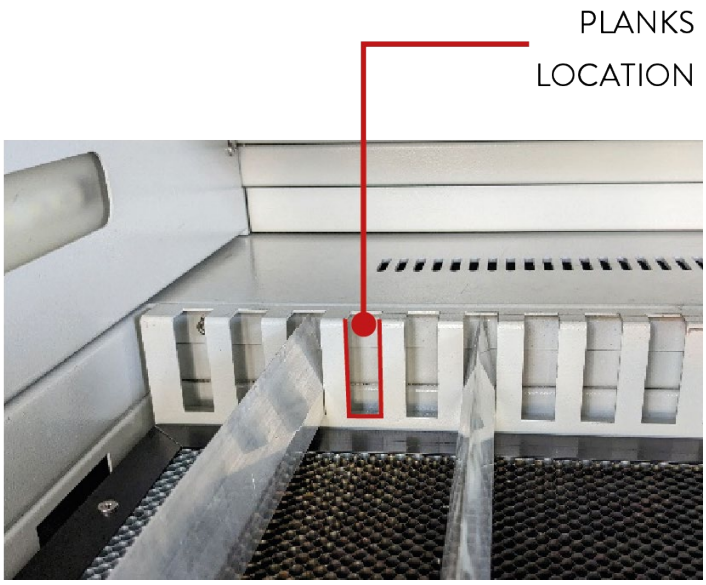
b. using the maximum working area

To fully exploit the **working area** of the plotter, which is larger than the normal **cutting area on the honeycomb panel**, it is possible to place the material on **support planks**.

Using the **planks** is recommended for **cutting rigid panels** such as **plywood or mdf and transparent methacrylates**: the planks limit the support surface of the material, **reducing the burn marks** on the underside of the material.



To place the planks, it is necessary to **lower the honeycomb panel below the seat of the planks**. On the **control panel** of the plotter press the ***Z/U*** button, then lower the panel by pressing and **holding down the right arrow**.

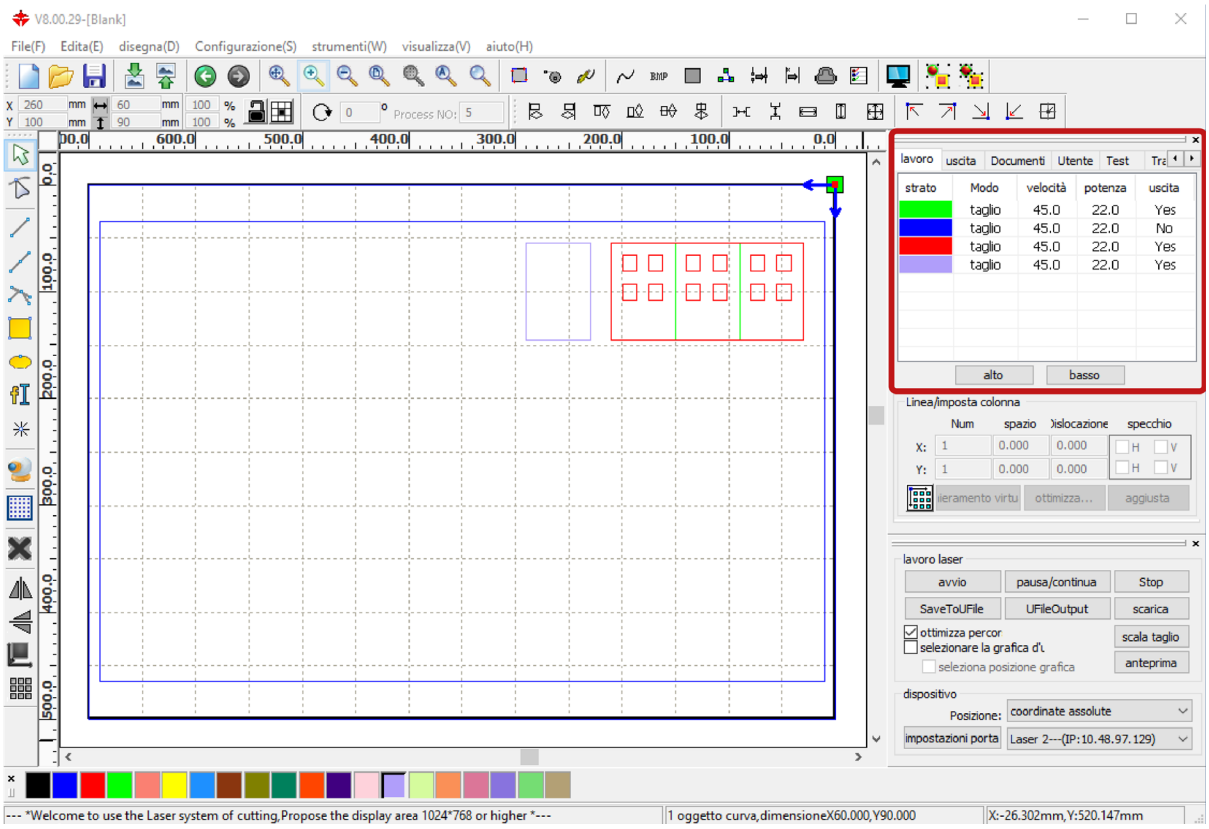


TURN OFF THE PLOTTER, by turning the **key on the right side only**, before **taking the planks** which are located inside the machine. **Open the front door** with the specific key that is found in the drawer CS1 of the CNC lab, **pull out the planks**, then **close the panel** and **restart the plotter**.

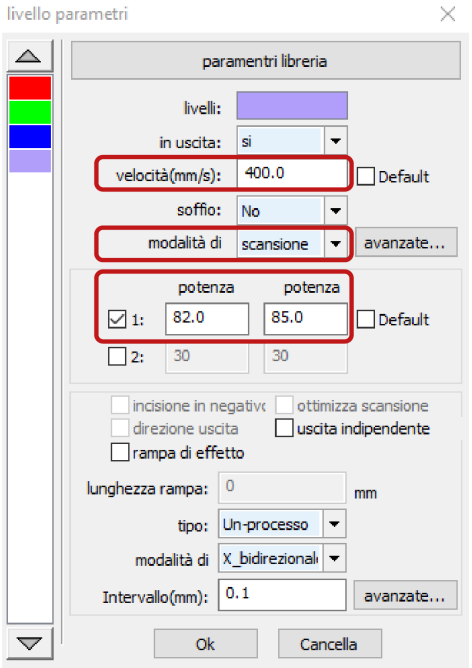
Place **as few planks as possible**, as long as **the sheet does not bend** due to its weight or the aspiration.

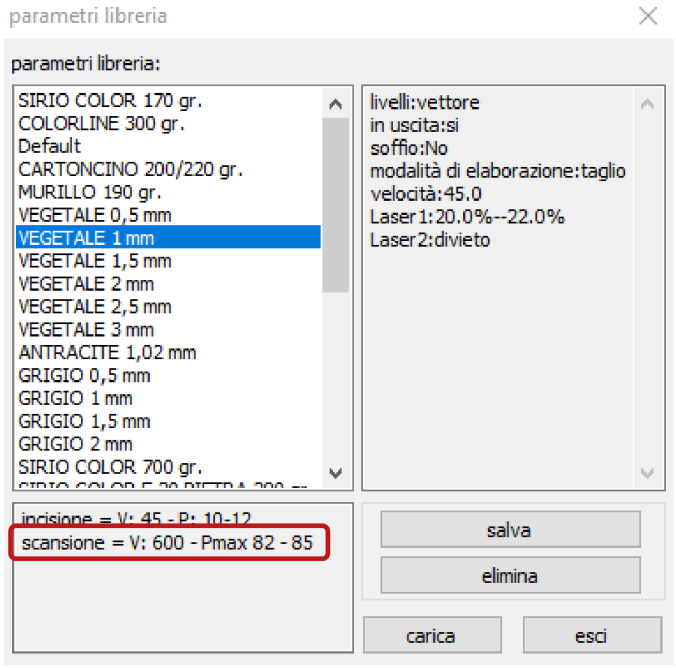
c. engraving of fillers

The realize a **filler**, which means **to engrave by burning the entire inner surface of a closed figure**, use the mode ***scansione*** (scan). In the top right menu in the section ***lavoro*, double-click on the layer that contains the figures to be filled** in order to open the related window ***livello parametri***.

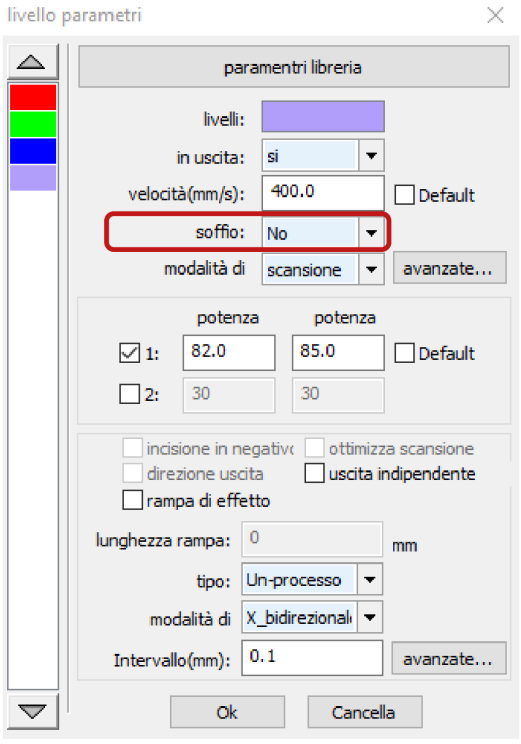


Set the item ***modalità di*** on ***scansione***. For the items ***velocità*** (speed) and ***potenza*** (power), copy the **values** related to *scansione* found in the **note for each material** in the **window *parametri libreria***.





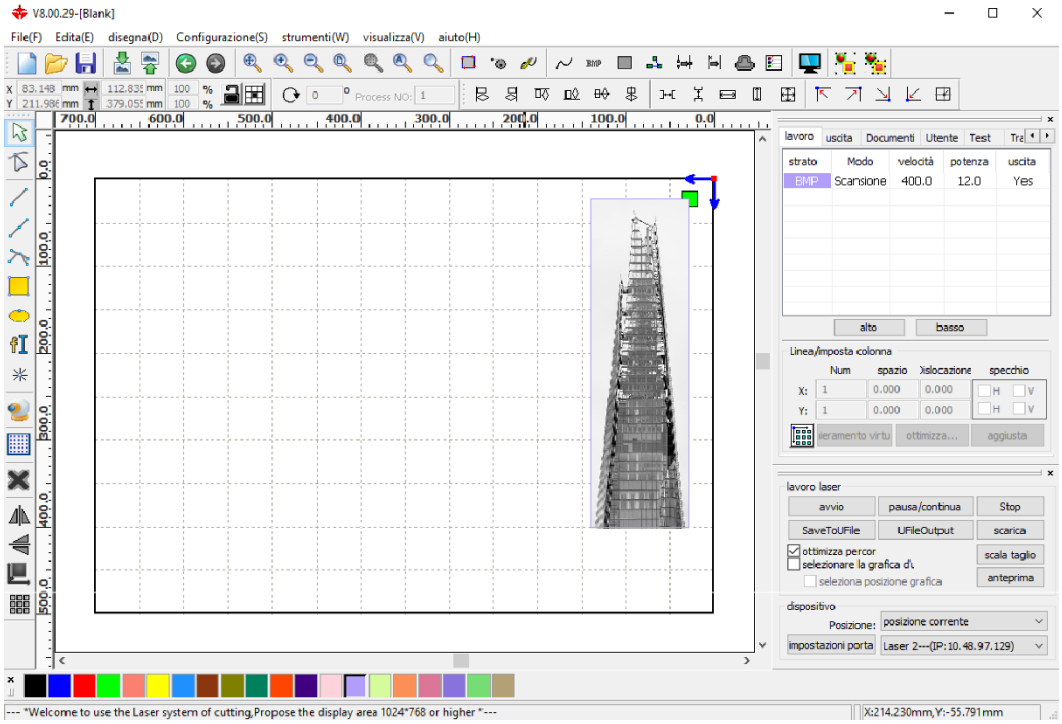
In the **window *livello parametri***, in addition to speed and power parameters, it is necessary to check the **parameter *soffio*** (blow), which is advisable to set to ***No*** in the case of procedures in ***modalità di scansione*** to keep the surface of the material cleaner.



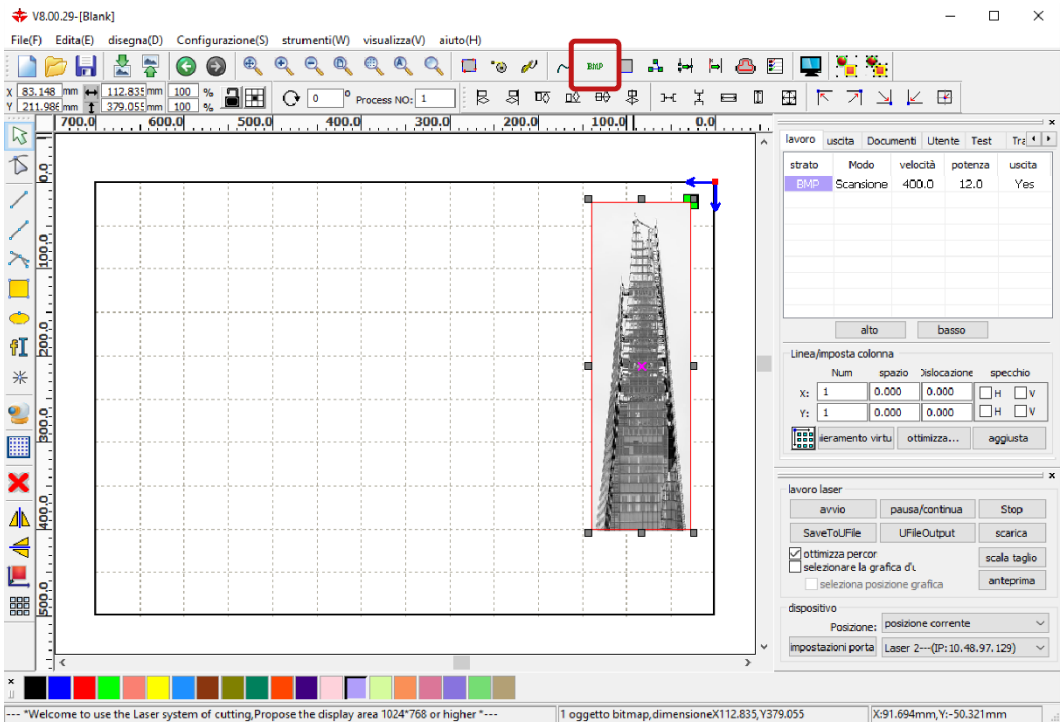
If the **parameters** for scansione **are not present**, it is necessary to identify them following the instructions in the next **chapter 13 paragraph a.** and add them as a note to the material in the window *parametri libreria*.

d. engraving of raster images

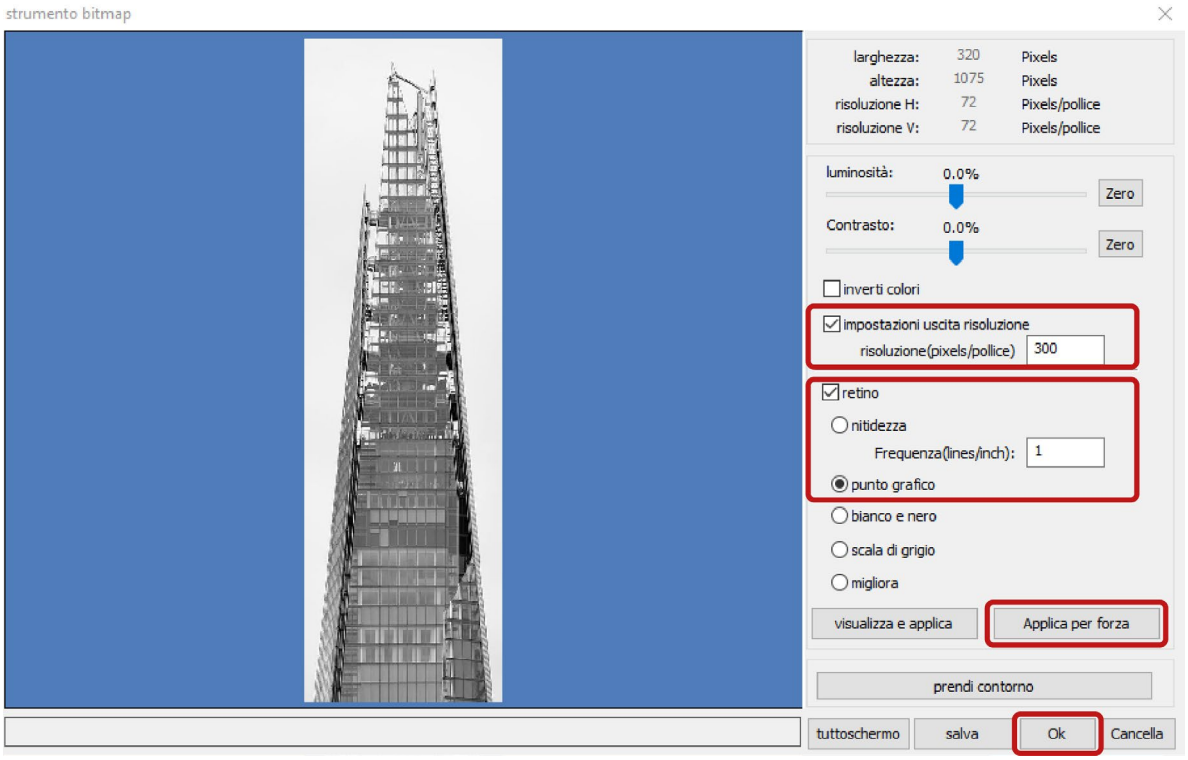
Using a similar procedure to paragraph c, it is possible to **engrave** on the surface of a sheet material **a raster image** (e.g. .jpg or .bmp) **in greyscale**, using the mode ***scansione***. Import the image, following the steps in chapter 1, and change the parameters for *scansione* by following the steps in paragraph c.



Click on the image to select it and choose the **BMP button** on the menu on top.



In the **window** ***strumento bitmap***, **activate** the item ***impostazioni uscita risoluzione*** to the desired resolution and **activate** the item ***retino*** to then select the option ***punto grafico***. Confirm the choices previously made in the window with the **button** ***Applica per forza*** (apply) and then with the ***Ok*** **button**.



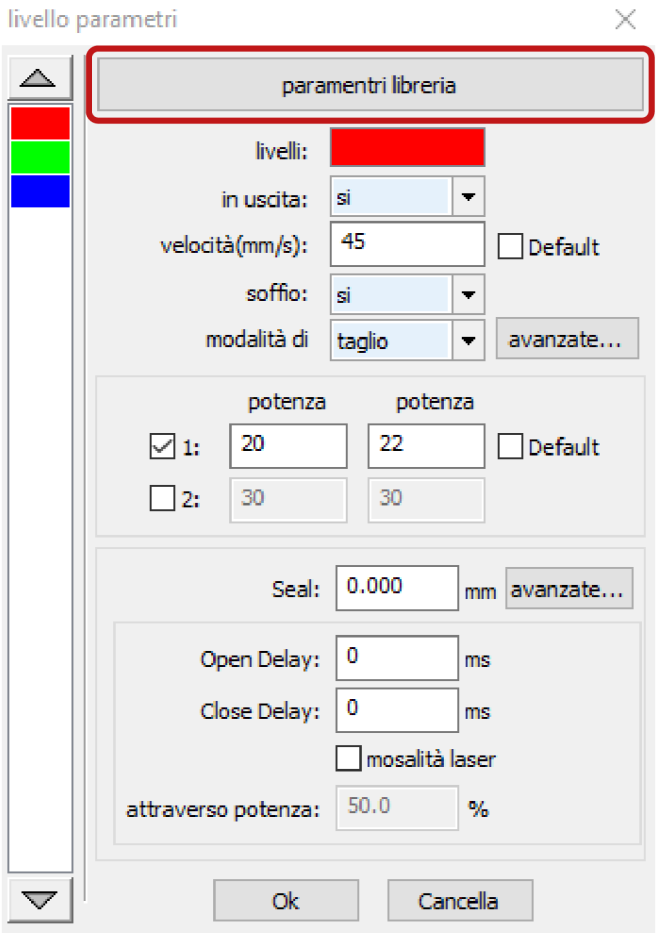
14. advanced settings – staff operators only

a. how to determine the parameters for cutting, engraving and scanning

In general, to determine the **best cutting and engraving parameters** of a laser plotter **for a given material of a given thickness**, it is necessary to proceed by trial and error, looking for the **highest speed**, to reduce processing time, and the **lowest power**, to burn the material as little as possible, until you find the right balance between the two parameters.

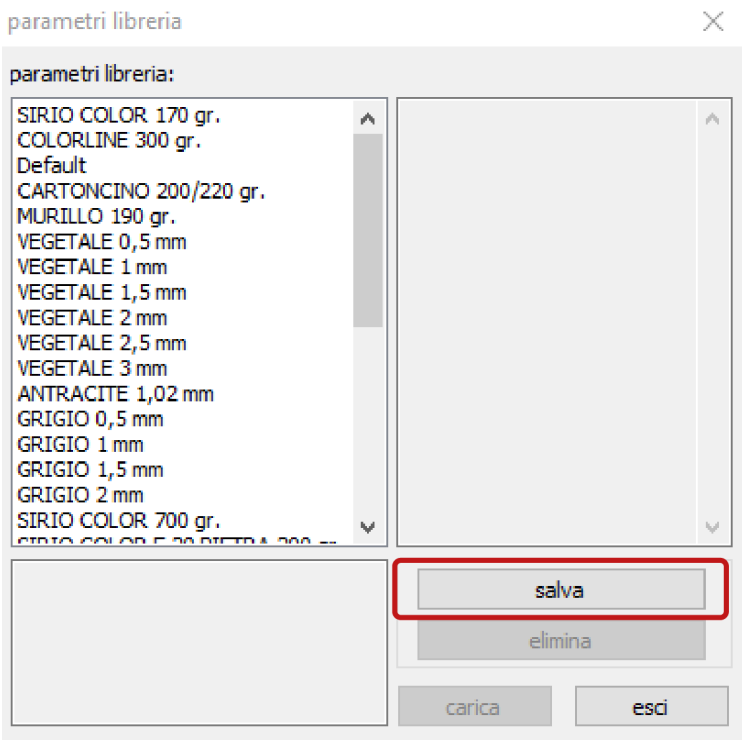
In particular, **the laser plotters that LaborA is equipped with**, for **cutting and engraving**, can reach a **maximum speed of 45** and a **maximum power of 85**. Therefore, to find the right balance of parameters, it is recommended to **begin the tests with a speed of 45 and increase the power up to a maximum of 85,** and once you get to this power start to decrease the speed.

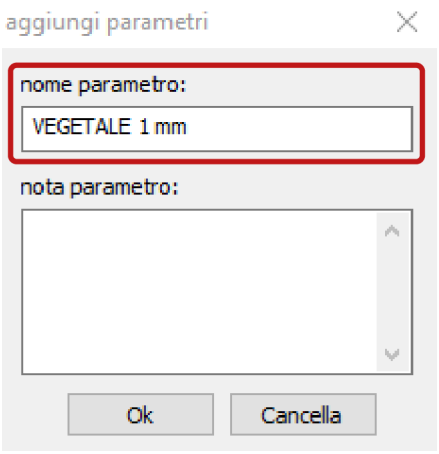
To determine the best parameters for **engravings of fillers** in ***modalità di scansione*** and raster images, proceed in a similar way, taking into account that **the plotters LaborA is equipped with**, for ***scansione***, can reach a **maximum speed of 400** and a **maximum power of 80.**



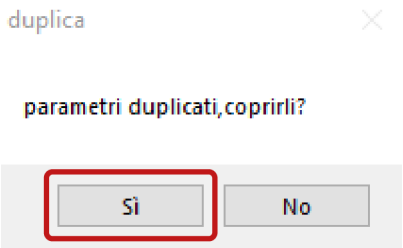
As explained in chapter 4, the parameters for **speed** and **power** to cut and engrave materials are indicated in the **window** ***parametri libreria***. After the tests for cutting and engraving it may be necessary to **change the parameters** of a material **or add** a new one by saving the settings in the **window** ***livello parametri***.

To **add a new combination** of speed and power parameters to cut a material, in the **window** ***parametri libreria*** click the button ***salva*** (save) and **assign a** ***nome parametro*** (parameter name).





If the ***nome parametro*** that you want to assign **already exists**, it is possible to **overwrite** its parameters to update the material. In this case it is necessary to fill in the item ***nota parametro*** with the values for ***incisione*** and ***scansione*** already determined for that material or with new parameters considered more fitting.



The syntax to fill in the item ***nota parametro*** with the values is:

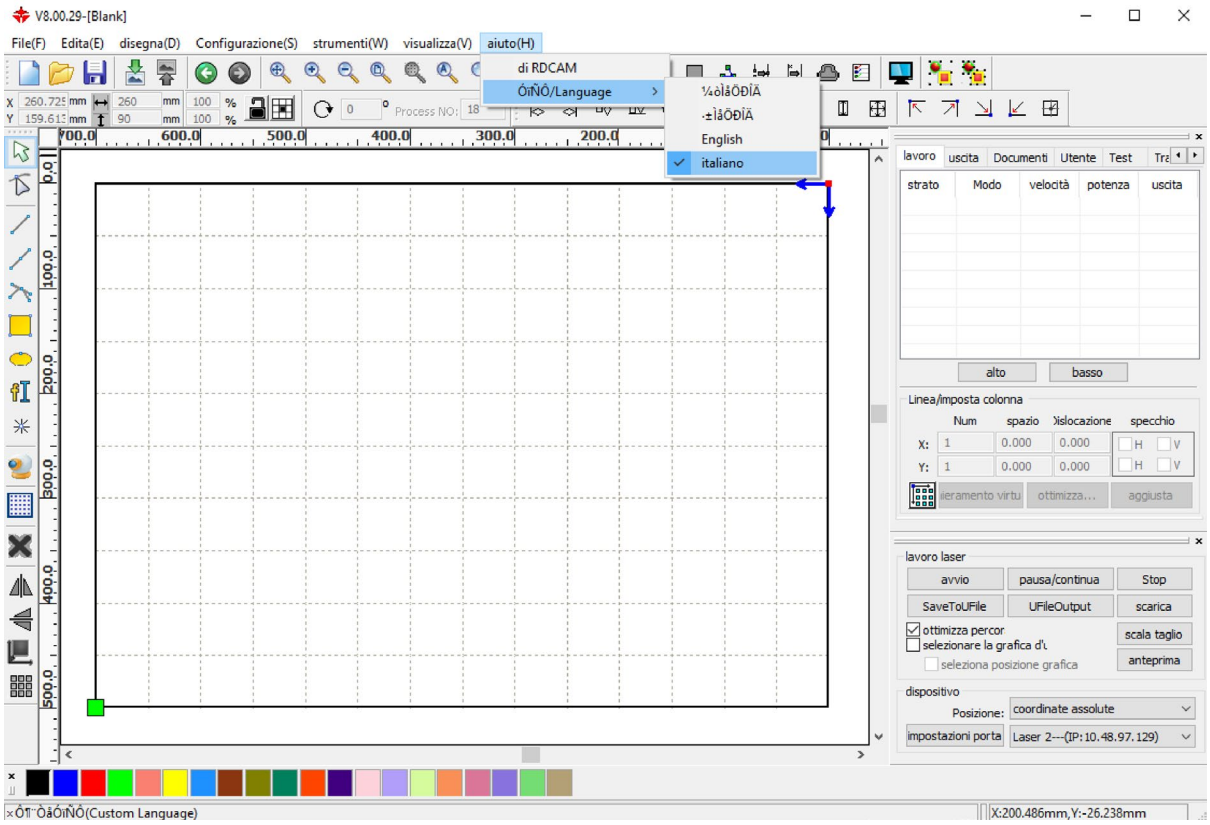
incisione = V: *number* – **P:** *number* – *number*

scansione = V: *number* – **Pmax:** *number* – *number*

The data in the window ***parametri libreria*** are automatically saved in the ***Param.lib* file** located in the folder ***(C:)*** > ***RDWorksV8***. Each time you change parameters in the window ***parametri libreria***, you must make a backup of the *Param.lib* file in order to have it available in case you need to reinstall *RDWorks*.

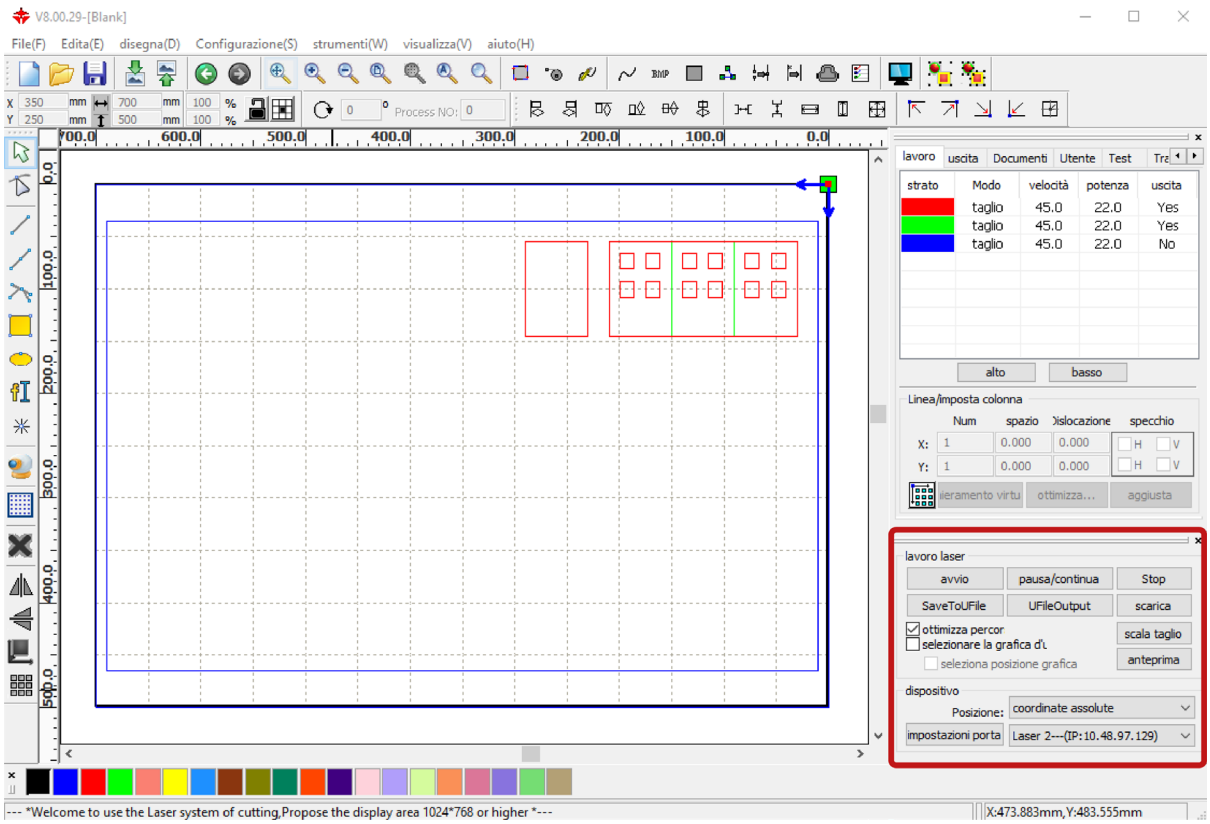
b. RDWorks in Chinese

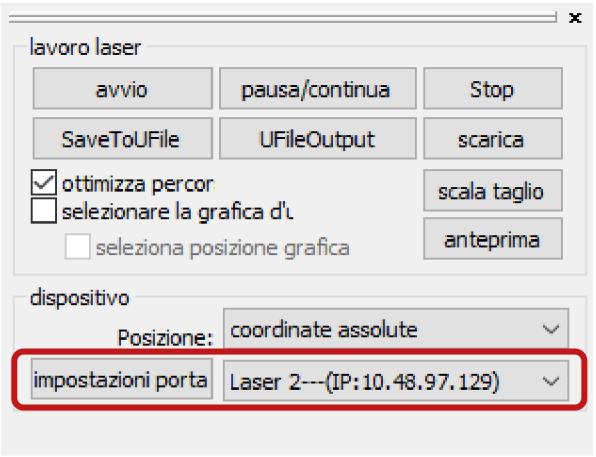
In the **main menu bar** at the top, which will appear in ideograms, click on the **last item *(H)*** > ***Language*** > ***Other*** > ***Italian***.



c. pc does not communicate with the plotter

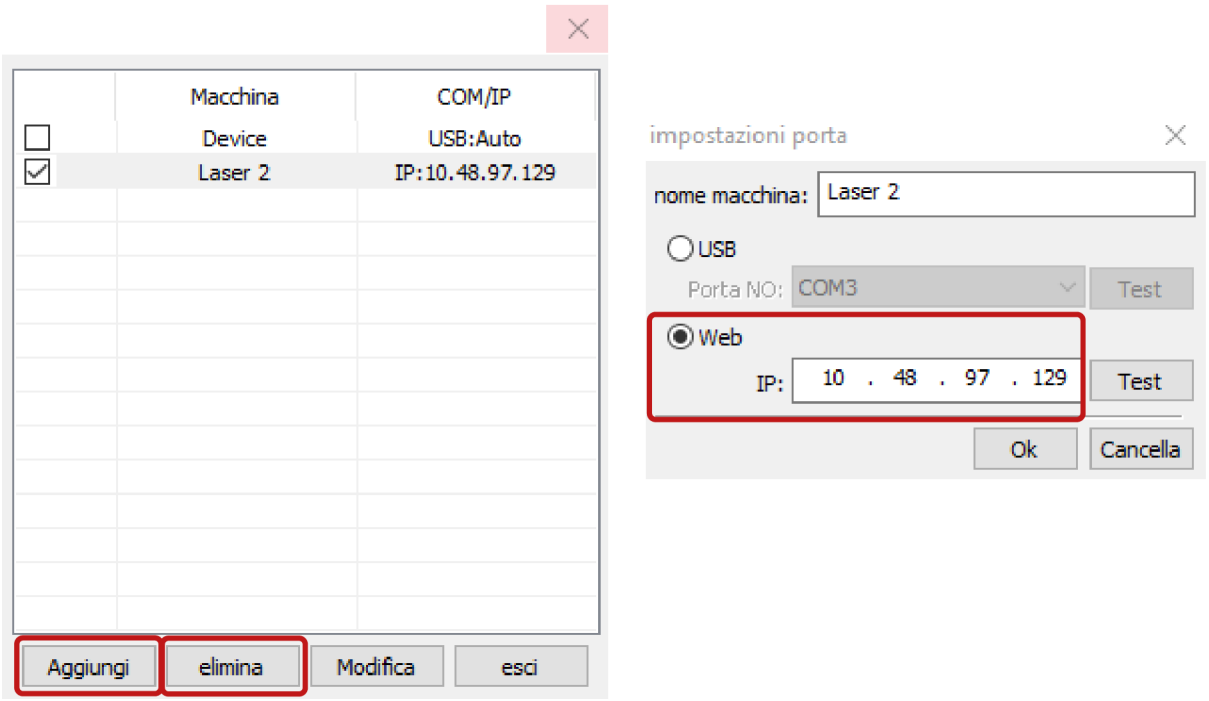
Communication Error appears. In the *RDWorks* software from the menu ***lavoro laser*** at the bottom right, in the section ***dispositivo***, select ***impostazioni porta***.





In the window that appears, **tick the line of the machine in use** and click the button ***elimina*** (delete).

In the same window **click the button *Aggiungi*** (add) to open the window ***impostazioni porta*** where you can enter the **IP of the plotter connected** to the pc you are using.



- ***Laser 1***: IP 10-4-82-11 / Gateway 10-48-97-254
- ***Laser 2***: IP 10-4-82-12 / Gateway 10-48-97-254
- ***Laser 3***: IP 10-4-82-13 / Gateway 10-48-97-254

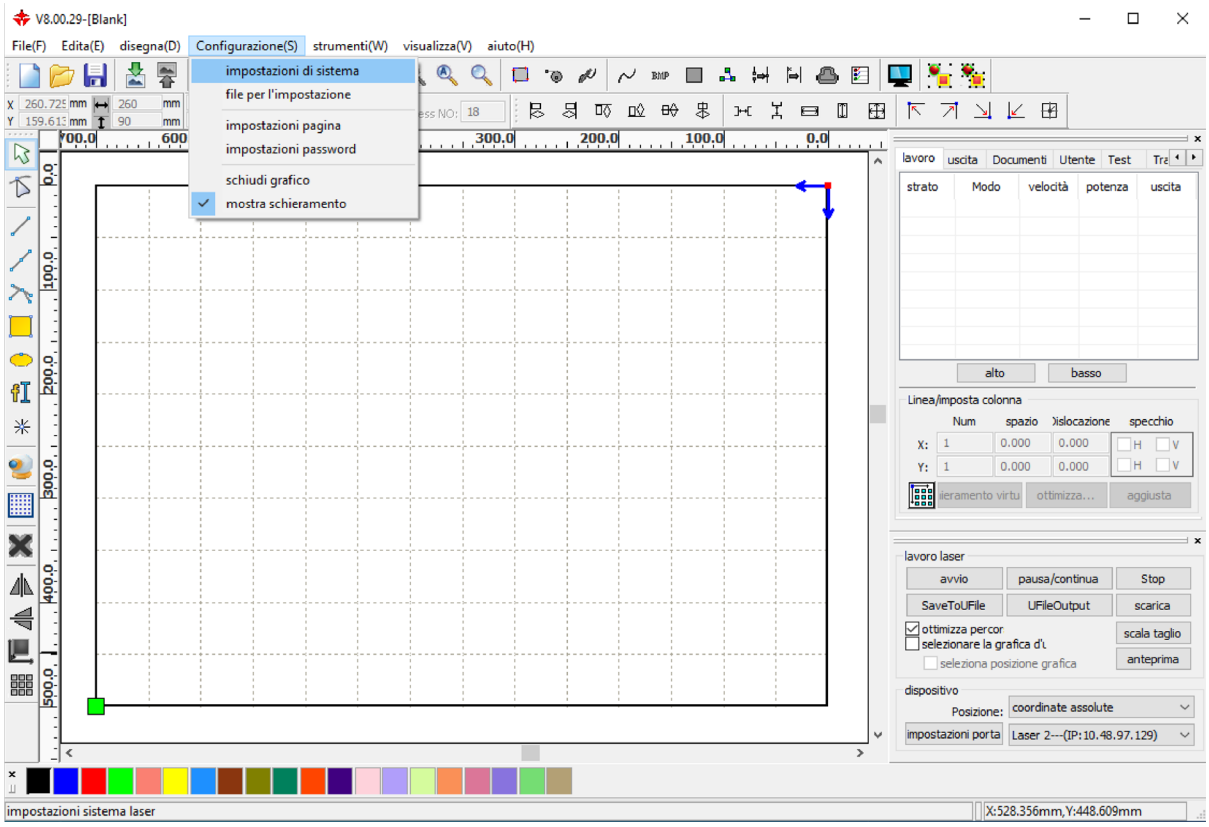
d. IP address of the plotter

To **read** the IP address of each plotter press ***Z/U*** > ***Config IP+*** > ***Enter*** on the machine control panel. To return to the main menu use the ***Esc*** button.

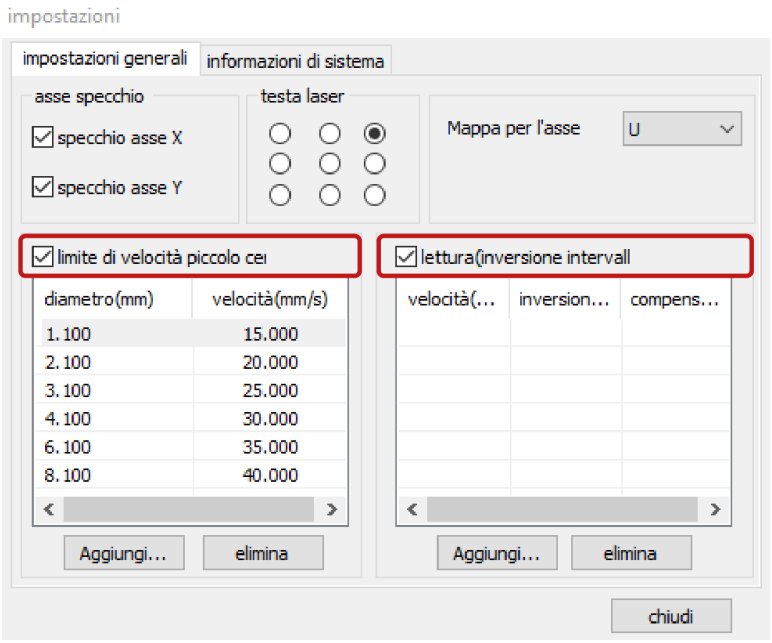
To **change** the IP address of each plotter press ***Z/U*** > ***Config IP+*** > ***Enter*** and **change the numbers in the boxes** using the ***up*** and ***down*** **arrows** on the control panel and move between the boxes with the ***Z/U*** key. Confirm the compilation with the ***Enter*** key.

e. installing the RDWorks software

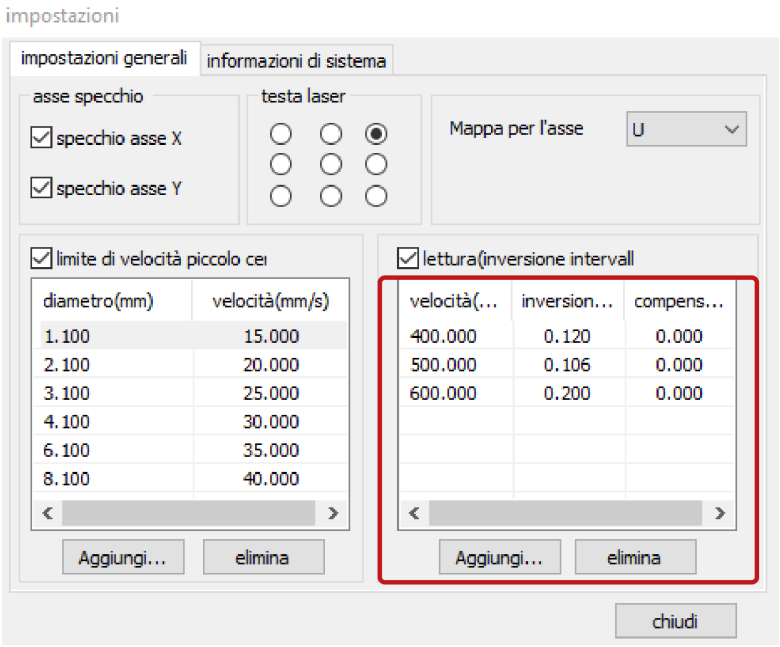
Set up the software as follows: in the **main menu bar** at the top select ***Configurazione (S)*** > ***impostazioni di sistema.***



Tick *limite di velocità piccolo cei* and ***lettura (inversione intervalli)***.



Then in the latter section **click the button *Aggiungi*** (add) and enter the following values of ***velocità*** (speed) and ***inversione*** (inversion) **of the plotter connected** to the pc you are using.



velocità	inversione
300.000	0.06
400.000	0.106
500.000	0.206
600.000	0.240

Laser 1

velocità	inversione
400.000	0.12
500.000	0.106
600.000	0.2

Laser 2

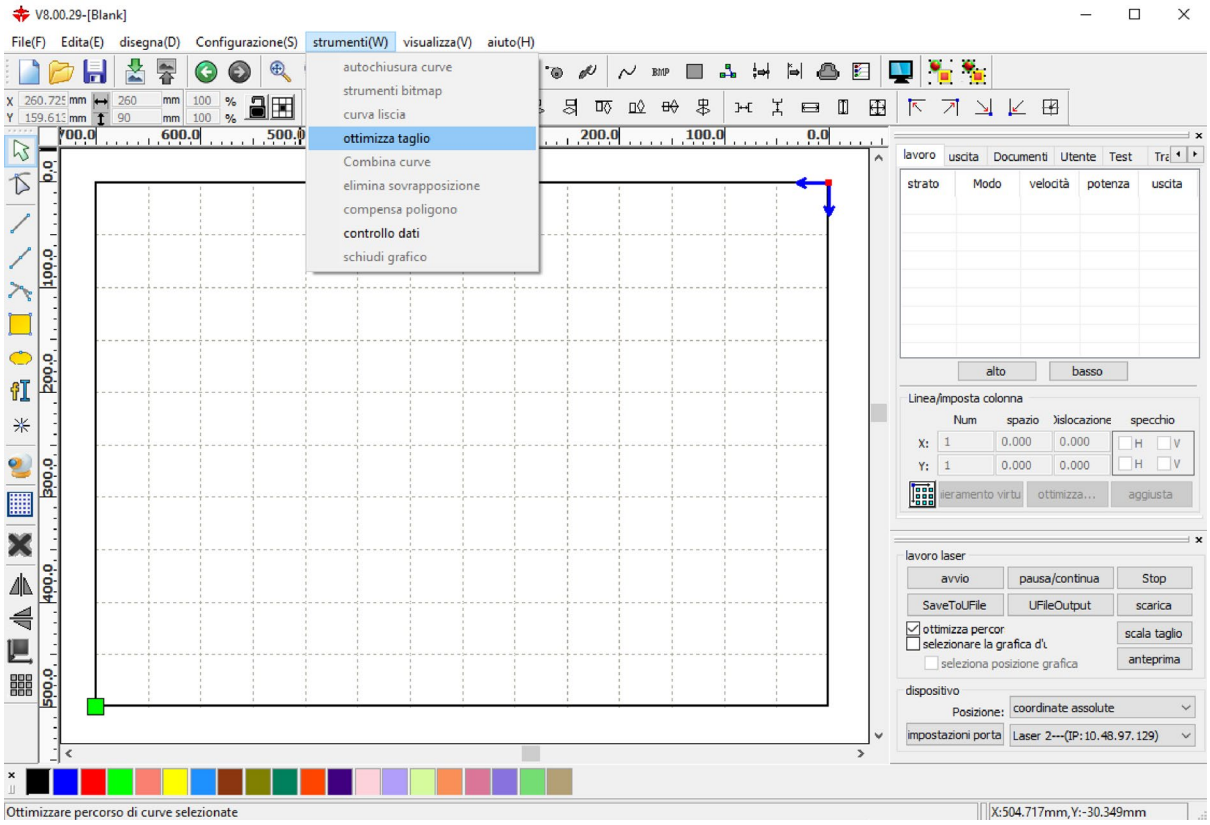
velocità	inversione
400.000	0.15
500.000	0.17
600.000	0.18

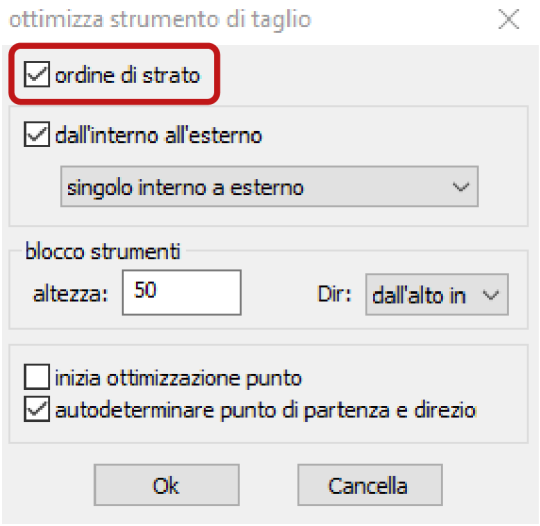
Laser 3

To import **parametri libreria** copy the backup file ***Param.lib*** in the folder ***(C:)*** > ***RDWorksV8***.

f. error in the cutting order of the layers

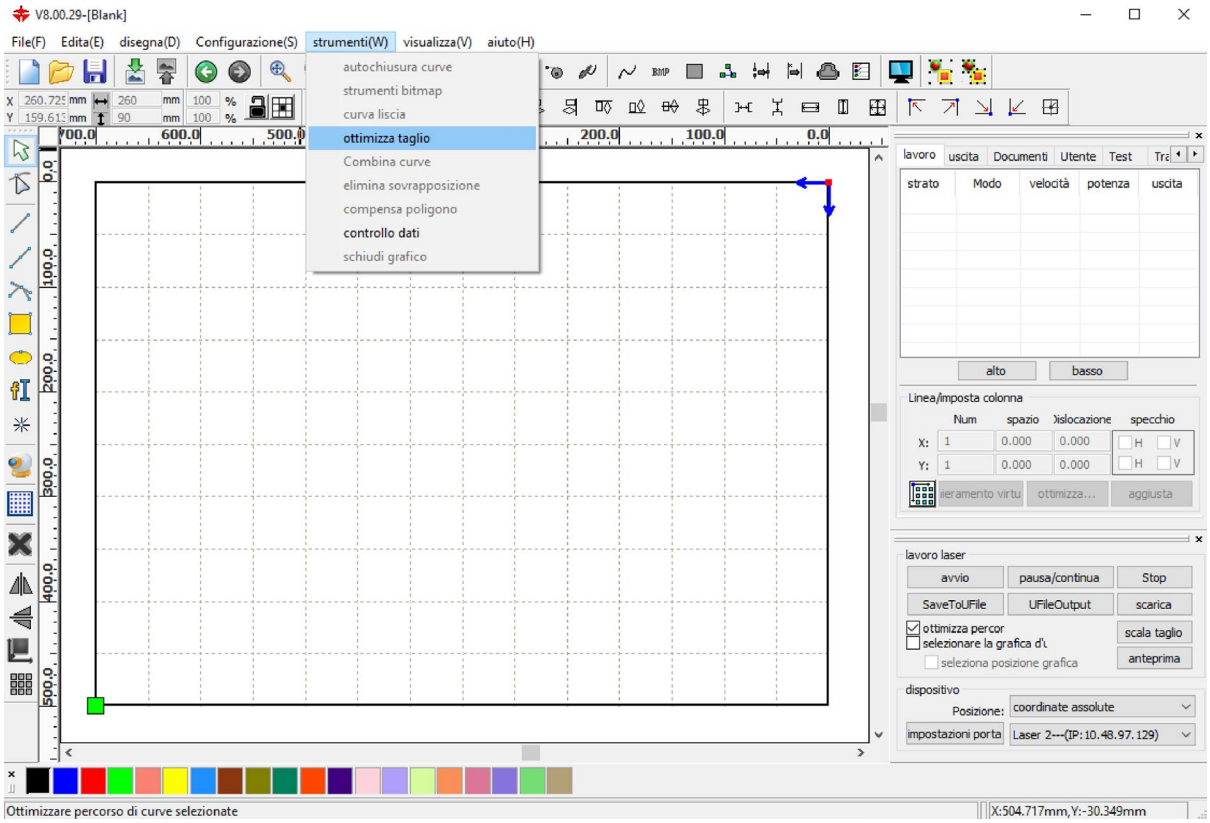
If the plotter **does not follow the cutting order** displayed in the window ***lavoro*** at the top right, **in the main menu bar** at the top select ***strumenti (W)*** (tools) **> *ottimizza strumento di taglio*** (optimize cutting tool) and check that **the item *ordine di strato*** (layer order) **is ticked**.

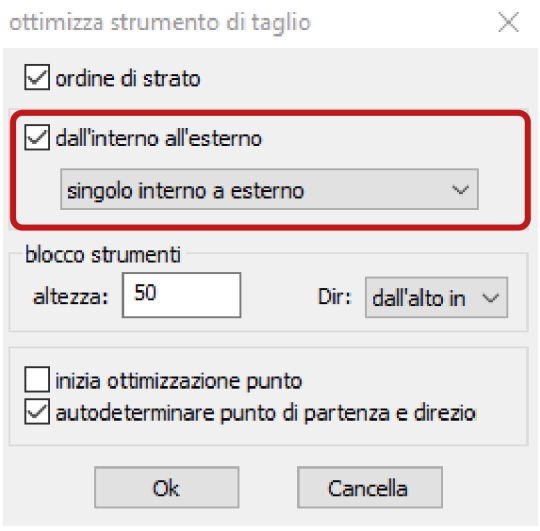




g. cutting order dall'interno all'esterno (from inside to outside)

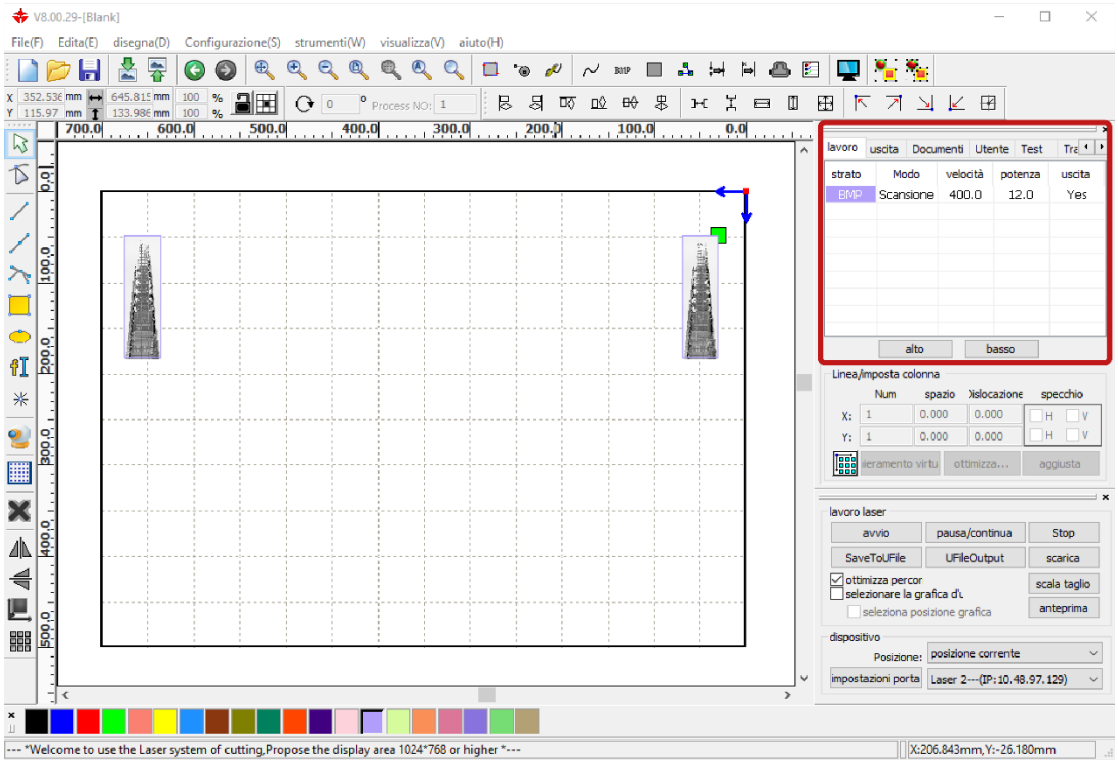
In the case of cuts of geometries that have holes inside a perimeter, as in the case of facades with windows, it is advisable that the cut starts from the windows. If the perimeter is cut first, the piece might move due to the flow of compressed air that assists the cutting. **In the main menu bar** at the top select ***strumenti (W)*** (tools) **>** ***ottimizza taglio*** (optimize cut) and **tick the item** ***dall'interno all'esterno*** (from inside to outside).

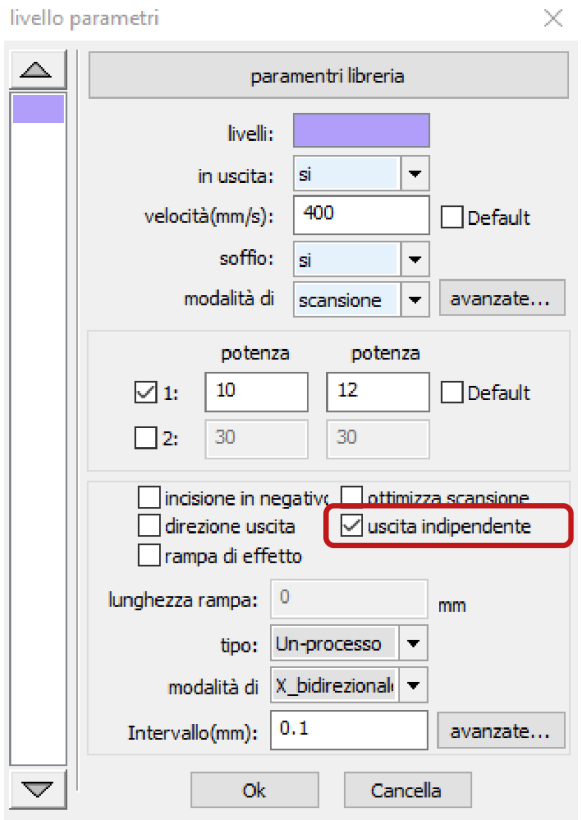




h. shortening engraving times for fillers and raster images

Making **scans placed at the extremities of the working area** can lead to long processing **times**, but it is possible to **significantly reduce them**.





In the **top-right panel** in the section ***lavoro***, **double-click on the layer** that contains the scans to open the related window ***livello parametri*** and activate the item ***uscita indipendente*** (independent output).

In this way the machine will carry out the scans independently: it will realise the first on in full before moving to the next one.

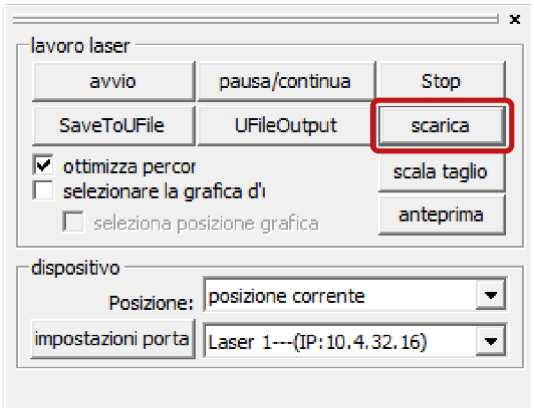
To **check the processing times**, refer to **chapter *6. check cutting times***.

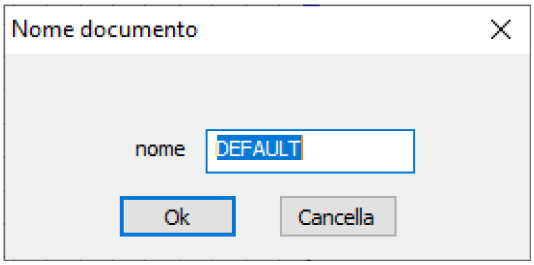
i. the plotter does not make engraving of background and raster

Once the cutting is started, if the plotter does not make only the frames or raster images placed near the limit of the working area it is necessary to place them at a distance at least 2 cm from the outer frame to give the machine technical braking space.

j. interruption during scanning of raster images

Communication between the software and the plotter may be interrupted during processing without warning when dealing with very heavy images. In this case you need to **download the file into the plotter** and **manage the scanning from the** laser **control panel**. Set the cutting/scanning parameters from RDWorks software and search for the *Posizione:* (Position) button at the bottom right of the laser panel: be sure the position is on ***current position***, at this point **click *scarica* (**download) and assign a name to the file.





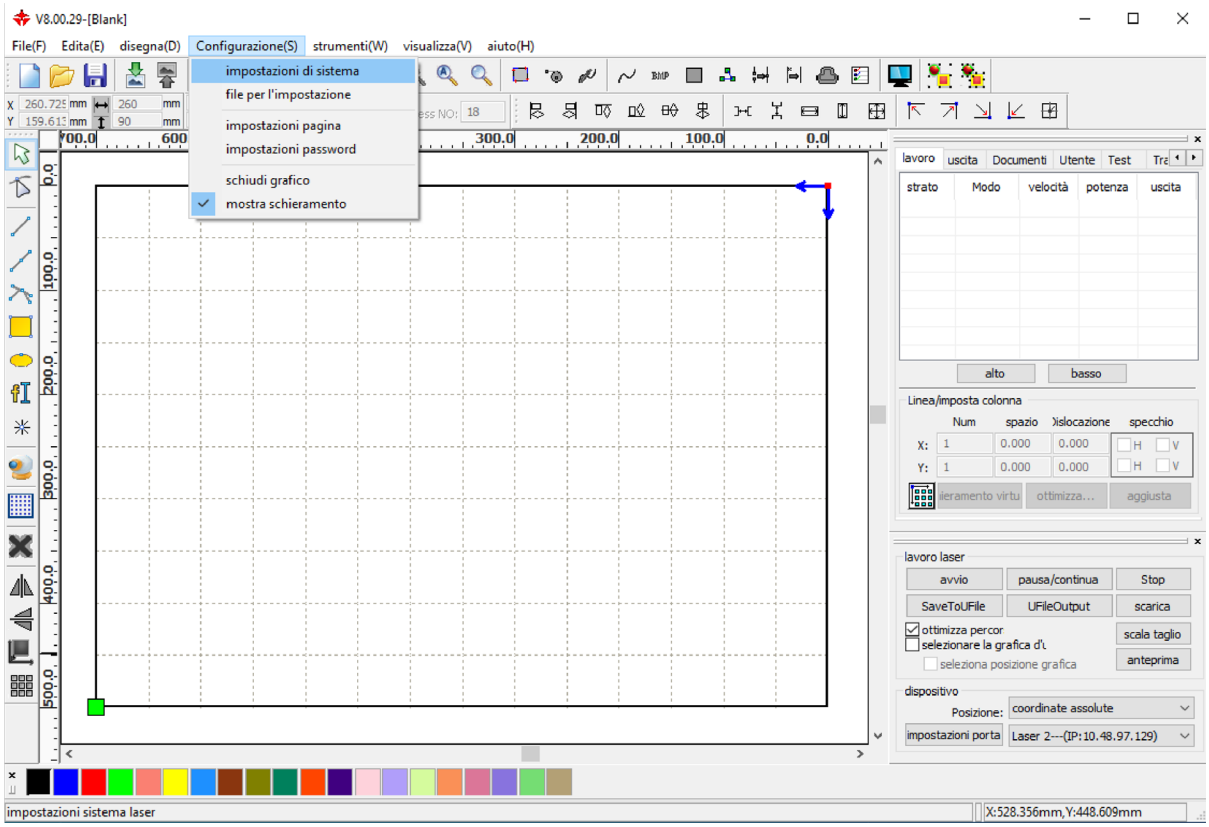
From the plotter's panel control **press the *File* button**, select the file to be cut with the arrows and confirm the selection with the ***Enter*** key. The preview of the selected file will appear on the display. By pressing the ***Frame*** button, you can see the preview of the perimeter of the cutting area on the plane through the movement of the cutting head.

To start the cutting press the **Start/Pause** button.

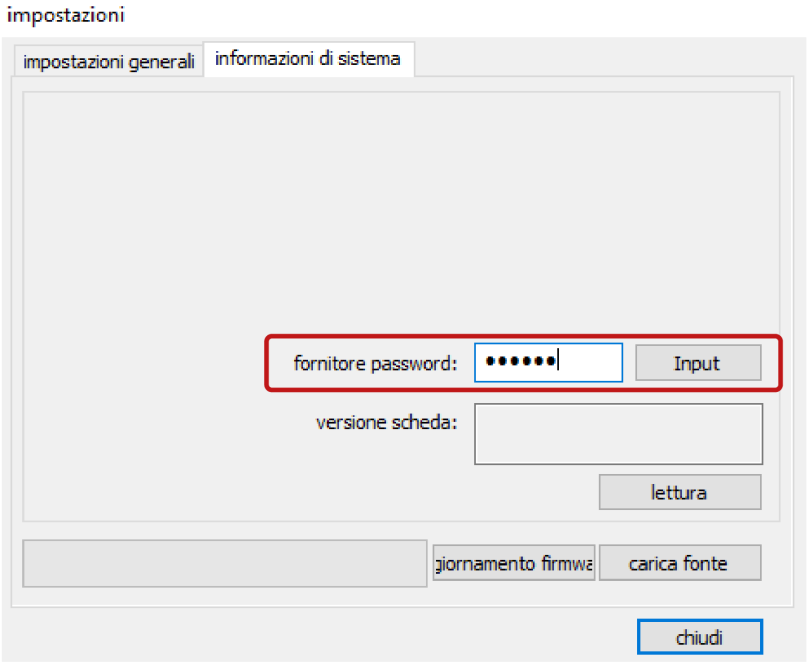
To **delete files from the plotter memory**, **select the file** you want to delete from the laser control panel, scroll through the menu to the ***cancella*** (delete) entry and confirm by pressing the ***Enter*** key.

k. reading machine work time

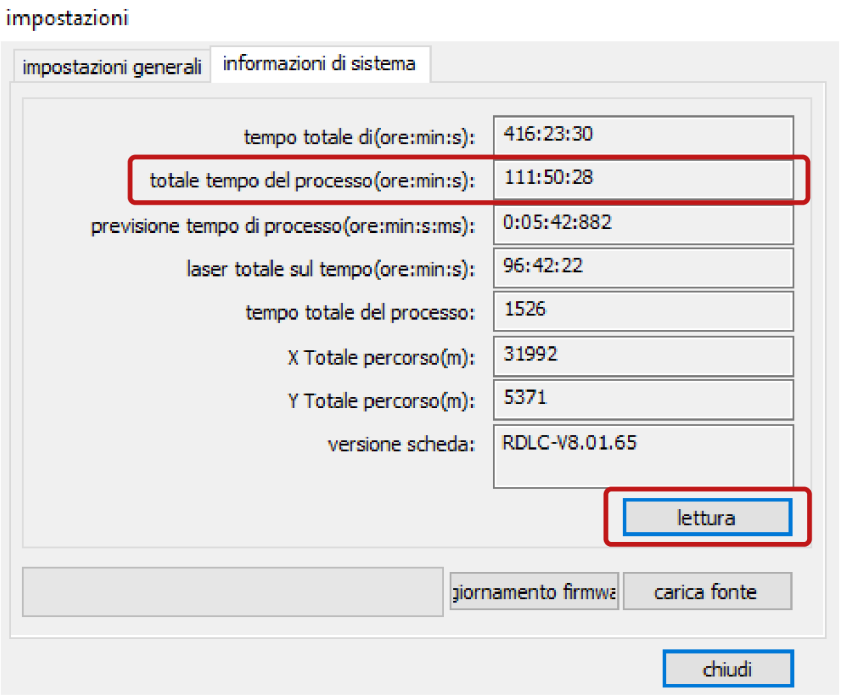
To read the working time of the plotter, **turn on the machine** and on the computer connected to it select *Configurazione(F) > Impostazioni di sistema* from the main menu of the *RDWorks* software.



In the window *impostazioni*, **choose the section *informazioni di sistema*** and insert the **password: RD8888** in the field *fornitore password*. Then **confirm** by clicking on the ***Input*** button.



After the window is updated, **click on the button *lettura*** (read) to view the data.



The **machine work time** corresponds to the second item ***totale tempo del processo(ore:min:s):***

15. check list for operators

a. check before cutting

- the **number of sheets** to be cut must coincide with the number noted in the **appointment**;
- the file must contain the **two frames** so that it is easier to check if the pieces have been drawn in the **correct scale** and on a single **plane with Z zero**;
- the **minimum distance of the pieces** from the inner frame and between the pieces to be cut must always be respected;
- always make a **small cutting test** to verify that the **parameters** of the library are **appropriate to that specific sheet of material**, especially in the case of plastics to verify their laserability;
- request **confirmation from students of the accuracy of the drawings once they are imported into *RDWorks*** before making the cuts, in order to be sure that the program has correctly read all the items saved in the .dxf file;
- if **tests** have to be cut, place them **between the programmed cuts** and make **only small samples**;
- in case you have to cut cardboard with a **striped texture, the pieces to be cut must be positioned in the same way**, otherwise the orientation of the stripes will change, for example on the facades;
- if you need to cut **drawings with dense lines**, backgrounds or raster images, **always check the processing times** by previewing them to schedule appointments.

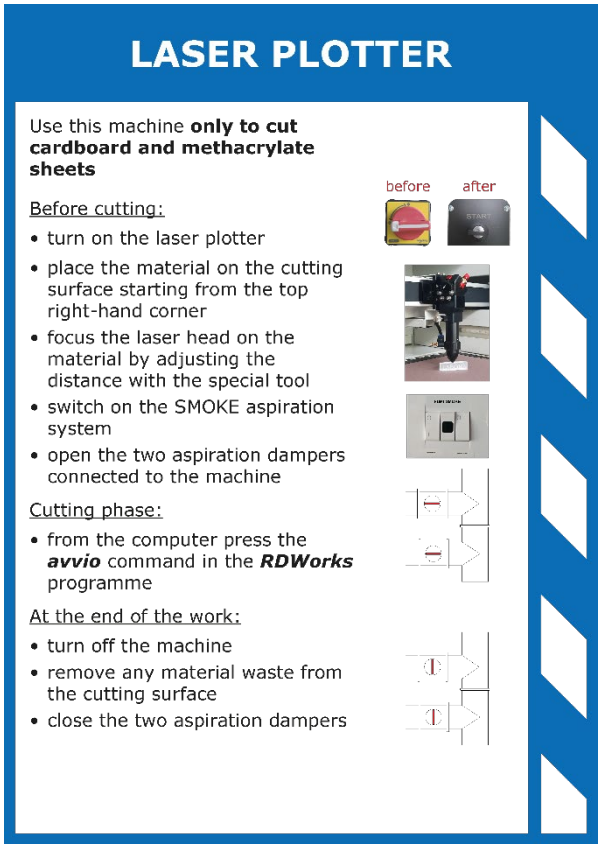
b. procedures not to be performed

Unless specifically indicated and confirmed by the reference tutor, the following operations shall **not be carried out**:

- cutting or engraving of **unusual materials;**
- **laser cuts on white or light-coloured cardboard**;
- laser cutting of **topography lines** that are normally made with blade cutting;
- cutting **simple shapes such as rectangles**;
- cutting **shapes almost as big as the frame**, such as, for example, the upper lining of a base with a simple hole;
- cutting of the **same shape repeated several times** which would presumably create a volume made of overlapping layers;
- cutting pieces with geometries **thinner than the thickness of the material** being cut;
- cutting **pieces that are too small and would be sucked by the panel**, if not bound by cutting breaks;
- cutting of **many thin grid elements with holes of about 1 mm**, railings or brise soleil, if to be realized on cardboard other than 200/360 gr/sqm;

- cutting of **methacrylate more than 1 mm** thick;
- cutting of **thin rods**;
- cutting **shapes of men, trees**, cars, bicycles, etc.;
- **engraving of urban plans**, facade drawings, for folding or **for placing pieces** both in urban and architectural models;
- **engravings on plastic of very detailed elements** such as doors or windows;
- **raster engravings**.

16. prohibitions and regulations



17. machine sheets

POLITECNICO MILANO 1863

LaborA modellistica fisica e virtuale
Campus Bonardi - building 16A
via Ampère, 2 - 20133 Milano

EQUIPMENT IDENTIFICATION						
Name	Description	Model	Manufacturer	Serial n°	Year	Supplier
Laser 70-05	Cutting plotter	Jupiter 70	Laser Veronese	LVJ70210205	2021	Laser Veronese

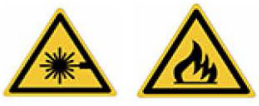
TECHNICAL SPECIFICATIONS						
Power	Weight	Asp. flange	Asp. Flange			
60 Watt	240 Kg	diam. 150 mm	diam. 150 mm			

Notes: laser source CO2 - Class 1 - cutting surface dimensions 700 x 500 mm - aluminium honeycomb cutting surface with aspiration system

IMAGE	OPERATING INSTRUCTIONS
	1 - Only cut sheets of paper, cardboard, poured or extruded methacrylate, PMMA, Perspex, Plexiglas
	2 - Check that the machine is clean and free from scrap materials
	3 - Turn on the machine
	4 - Start the aspiration system and open the dampers connected to the machine
	5 - Place the workpiece on the cutting surface
	6 - Adjust the focal distance between the cutting head and the material
	7 - Start the cut by pressing the button **Enter**
	8 - Remove the workpiece from the surface when you hear the buzzer
	9 - Remove any leftovers from the surface
	10 - Turn off the machine
	11 - Clean the machine and clear from any leftovers
	12 - In case of malfunctioning or incidents turn off the machine by disconnecting the power supply

AUTHORISED MACHINE OPERATORS
Laboratory staff or collaborators adequately educated and trained for use

PPE - PERSONAL PROTECTION EQUIPMENT	
No PPE requested	

POTENTIAL DANGERS	
Laser source hazard - Class 1	
Fire hazard	

PROHIBITIONS	
Forbidden to remove protective devices	
Forbidden to perform maintenance with moving parts	

AUTHORISED MAINTENANCE OPERATORS	
ORDINARY	Laboratory staff adequately educated and trained
EXTRAORDINARY	Specialised external personnel

POLITECNICO MILANO 1863

LaborA modellistica fisica e virtuale
Campus Bonardi - building 16A
via Ampère, 2 - 20133 Milano

EQUIPMENT IDENTIFICATION						
Name	Description	Model	Manufacturer	Serial n°	Year	Supplier
Laser 70-06	Cutting plotter	Jupiter 70	Laser Veronese	LVJ70210206	2021	Laser Veronese

TECHNICAL SPECIFICATIONS						
Power	Weight	Asp. flange	Asp. Flange			
60 Watt	240 Kg	diam. 150 mm	diam. 150 mm			

Notes: laser source CO2 - Class 1 - cutting surface dimensions 700 x 500 mm - aluminium honeycomb cutting surface with aspiration system

IMAGE

OPERATING INSTRUCTIONS

1 - Only cut sheets of paper, cardboard, poured or extruded methacrylate, PMMA, Perspex, Plexiglas
2 - Check that the machine is clean and free from scrap materials
3 - Turn on the machine
4 - Start the aspiration system and open the dampers connected to the machine
5 - Place the workpiece on the cutting surface
6 - Adjust the focal distance between the cutting head and the material
7 - Start the cut by pressing the button **Enter**
8 - Remove the workpiece from the surface when you hear the buzzer
9 - Remove any leftovers from the surface
10 - Turn off the machine
11 - Clean the machine and clear from any leftovers
12 - In case of malfunctioning or incidents turn off the machine by disconnecting the power supply

AUTHORISED MACHINE OPERATORS

Laboratory staff or collaborators adequately educated and trained for use

PPE - PERSONAL PROTECTION EQUIPMENT

No PPE requested

POTENTIAL DANGERS

Laser source hazard - Class 1
Fire hazard

PROHIBITIONS

Forbidden to remove protective devices
Forbidden to perform maintenance with moving parts

AUTHORISED MAINTENANCE OPERATORS	
ORDINARY	Laboratory staff adequately educated and trained
EXTRAORDINARY	Specialised external personnel

POLITECNICO MILANO 1863

LaborA modellistica fisica e virtuale
Campus Bonardi - building 16A
via Ampère, 2 - 20133 Milano

EQUIPMENT IDENTIFICATION						
Name	Description	Model	Manufacturer	Serial n°	Year	Supplier
Laser 100-05	Cutting plotter	Jupiter 100	Laser Veronese	LVJ100210205	2021	Laser Veronese

TECHNICAL SPECIFICATIONS						
Power	Weight	Asp. flange	Asp. Flange			
90 Watt	390 Kg	diam. 150 mm	diam. 150 mm			

Notes: laser source CO2 - Class 1 - cutting surface dimensions 700 x 500 mm - aluminium honeycomb cutting surface with aspiration system

IMAGE	OPERATING INSTRUCTIONS
	1 - Only cut sheets of paper, cardboard, poured or extruded methacrylate, PMMA, Perspex, Plexiglas
	2 - Check that the machine is clean and free from scrap materials
	3 - Turn on the machine
	4 - Start the aspiration system and open the dampers connected to the machine
	5 - Place the workpiece on the cutting surface
	6 - Adjust the focal distance between the cutting head and the material
	7 - Start the cut by pressing the button **Enter**
	8 - Remove the workpiece from the surface when you hear the buzzer
	9 - Remove any leftovers from the surface
	10 - Turn off the machine
	11 - Clean the machine and clear from any leftovers
	12 - In case of malfunctioning or incidents turn off the machine by disconnecting the power supply

AUTHORISED MACHINE OPERATORS

Laboratory staff or collaborators adequately educated and trained for use

PPE - PERSONAL PROTECTION EQUIPMENT

No PPE requested

POTENTIAL DANGERS

Laser source hazard - Class 1
Fire hazard

PROHIBITIONS

Forbidden to remove protective devices
Forbidden to perform maintenance with moving parts

AUTHORISED MAINTENANCE OPERATORS	
ORDINARY	Laboratory staff adequately educated and trained
EXTRAORDINARY	Specialised external personnel