

ProcessPower 3.9

User's Manual

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ProcessPower

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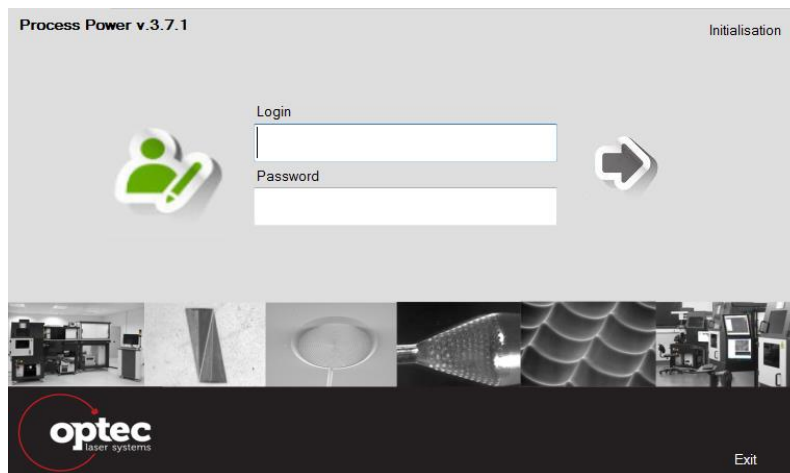
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1 [Introduction](#)

ProcessPower is the user interface for Optec laser micromachining systems, and is a 100% Optec development product written in VB.net.

1.1 [Login](#)

Depending on configuration and application, the user may have the choice to log in with a password and to have access to different user levels. As a function of level, the user will have access to different tools.



If the application has been configured without such log-in, the software will automatically be opened in Process Set-up mode.

1.2 [System start](#)

On system start, ProcessPower initializes, with progress report as at right, and then opens at the defined default position:



On system start, ProcessPower initializes, with progress report as at right.

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1.3 Initialization

After login, initialization of the machine starts. When all Home procedure are completed, the following main menu appears. Different menus are available in function of rights of the user logged.



- Production is use for executing a PART file with optimized operating for production.
- Maintenance is the mode used by Optec's engineers.
- Process Set-up is the mode used for process development and which allows the creation of PART file if the production option is included.
- Logout is used to change of user

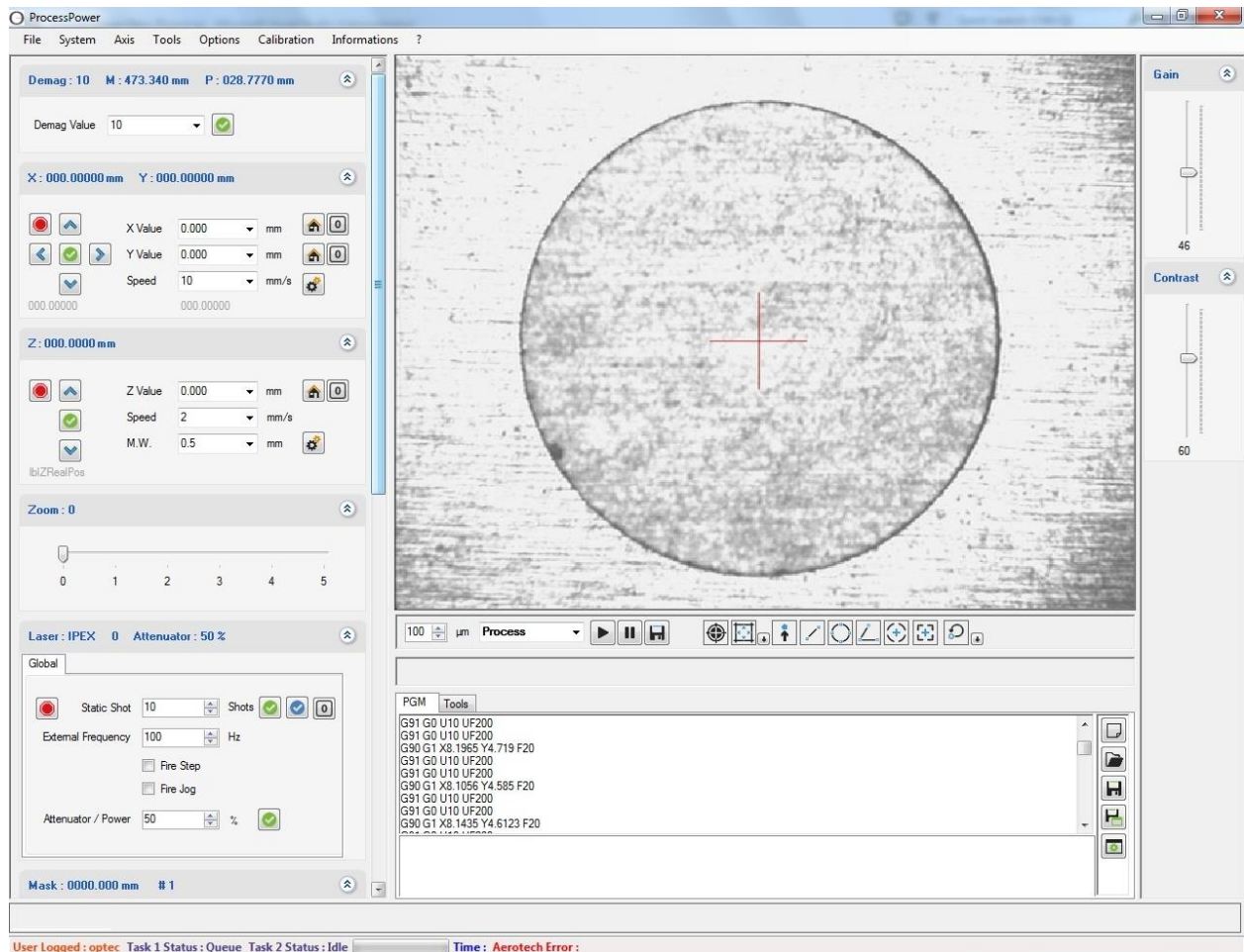
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2 ProcessPower Description in Process set-up mode

2.1 Overview

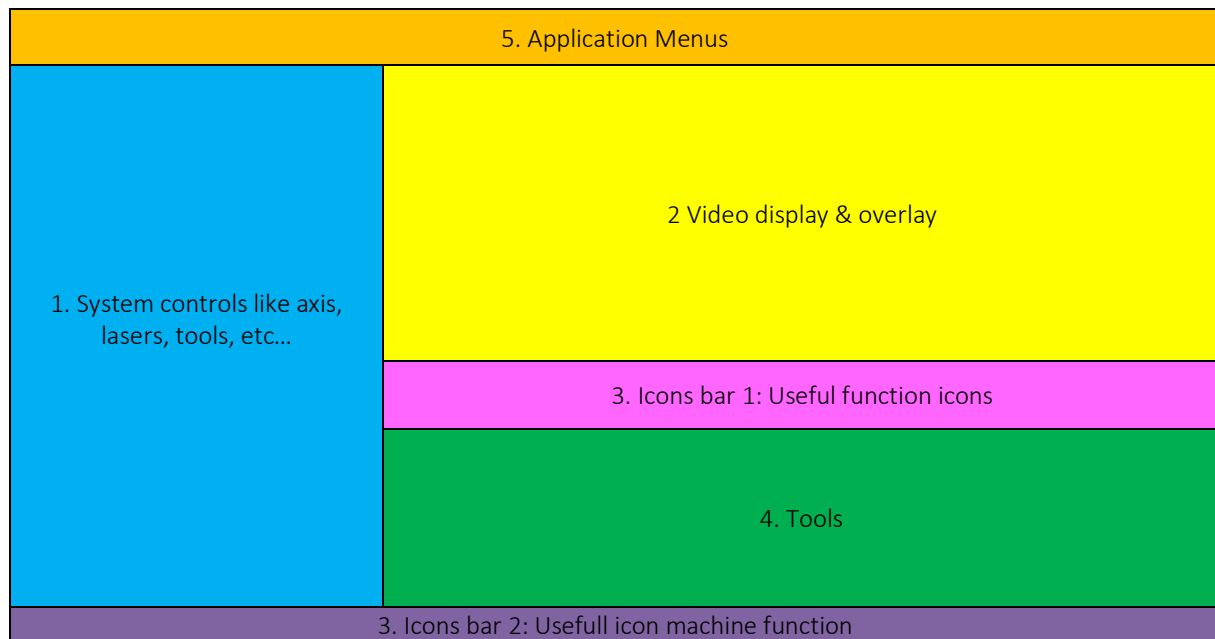
Process Set-up opens at the defined default position, typically with the part below the inspection microscope, and loads appropriate screen:



ProcessPower has different modes, for e.g. for mask projection or for direct writing with fixed lens or galvo; On specific machines where hardware functions are absent the linked mode will be inhibited or 'greyed out'.

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- In general, clicking on the pad to the right of a display opens a menu of predetermined or recently used options/values.
- System configuration & calibration. data is managed by Regedit.
- In a complex system, which might have galvo, fixed lens, inspection microscope, etc, different 'zones' (= positions of X,Y stages) are predefined, the default zone on start-up is generally that of the zoom inspection microscope. Some systems have only one 'zone'.



- Note that in general parameters in laser tabs are only accessible when in that working zone, OR in Zoom position after having previously visited the specific laser position.

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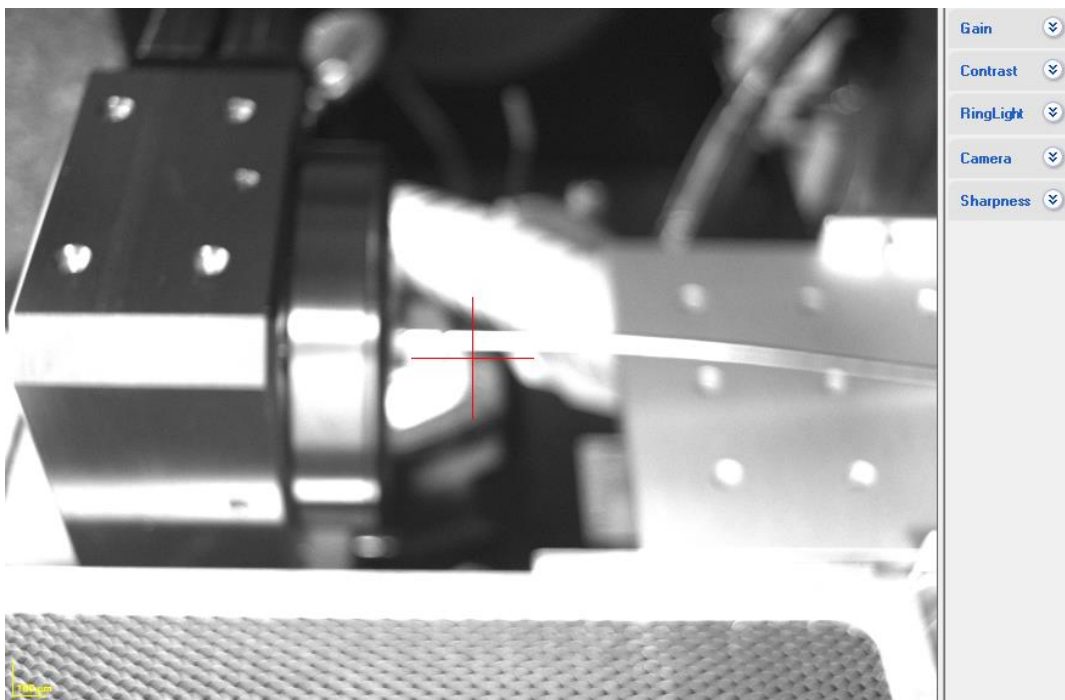
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2.2 [System Controls](#)



In this section, one can control the different motorized elements of the system like linear or rotation stages. Different tools to control laser parameters are also available.

2.3 [Video display and overlay](#)

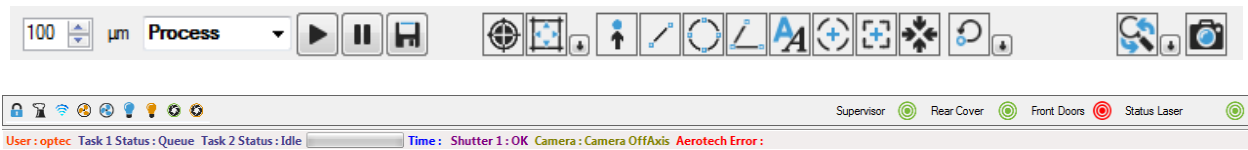


In general systems are delivered with at least one camera. Camera or lighting properties can be modified in the right panel. Right click on display gives access to different options regarding the overlays.

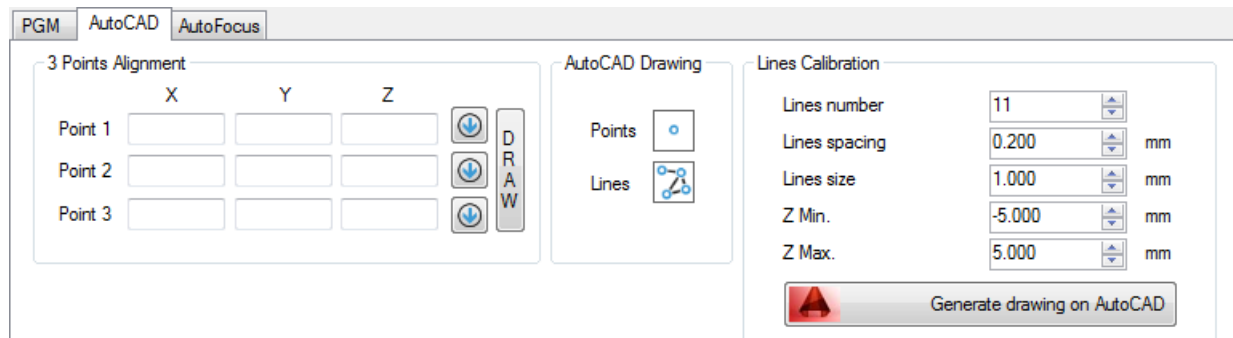
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2.4 Icon bars

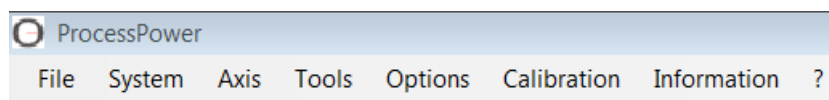


2.5 Tools



Different tools can be found in this section like handling of PGM files, AutoCAD tools or Autofocus based on image processing.

2.6 Application menu



Application menu allows access to main functions of the software. Some of them are described in this manual.

- File : logout and exit function.
- System: Reload configuration and reset system functions.
- Axis: allows activating or deactivating axis.
- Camera: gives access to main function of cameras
- Tools: gives access to main tools of the machine.
 - Controller's information
 - Coordinate file Creation
 - Process list file creation
 - Autofocus via PRS (only if PRS option is activated)
 - Chromatic Probe coding (if probe is available)
 - Keyence (if a Keyence sensor is available)
 - µpsilon (if the line sensor is available)
 - Power meter (if available on the machine)
 - Photo Z

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- Option: allows software configuration, change language, configuration backup and user management tool.
- Calibration: gives access to axis calibration like attenuator, mask settings or variable DMG calibration (option).
- Information: gives information of process done (Previous Processing times and Log file).
- ?: gives information on software.

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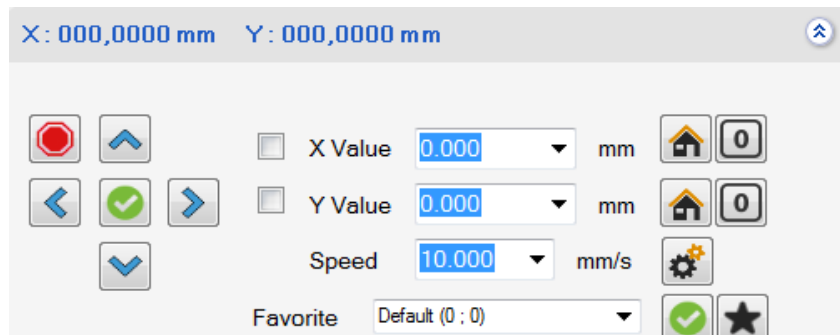
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3 System controls









3.1 Motion control

3.1.1 Overview

X,Y & laser firing are all treated as 'axes' by the A3200 controller, and hence laser firing & stage motion can be both coordinated and synchronized.


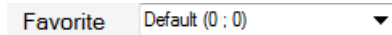



Common buttons

-  Current Position
-  Stop movement
-  Click for move to absolute position on selected axes
-  Click left for an increment, right for a continuous move, click to stop.
-  Start home Procedure
-  Floating Zero
-  Incremental or absolute values
-  Defined speed

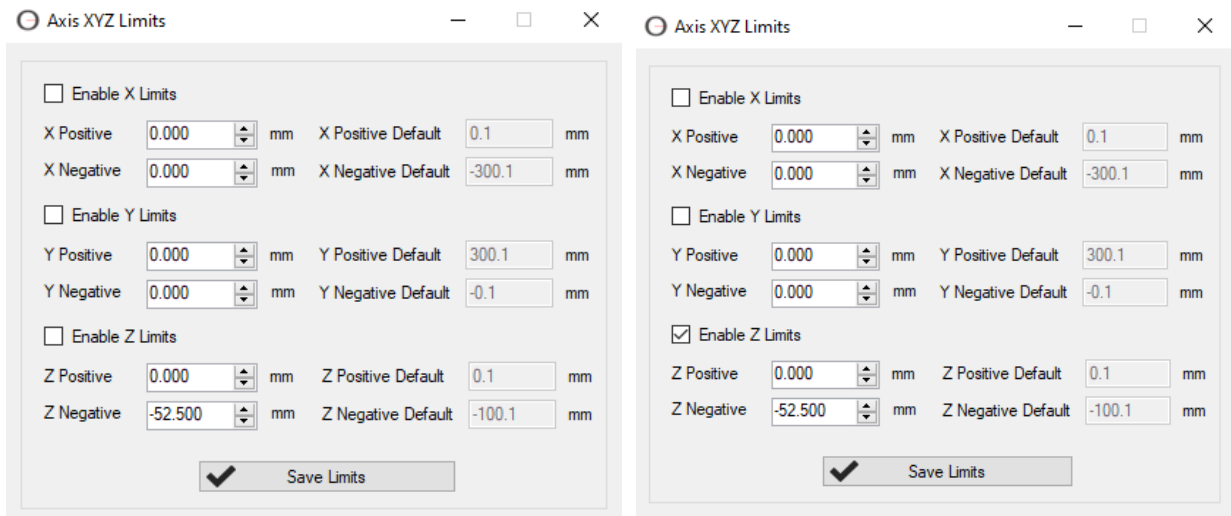
3.1.2 X-Y Axis

Specific Buttons

- X Value Check this box to allow absolute positioning
-  Click to register current position in favorite list
-  Favorite list
-  This button allows to define limits for X, Y and Z axis depending on the current zone. (see following picture)

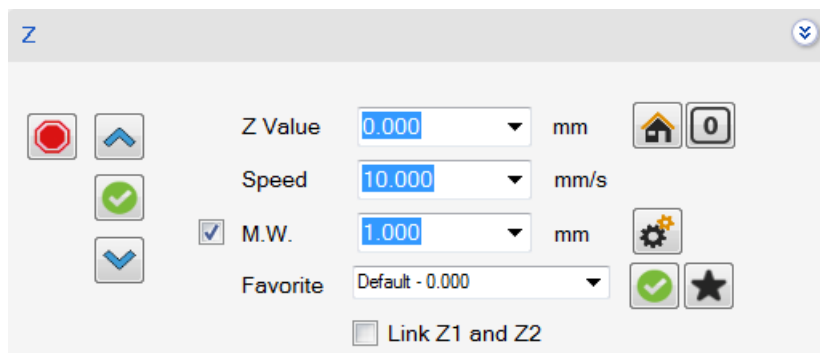
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Axis software limits are fixed inside the aerotech manager. However inside the range accepted by Aerotech manager, the user can be modified limit of 3 mains axis (X, Y and Z). For example when the machine is equipped by a rotary chuck for tube cutting, it can be interesting to limit the Z axis to avoid a crasj between the vision zoon with the chuck.

3.1.3 [Z axis \(focus adjustment\)](#)



Most buttons have been explained in the previous paragraph.

Specific Buttons



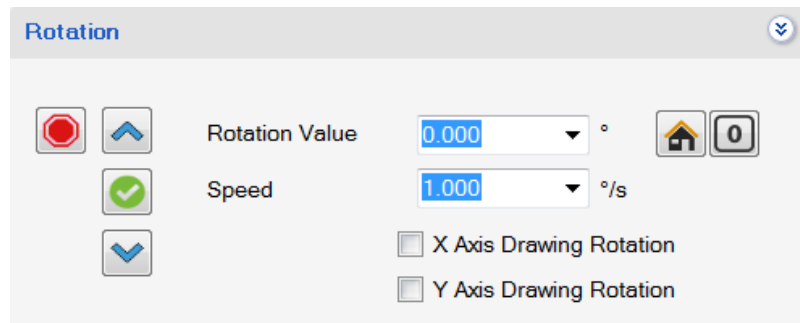
Allow to move the z axis with mouse wheel when the mouse is on the video display window

If two z axis are present on the machine, moving one axis automatically moves the second one

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3.1.4 [Rotation axis](#)



Specific Buttons

X Axis Drawing Rotation

If active, the drawing is rotating around the X axis when the rotating axis is moving.

3.2 [Zoom inspection microscope \(option\)](#)



This tool allows to set magnification at 6 preset levels.

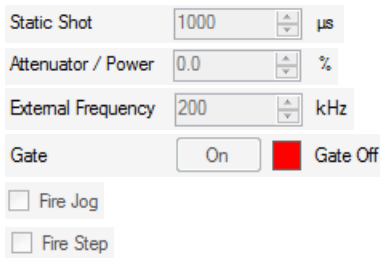
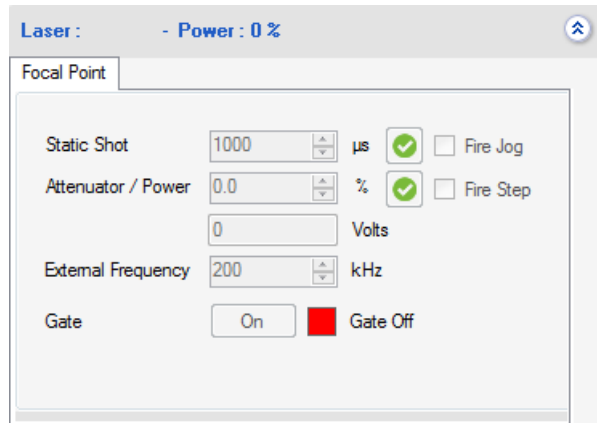
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3.3 Laser Firing control (Typical)

3.3.1 Focal Point Systems

Selected parameters of all lasers can be controlled for convenience directly from ProcessPower rather than having to go through the laser software.



Define the time for static shot

Set the attenuator value.

Define the laser frequency for laser externally triggerable

Open / Close the Laser Gate

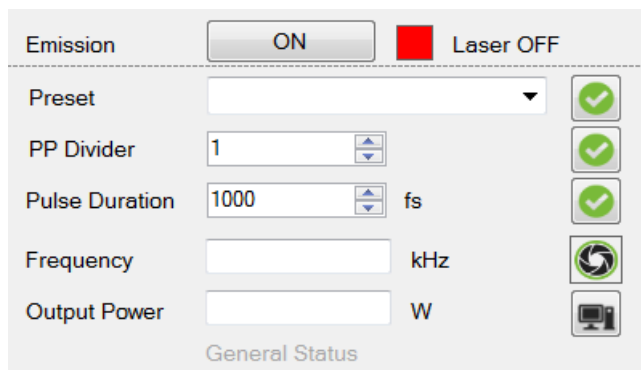
Laser is firing by moving stages with right click

Laser is firing by moving stages with relative movements

When the user activates the Gate of the laser, which means the laser will fire continuously. In supervisor mode, this option can be activated at will. In CLASS I mode, doors must be locked.

3.3.2 Specific lasers

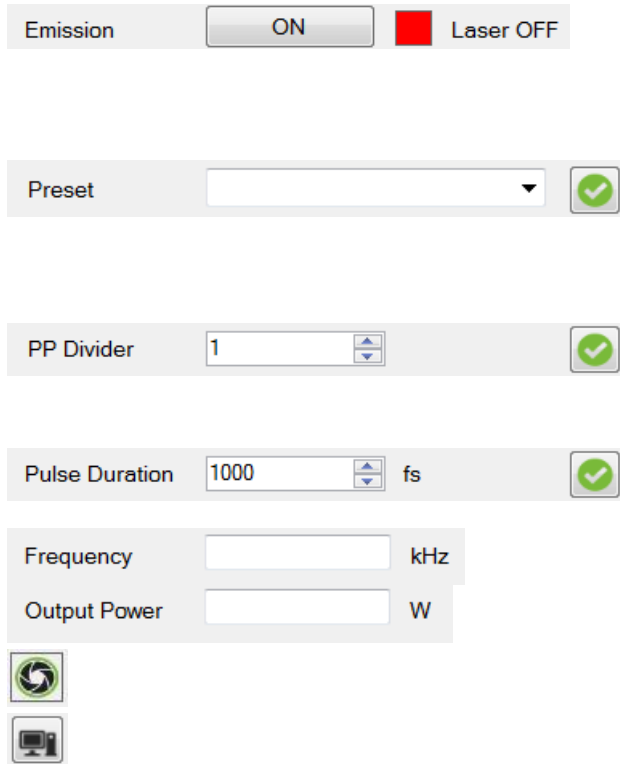
3.3.2.1 Carbide Laser



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Buttons explanation



Click on this button to turn-on or turn-off the laser. When turn-on the laser one may have to wait several minutes before laser is completely started. In that case, red square becomes green. This functionality allows to choose a couple the max rep. rate for a given energy. As maximum output power is constant to 4W, the energy can be easily computed by dividing this value by the repetition rate.

The PP divider is an integer number used to choose the working repetition rate of the laser. Divide the rep. rate chosen in the presets by this number to have the working rep. rate.

Pulse duration can be modified from femtosecond to picosecond range. Please refer to laser manual to know the exact range.

Working frequency

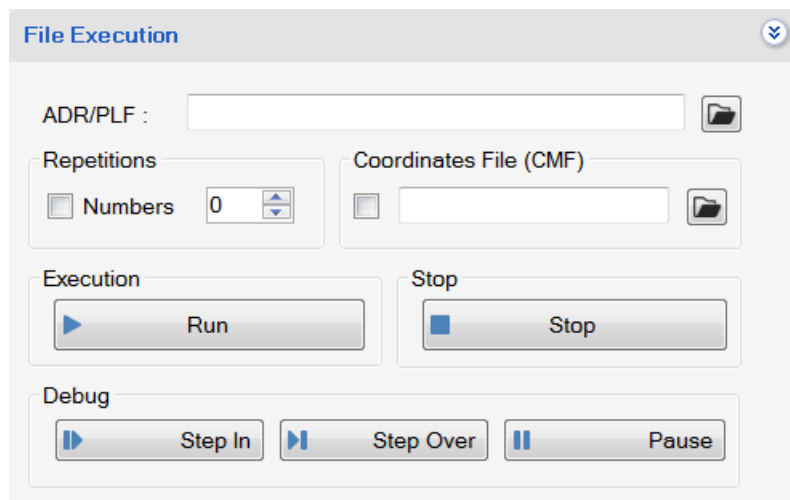
Working laser output power.

Laser shutter. Do not forget to open before running a process.

Software laser shortcut.

The laser automatically shuts down when close ProcessPower software.

3.4 [File execution](#)



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The screenshot shows a control panel with several sections:

- ADR/PLF :** A text input field with a folder icon to its right.
- Repetitions:** A section containing a checkbox labeled "Numbers" and a numeric spinner set to "0".
- Coordinates File (CMF):** A section containing a checkbox and an empty text input field with a folder icon to its right.
- Execution:** A section containing a button with a play icon and the text "Run".
- Stop:** A section containing a button with a square icon and the text "Stop".
- Debug:** A section containing three buttons: "Step In" (with a right-pointing arrow), "Step Over" (with a right-pointing arrow and a vertical bar), and "Pause" (with a vertical bar and a right-pointing arrow).

Load the PGM / ADR / PLF / JOB file

PGM / ADR / PLF file will be repeat the number of time define by the user.

Associate the PGM file to a coordinate file: Allows repeat the PGM file on all defined points

Run the Process

Stop the Process

3.5 [Send command](#)

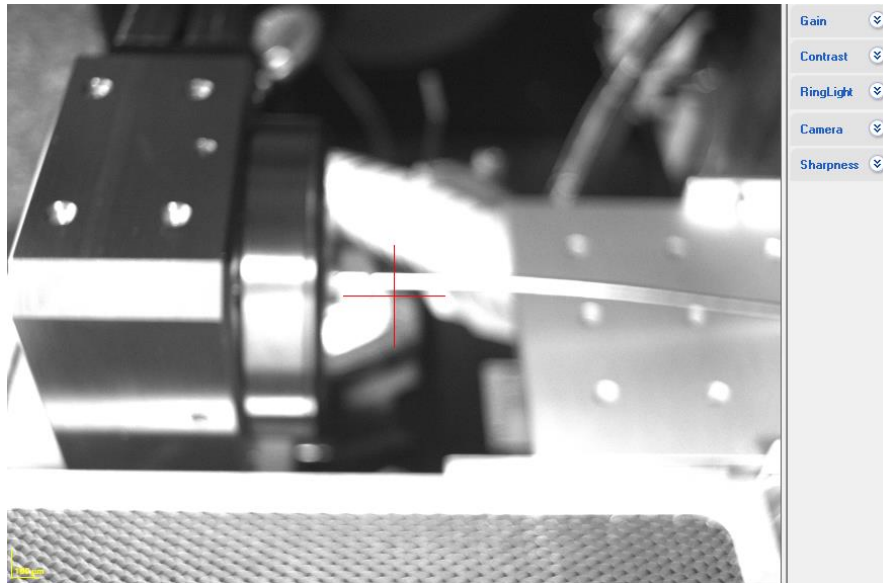
This allows sending a command to the Aerotech without starting the motion composer.

The screenshot shows a dialog box titled "Send Command" with a close button in the top right corner. It contains a label "Command :" followed by a text input field with a dropdown arrow. At the bottom right, there is a red "X" button and a "Send" button.

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4 Video and Overlay



The video overlay is composed of 2 different areas. The first one is the video itself which display the selected camera vision. The 2nd one is the adjustment parameter like gain, contrast of lighting power.
















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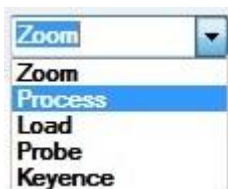
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5 The Icons Bars

5.1 Icons bar 1



-  Play the active camera
-  Stop the active camera
-  Save the vision picture
-  Red cross position
-  Pixel vs μm vision calibration
-  Move to: Go to the clicked position
-  Line measurement
-  Circle measurement
-  Angle measurement
-  Circle position crosshair
-  Rectangle position cross air
-  Rotation alignment (with theta stage): align a part in rotation.
-  False color beam analysis
-  Find fiducial with a PRS image: allow testing a PRS recognition
-  Grab PRS image: allow saving reference image for PRS.



In a complex system (see WS300 or MAS400), which might have different tools, different area (= positions of X,Y stages) are predefined, the default area on start-up is generally that of the zoom inspection microscope if a zoom is included. Some systems have only one area.

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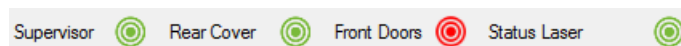
5.2 [Icons bar 2](#)

5.2.1 [Icons](#)



- Lock the door of the machine
- Open / close door
- Start fume extractor
- Start suction
- Start the stages flush
- Helium valve
- N2 valve
- Chuck Grip
- Grip Rotation
- Front fan
- Rear fan
- Lighting of back area
- Lighting for Process camera

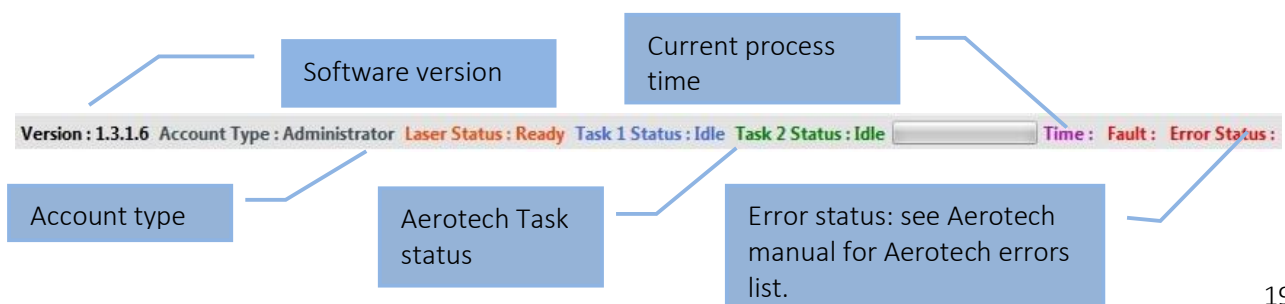
5.2.2 [Status bar](#)



Status bar give information concerning door of the machine or laser status. In this example, we are in supervisor mode, back doors are closed and front door are opened.

5.2.3 [Information bar](#)

The information bar gives information about the machine or the current process.



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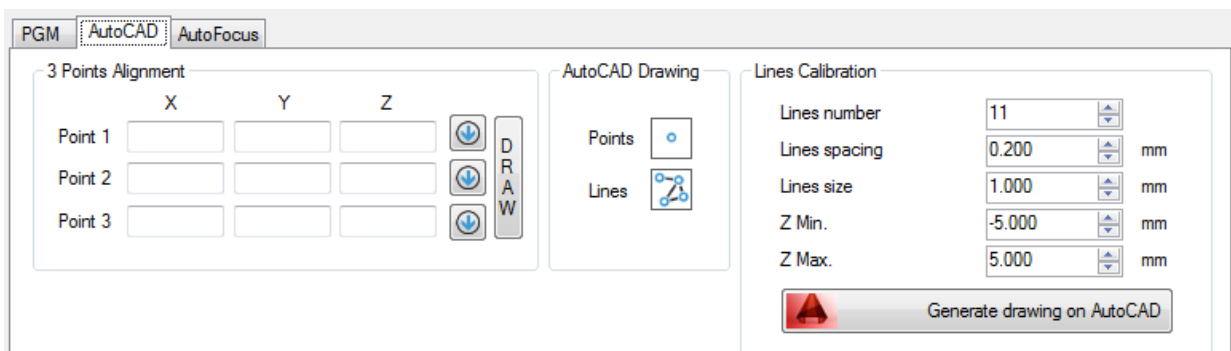
6 Tools

6.1 PGM Window

When a process is launched with OptecCAD or loaded in the execution panel, the Gcode is loaded in the PGM window. Here the user can read the G-code and modify it if needed.



6.2 Autocad window



- 3 points alignment

This tool allows align a 3D drawing to a geometrical plan measure with the machine. For example, if the part surface is not parallel to XY stages plane, the user can select 3 points on the part surface and draw the obtained plane on autocad. Then with autocad, the user can align the ablation drawing with the part surface.

- Autocad drawing

This tool allows drawing directly on the video screen dots or line and reproduces this drawing automatically in autoCAD.

- Lines calibration

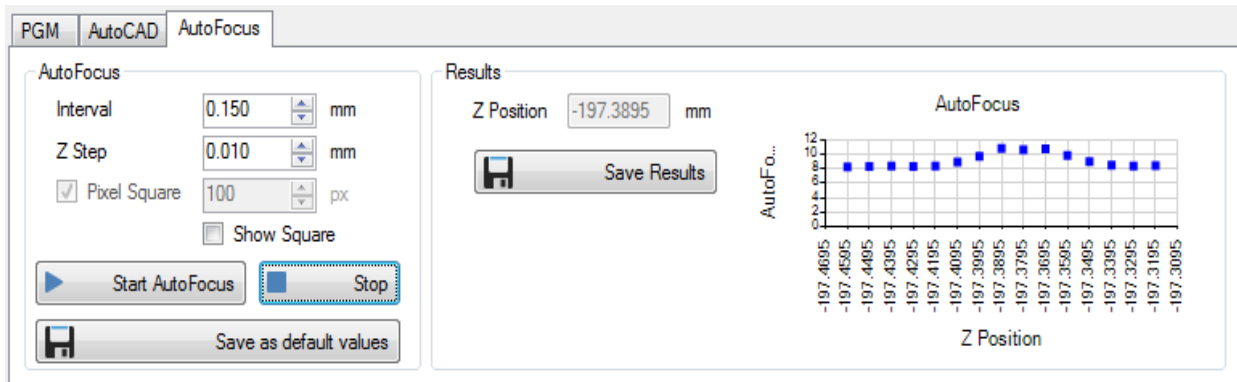
This tool is usually used for line drawing at different Z position for Z offset calibration between the zoom and the process lens.

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6.3 Autofocus window

The autofocus window gives access to an autofocus based on the video image analysis. The machine comes automatically in the focus position. The user has to enter the range of autofocus measurement and the Z step between each measure. Then the algorithm calculates the better focus point and move to its position.

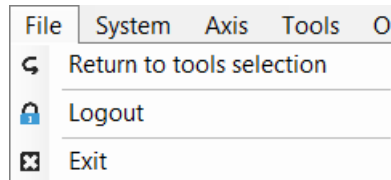





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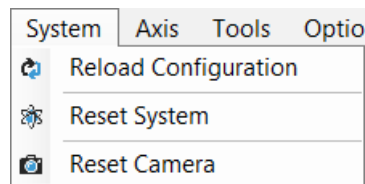
7 Application Menu




7.1 File



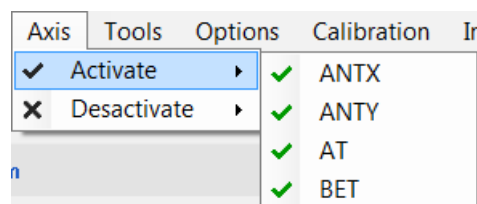
-  Return to tools selection Come back to Initialization window
-  Logout Allow to change of user profile
-  Exit Quit the software



7.2 System



-  Reload Configuration Reload the configuration if some parameters in the Regedit file have been modified
-  Reset System Restart the ProcessPower
-  Reset Camera Initialize the camera in case of troubles

7.3 Axis



-  Activate Allow to enable some axis
-  Desactivate Allow to disable some axis

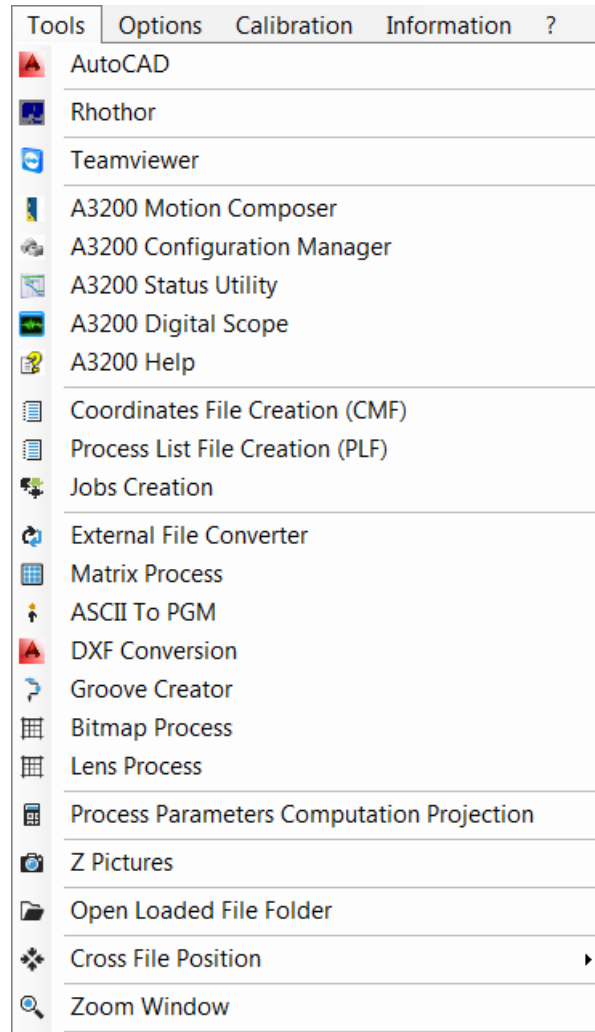
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7.4 Tools

7.4.1 Overview

Many tools are available in option.



Tools: gives access to main tools of the machine.

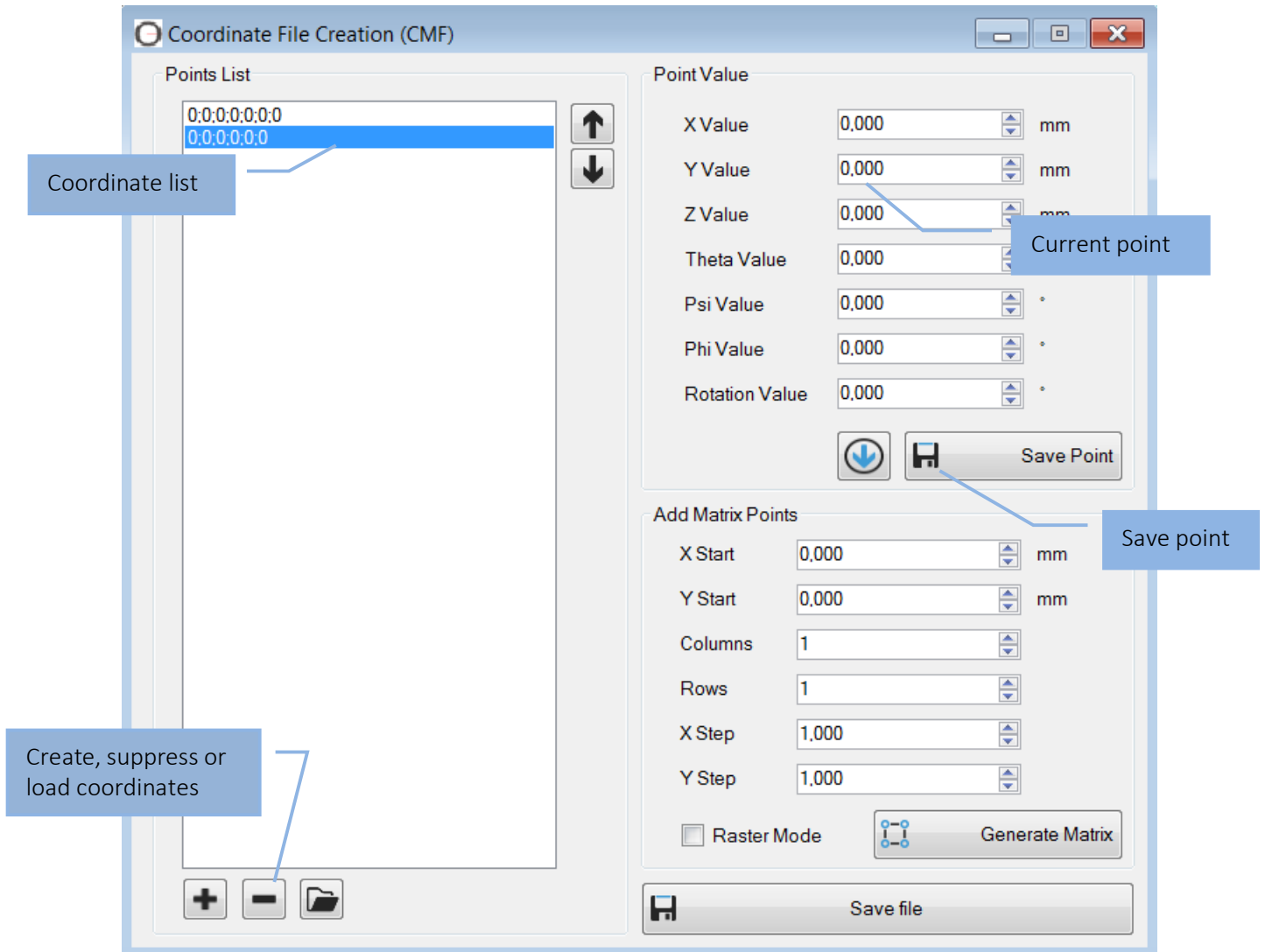
- OptecCAD launch (see OptecCad manual)
- Rhothor (if newson scanner available)
- Aerotech softwares
- Coordinate file Creation
- Process list file Creation
- Matrix Process
- ASCII to PGM
- DXF Conversion
- Keyence (if a Keyence sensor is available)
- μ psilon (if the line sensor is available)
- Process Parameters computation

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7.4.2 [Coordinate File Creation](#)

This tool allows creating coordinate files (CMF file). When the CMF file is loaded on [the file execution window](#) (see [chap3.4](#)) the loaded ADR file will be executed at all coordinates saved in the CMF file. The ADR file is a process file created by OPTECAD. (see OptecCAD manual)

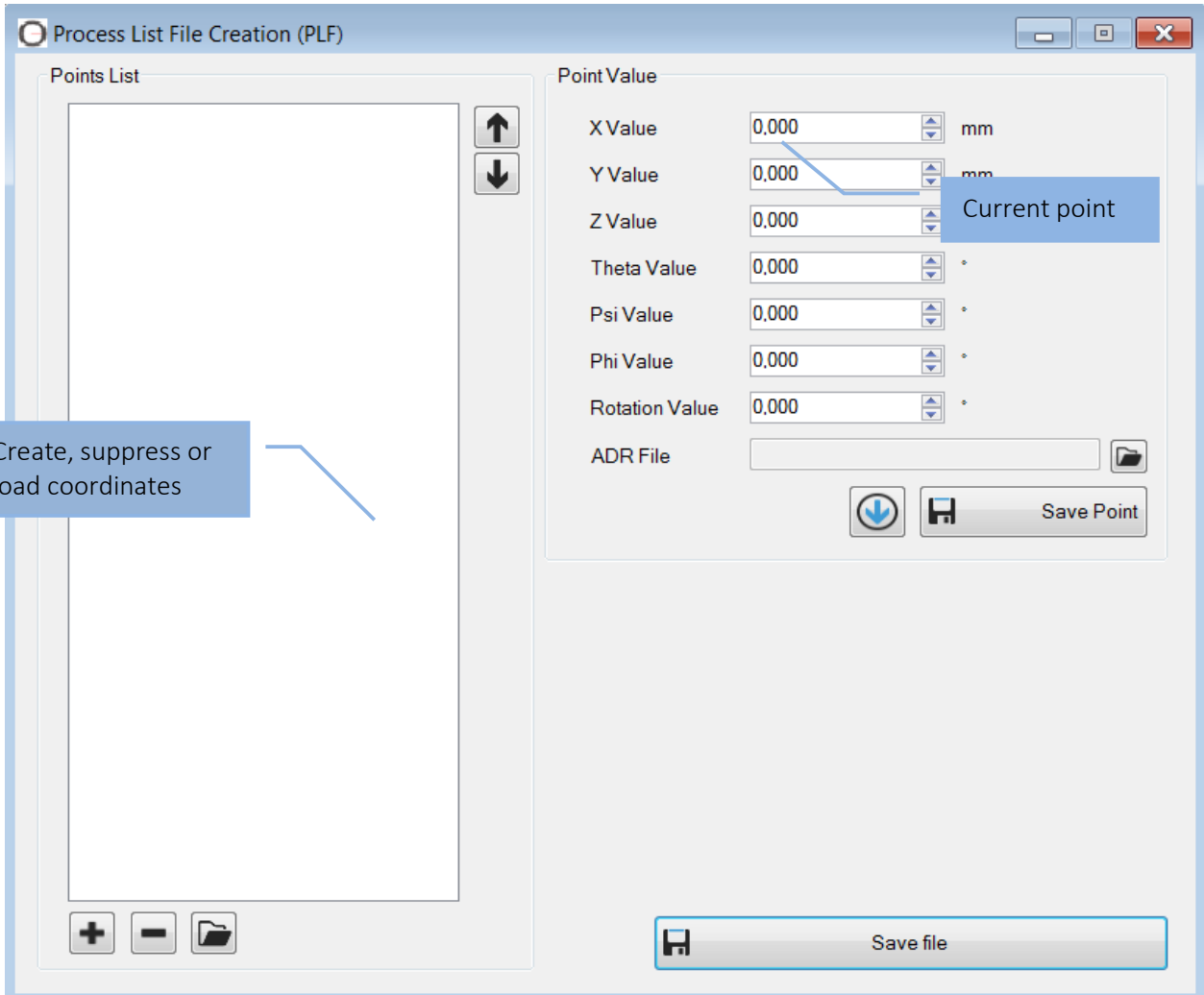


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7.4.3 [Process list creation](#)

This tool allows creating a 3D coordinate file where a define process (ADR file) will be executed.



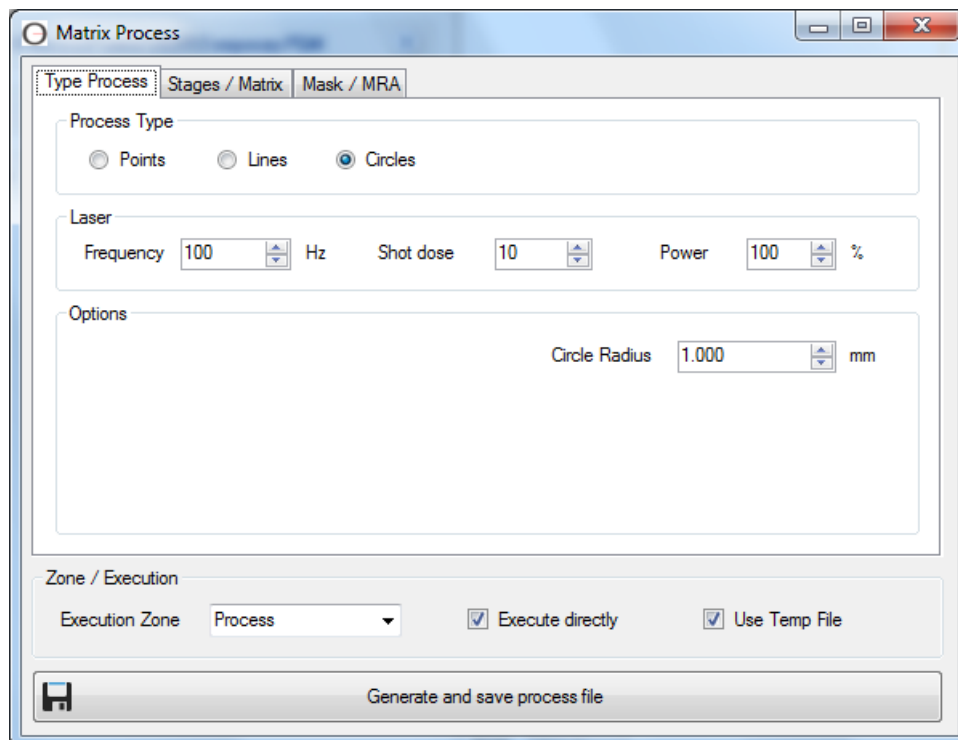
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7.4.4 Matrix Creation

The matrix tool is a pre-defined tool which allows to create matrix with different mode.

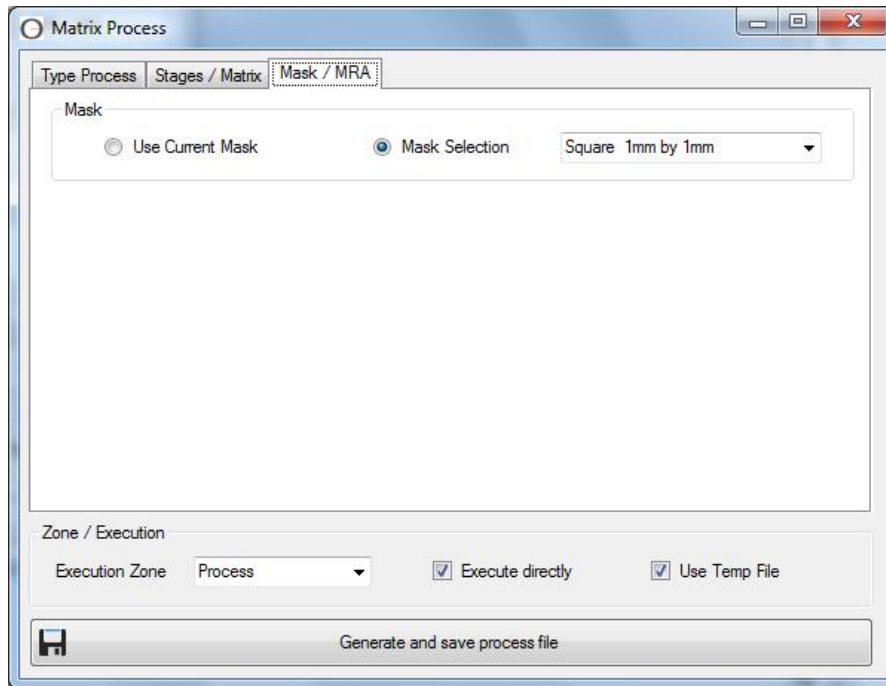
- Process type:
 - o define type of ablation on each matrix point.
 - o When PSO is selected, the laser will fire one shot for each location spaced by 0.1mm
- Laser: define laser parameters for ablation. Shot dose is disabled when PSO is enabled
- Option: Define parameters in function of previous parameters selected.
- Zone/execution: Give option for execution: Execute the process directly, save the G-Code file without execution or both in the same time.



Mask and MRA tab give information of the selected mask for the ablation.

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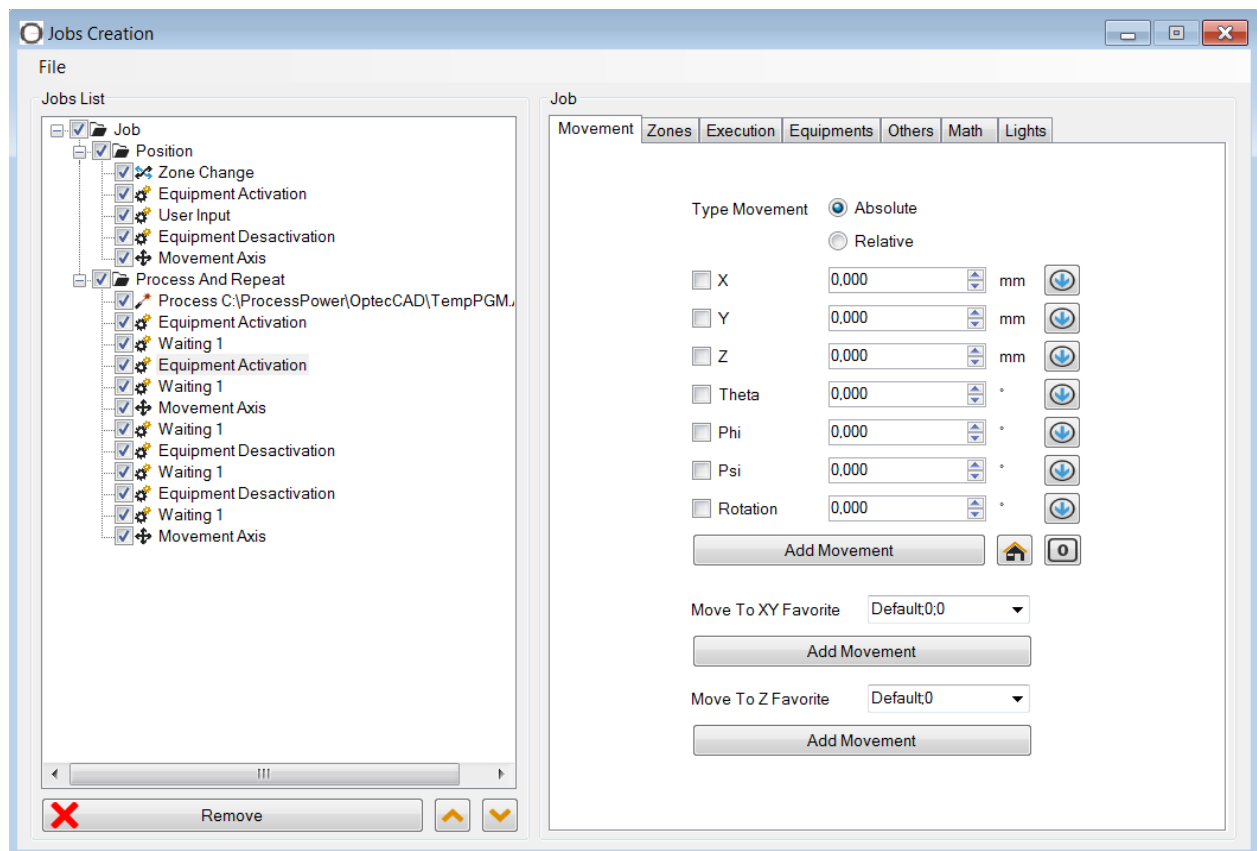
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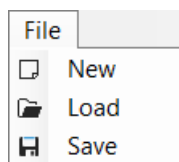
7.4.5 Job Creation



Job Creation tool allows to create some list of tasks which will be realized one after the other in ProcessPower. The objective is to create automatized sequences of a process to create pre-series processes. The user has to create each task one by one and the machine will execute them automatically.

According to the type of machine, present axis / equipment or options, some tools will be activated or deactivated.

Jobs can be load and save from File menu.



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Available tasks:

Movement:

First and main action are axis movement. All movement can be done in relative or absolute coordinates. Each axis can move independently or in coordinate motion if several axis are selected.

- Move of X/Y/Z/THETA/PSI/PHI/ROTATION axis in Absolute or Relative.
- Floating 0 on those axis
- Move to favorite position on X/Y or Z axis.

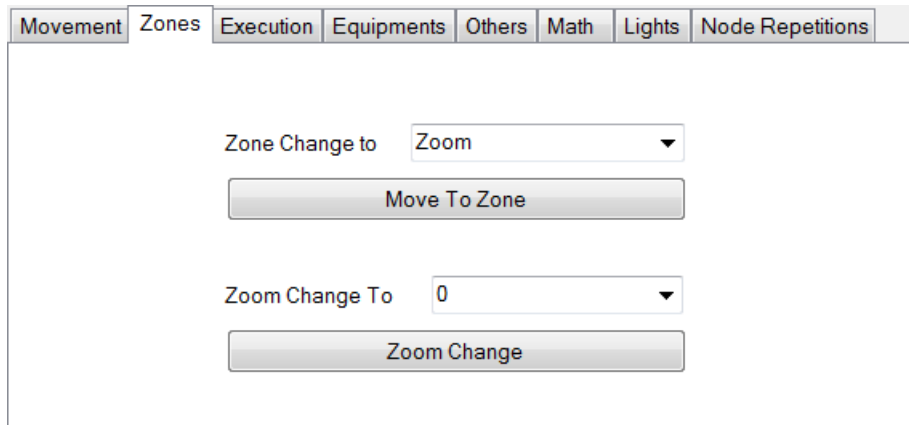
The screenshot shows the 'Movement' tab of the software interface. It features a tabbed menu at the top with 'Movement' selected. Below the menu, there are radio buttons for 'Type Movement' set to 'Absolute'. A list of axes (X, Y, Z, Theta, Phi, Psi, Rotation) is shown, each with a checkbox, a numerical input field (all set to 0.000), a unit indicator (mm for X, Y, Z; degrees for Theta, Phi, Psi, Rotation), and a blue arrow button. Below this list is an 'Add Movement' button, a home icon, and a '0' button. Further down, there are two sections for 'Move To XY Favorite' and 'Move To Z Favorite', each with a dropdown menu (set to 'Default;0;0' and 'Default;0' respectively) and an 'Add Movement' button.

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Zones:

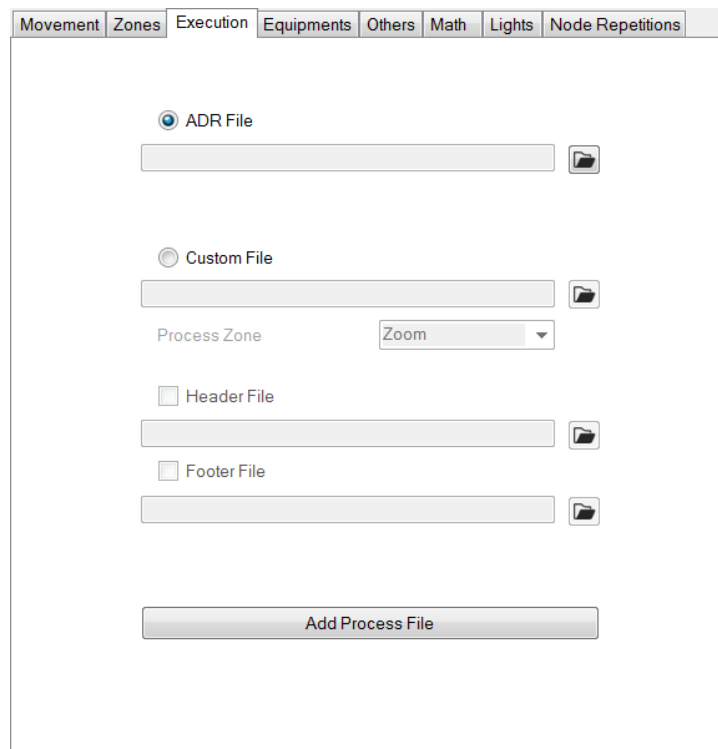
Zone movement can also be done automatically by selection of the zone change. Take care to always go back to zoom zone before moving to a new process or probe zone.



File Execution:

Process can also be executed. On standard example is to move stages in the reference position. Then change zone from the zoom vision to process. Then execute a file. The following window is use to integrate a process file execution inside the list of task. Different file can be loaded. ADR file is loaded (associated to a PGM file) to move automatically in the process zone. (no need to move in the zone first). PGM file alone can also be loaded. In this case a zone movement is required first.

ADR and PGM files are created by OptecCAD. The user can also create his own PGM file. PGM files are Gcode files.

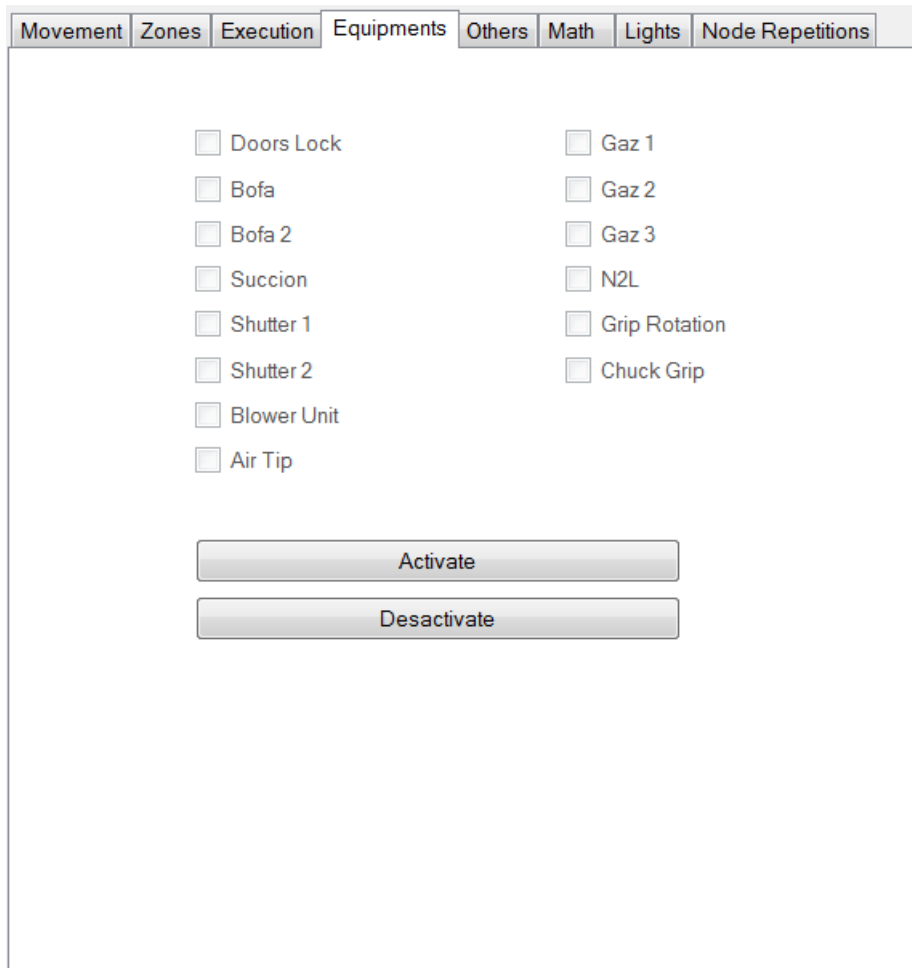


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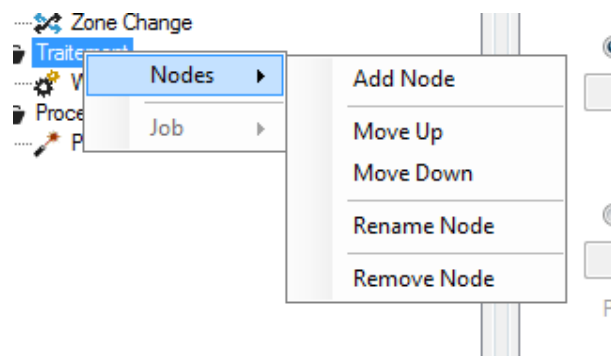
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Equipments:

Many different devices can be activated or deactivated with this tool like Bofa, gripper, Blower Unit, Gaz, etc...



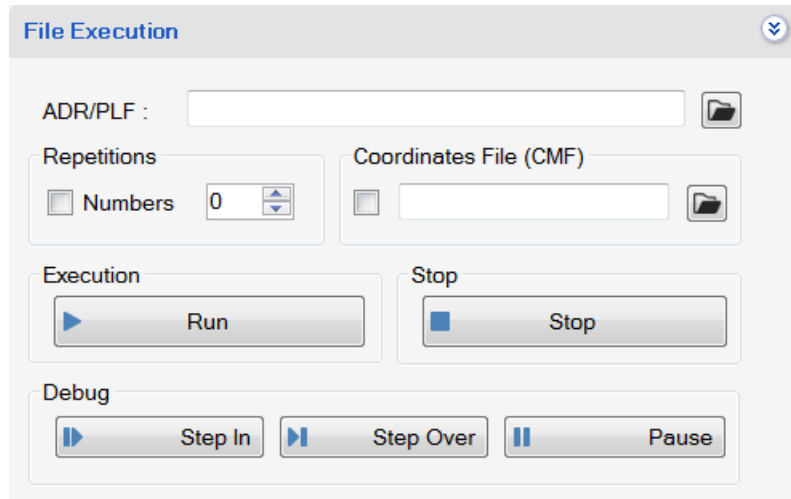
The creation of subfolders can also be done with this tool as to exchange the order or realization of some tasks. Each nodes can be repeated.



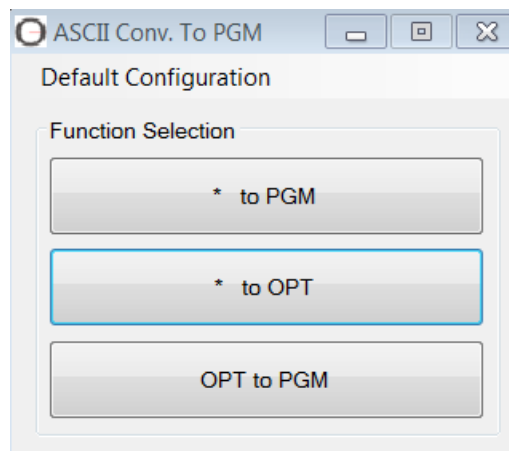
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Once tasks have been defined, file can be saved in *.JOB format.
It can be then executed in the tab File Execution.



7.4.6 [ASCII converter](#)



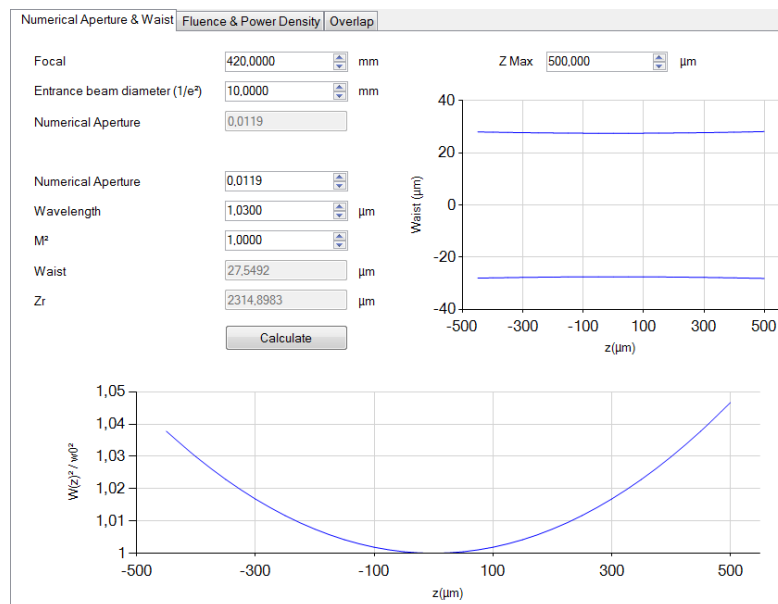
The ascii converter allows converting an ascii file including coordinate points to a PGM file. 3 options are available:

- TO PGM: Direct PGM conversion of the ascii coordinate file.
- To OPT: This tool allows optimising the process time of an ascii file including coordinates. The objective is to reduce movement between 2 ablations. We can call this tool Travel optimizer.
- OPT to PGM allows to convert the optimized file in GCODE.

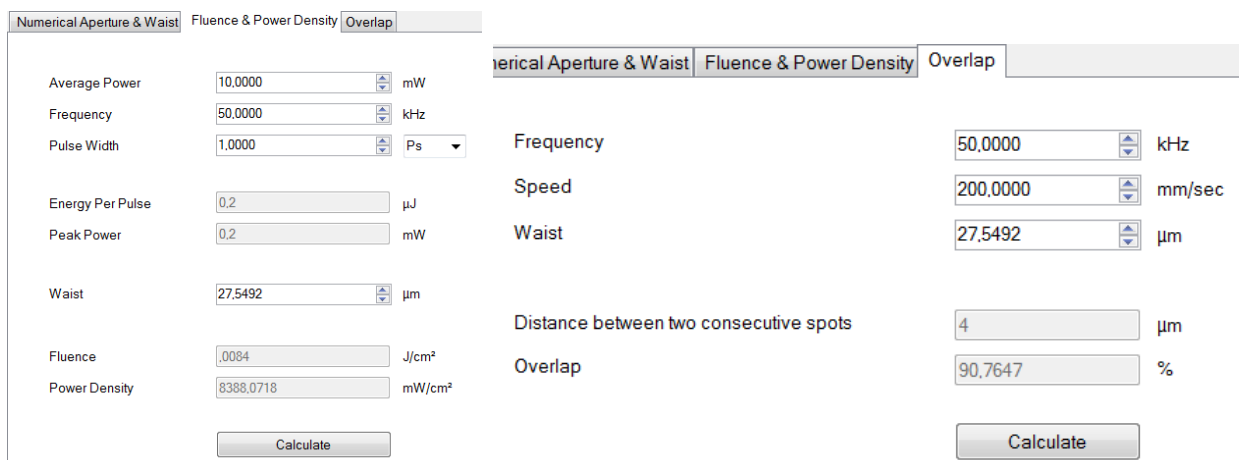
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7.4.7 Process Parameters computation for focal point machine



The objective of this tool is to help the user to define ablation parameters. This tool will calculate spot diameter in function of the used lens, overlap, energy density and a lot of more parameters.



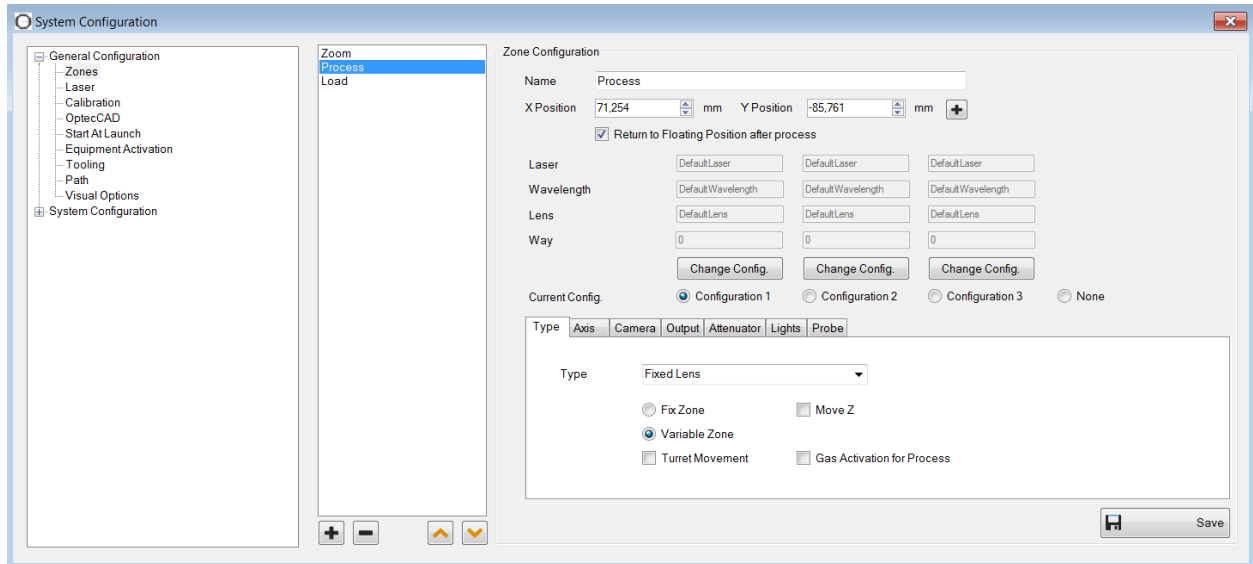
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7.5 Options

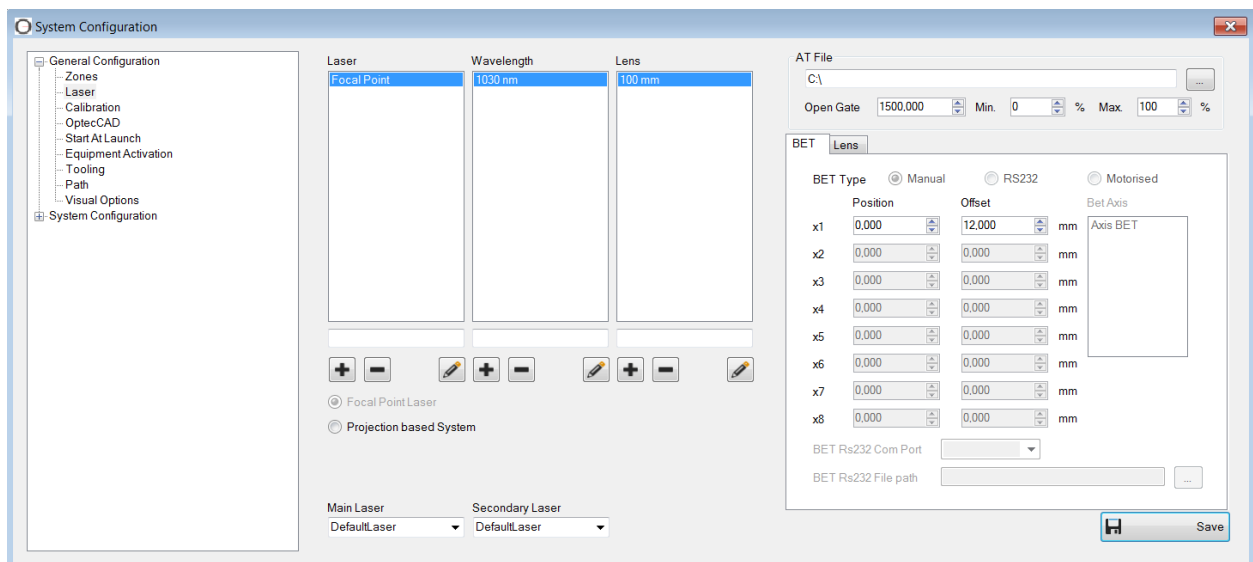
7.5.1 System Configuration

7.5.1.1 Zones



In function of the machine, different working zones can be configurated. For example zone called zoom or process or galvo. Those zones need to be configurated for giving instructions for correct software operation.

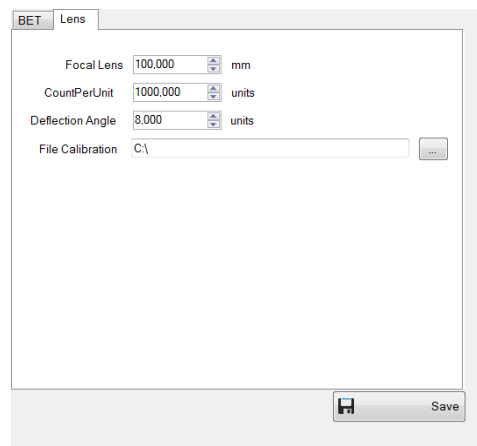
7.5.1.2 Lasers



Laser window is use to set the optical configuration in case of some optics can be changed.

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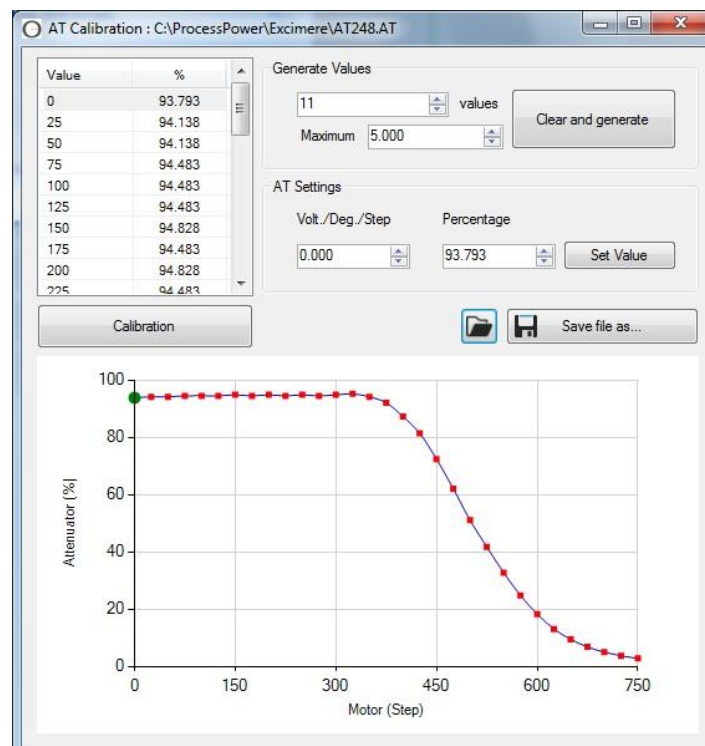
7.6 Calibration for focal point systems

The machine is factory calibrated. All calibrations are updated during installation. However, in function of the environment around the machine (clean room or not, temperature stabilization ...) or if optics are changed, some calibrations need sometimes to be checked and optimized.

7.6.1 Video (pixels/ μ m) Calibration:

The objective of this tool is to calibrate the camera to determine the calibration Pixels vs μ m measure on the screen. This calibration is very important to use correctly others tools (measurement tools, move to tools ...). This calibration must be done for all zoom positions.

7.6.2 AT calibration



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The attenuator needs to be calibrated. In case of optics replacement, a new calibration must be done. The procedure is semi-automatic. The curve gives you an indication of the success of measures.

7.6.3 Process Zone calibration: Centration of the ablation

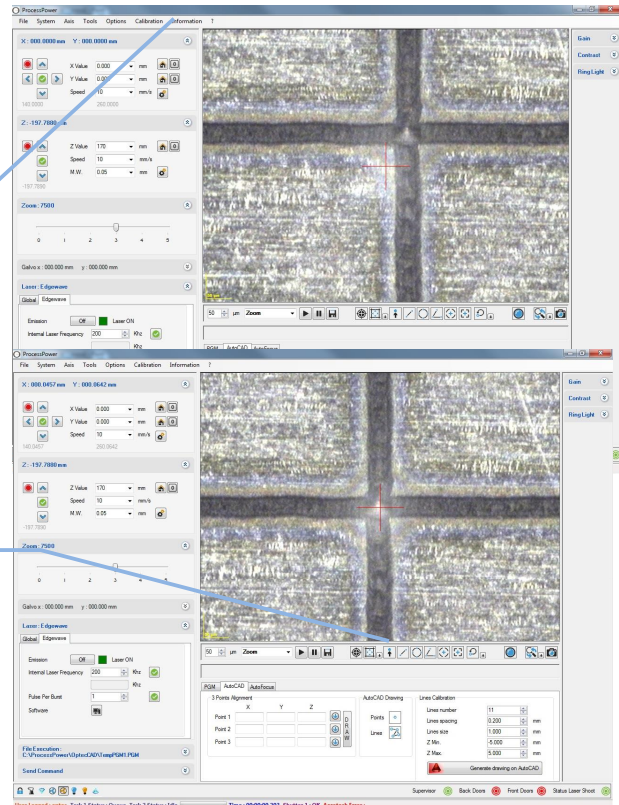
To center the ablation, the user has to draw on OptecCAD a cross centered on 0 and mark it on a metallic sample for example. Then:

- Set the floating position of the stages to 0.

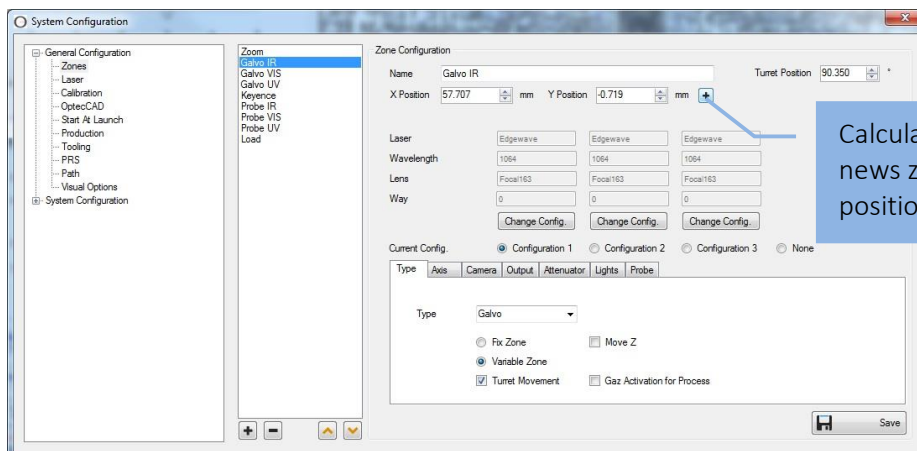
Set floating 0

- Use the icon "Move to" to center the ablated cross on the red cross of the screen

"Move to" icon



- Start the system configuration window and calculate the new zone position. Here, we mark the cross with the IR galvo scanner.



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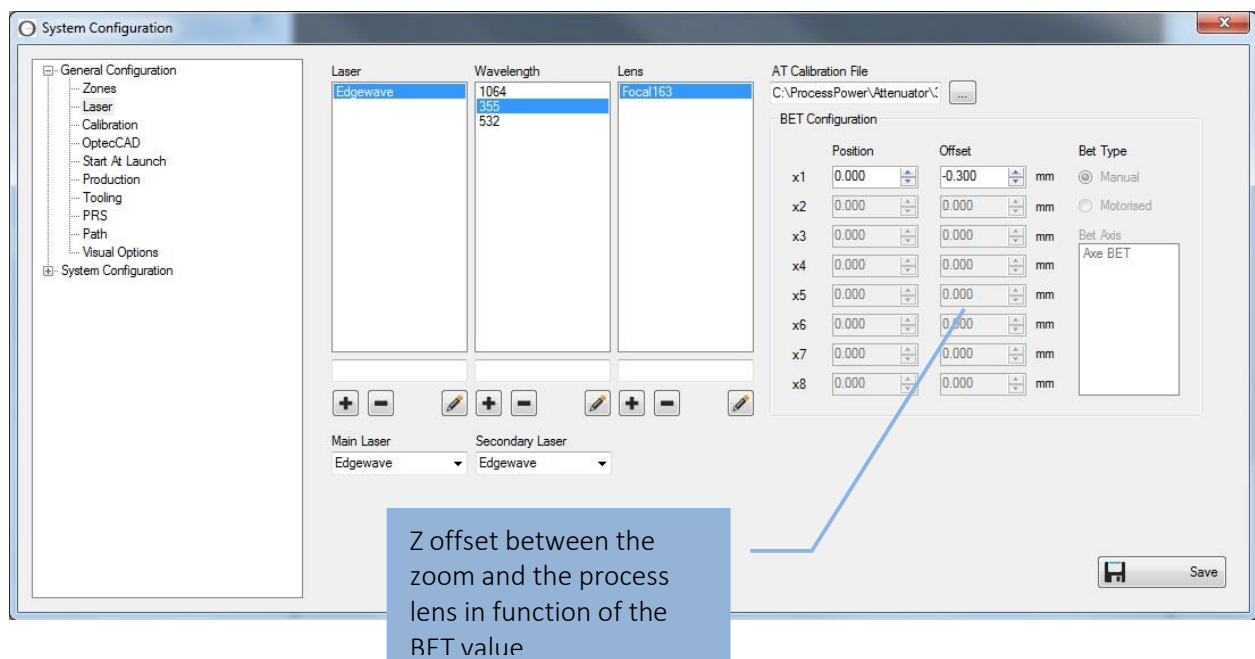
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7.6.4 Z-calibration

In case of process lens change, it is necessary to recalibrate the BET Z position. The objective of this calibration is to have a “confocality” between the zoom vision and the focus point of the process lens. Firstly, to define the well Z position, mark a material with lines at different Z position. The finest line will correspond to the good position. To generate automatically the good drawing on autocad, the user can use the tool describe in the chapter 4.11, line calibration.

NB: Ablation parameters are important for the precision of the calibration. Try to use a power not too high to avoid an enlargement generate by thermal effect of too high power. A trick is to have an optical power which marks on the focus point but not line on edge.

Then modify the Z value on the following window. In case of fixed or manual BET, only the first case is available.



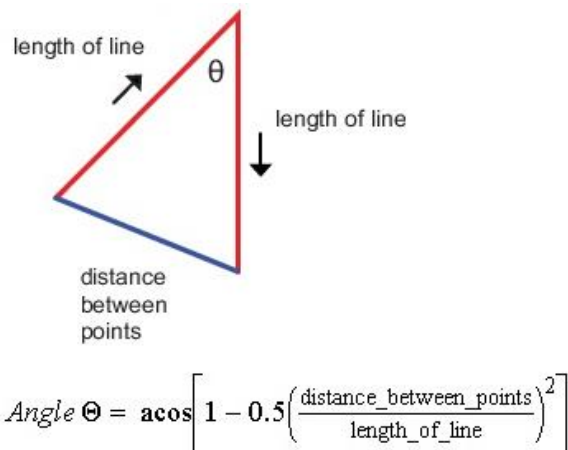
7.6.5 Angle calibration

For Infinite field of view and segmentation, to work correctly, the X/Y coordinate system of the galvo axes must be accurately aligner with the X/Y coordinate system of the servo stages. That is motion in the X direction of the galvo coordinate system must be collinear with motion in the X direction of the servo coordinate system and must not result in motion in the Y direction of the servo coordinate system. Perfect mechanical alignment of the galvo to the servo Laser coordinate can be difficult. It's possible to compensate with a software calibration.

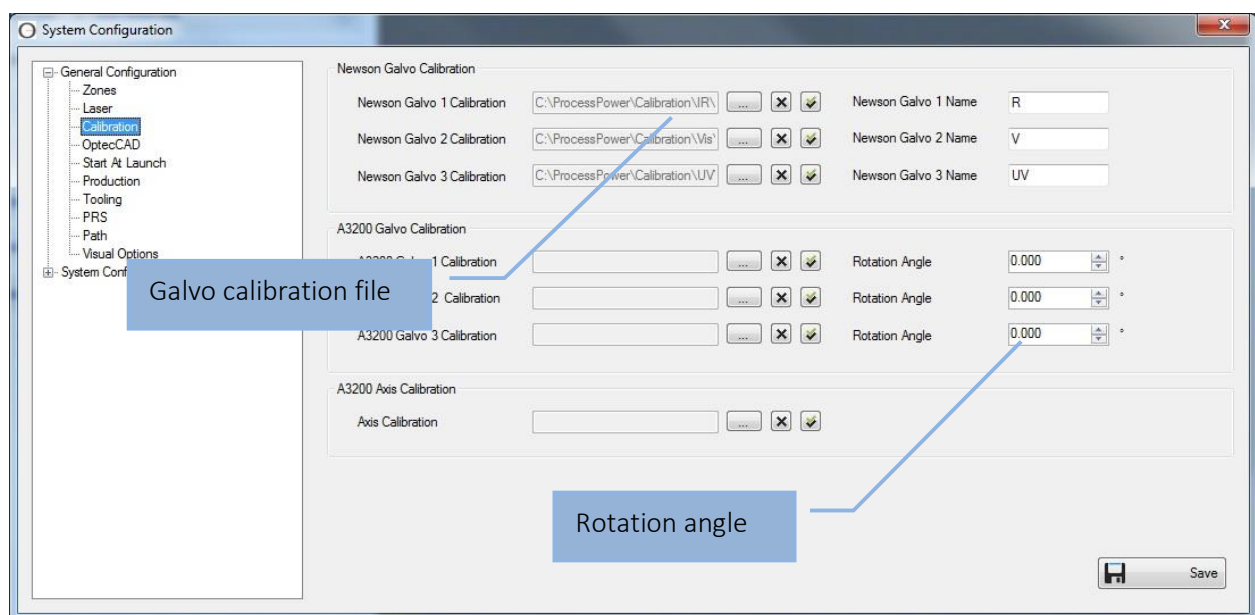
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One procedure of measuring the alignment error is to mark one line with only galvo axes and then mark an identical line in the with only the stages axes. Measure the distance between the two end points of the 2 lines and use the distance to calculate the rotation angle.



Then, the obtained value is put on the following window.



7.6.6 Scanner calibration

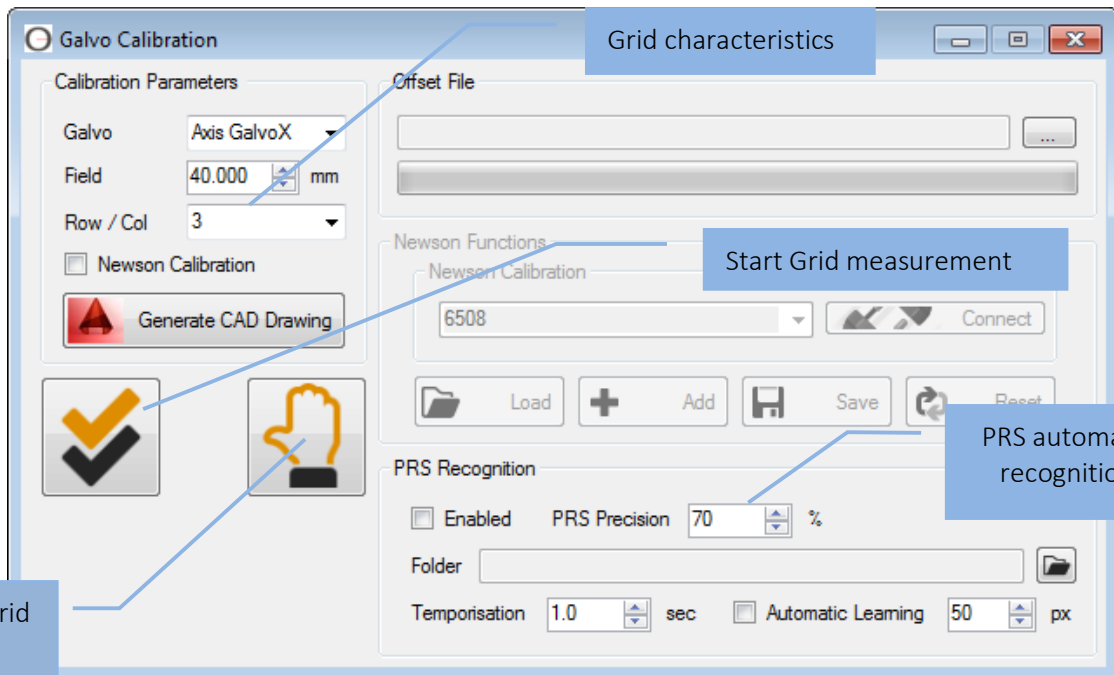
NB : Before starting the scanner calibration, it's necessary to center the ablation on the video screen and put the red-cross on the ablation center. (0,0 position) (see Process zone calibration)

Calibration is an iterative process necessary to compensate distortion of the F-theta lens. Multiple calibrations with a progressively finer grid have to be performed.

The calibration files are automatically called by OPTCCAD and OPTEC's software depending of the machine configuration described in the REGEDIT file data.

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Step 1.

Choose Newson Calibration if this kind of galvo is present in the machine.

Generate a DXF file on OptecCAD with a grid covering the entire field of the lens. With proper measurements, one can reach low residual errors after 3 iterations

Mark the grid on a flat piece of aluminum or stainless steel covered with black ink from a marker (Artline 100N) or on thermal paper.

Define a new Offset File (offset_1.txt for instance) and click on Start Grid Measurement

NB: Use a moderate energy to minimize the thickness of the marked line.

Step 2.

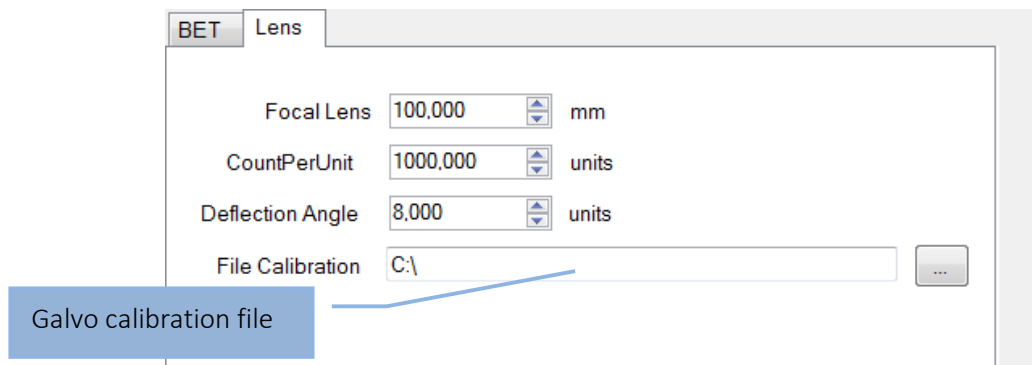
Once it's finished, click on Add and choose the offset file.

Save the new calibration file (Calib_0.txt for instance).

And start again by marking a new grid, define a new offset file, etc...

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Step 3.

Repeat the sequence with more accurate grid or finish the calibration if considered good enough for purpose.

NB: If the calibration step is the first step of the lens calibration, the user has to reset the calibration, save it in a defined file name and load it. Then the user can add the first calibration file, save it and load it.

The user has to repeat this procedure several times (see each matrix described previously in function of the lens field).

Finally, load the last calibration file in Option / Software Configuration / Laser
Choose the appropriate Laser, Wavelength and Lens and go into Lens Management tab.