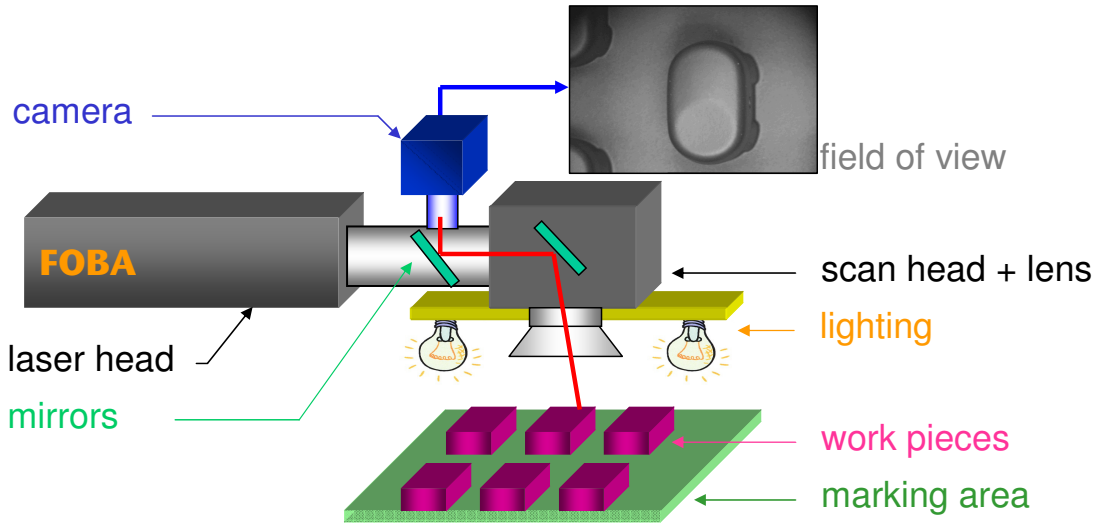
IMP – Intelligent Mark Positioning

1	**Principle**	How does IMP work?
2	**Operating**	How can I run existing jobs?
3	**Preparation**	What do I have to prepare for a new job?
4	**Basic functions**	What opportunities has the IMP software?
5	**Optimising**	How can I optimise the camera functions?
6	**Maintenance**	What maintenance work I have to do?

IMP Version: 2.2.21
Fobagraf: 4.38 SR02

Components



The camera detects via scan head mirrors a part of the marking area

camera The camera detects via a partially transmitting mirror and the scan head a sub area of the marking area. The IMP software searches for predefined contours and can detect the actual position and rotation of the work pieces. The software sends the information to the marking software to start the marking process.

mirrors A partially transmitting mirror is used. It reflects the wavelength which is useful for the camera but transmits the laser wavelength without big losses (approx 2-5%).

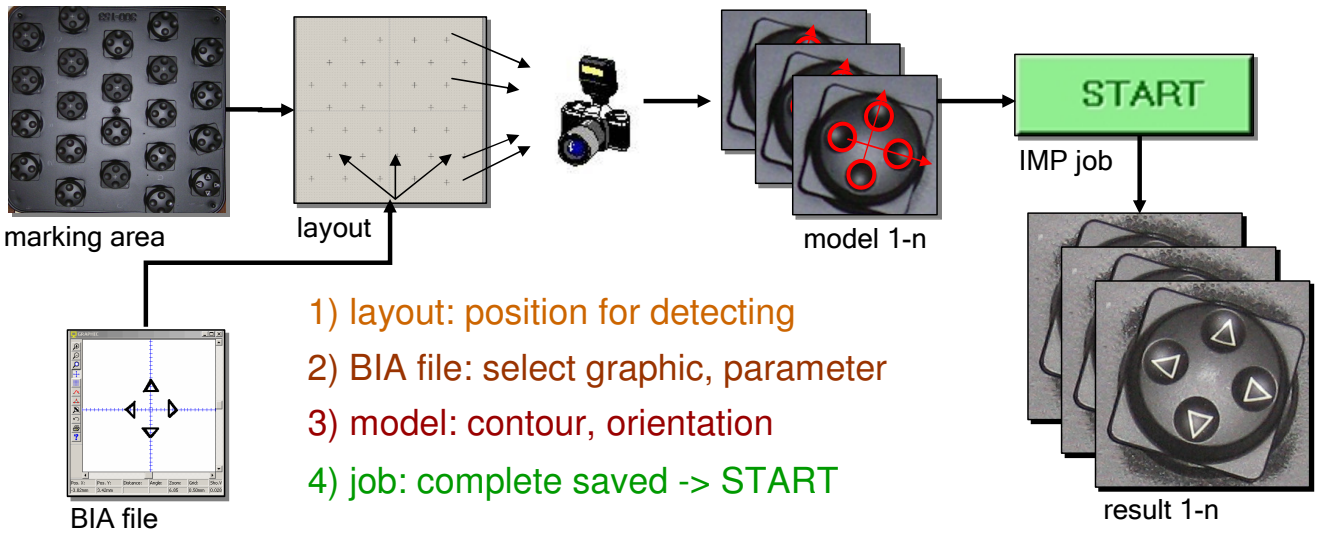
lighting It is important to illuminate the work pieces correctly. Usually the standard lighting which is mounted underneath the scan head is sufficient. For special work piece depending on itsgeometry or colour specific optimised lighting modules may be used.

field of view The camera identifies the working pieces via the mirrors of the scan head. But the field of view is limited; the camera detects just a sub area of the complete marking area. The size of the field of view depends on the focal length of the mounted lens:

focal length [mm]	field of view [mm x mm]
100	11 x 7
160/163	19 x15
254	28 x 20
420	49 x 35

Work flow

Following set up is necessary to run a complete job:



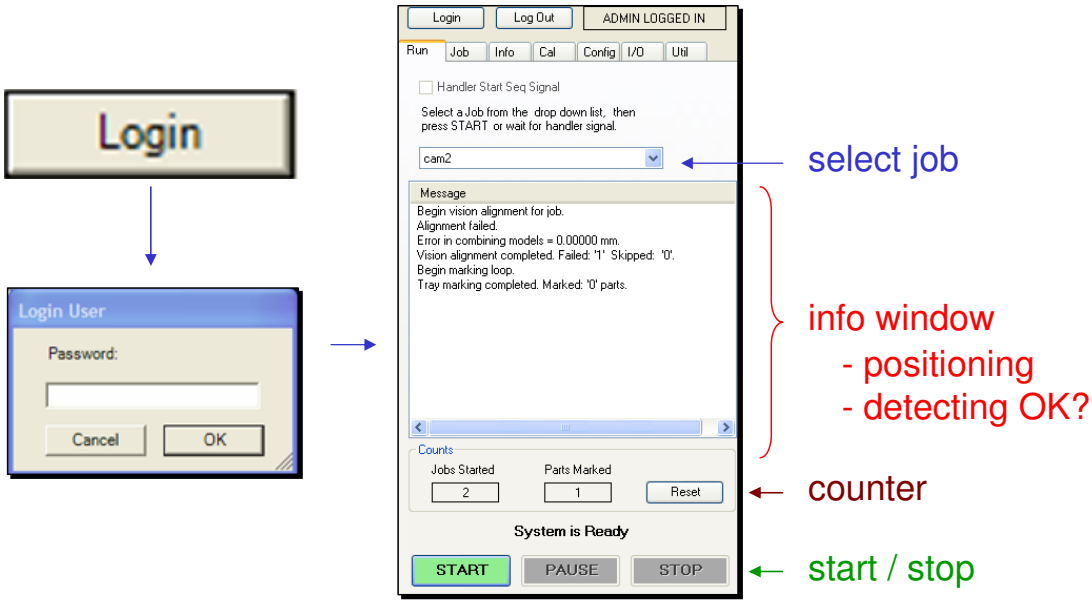
layout The camera detects just a sub area of the complete marking area. Therefore the layout contains the position of each working piece.

BIA file The BIA file contains all necessary information and set up information of the marking process (laser parameter, number of repetitions etc.). To use the complete functionality of the software, the graphic content should be exactly centered in the BIA-file.

model For each layout element, you have to teach a model in **Train Vision**. The software has to know how which are the characteristic contours of the work piece and where to mark the BIA file related to the detected contours.

job All settings are saved as a job which can be loaded directly at any time.

Start job



Complete jobs can be selected and started in the window *RUN*.

login To select and run jobs, logging in as an **operator** is sufficient. An **administrator** can also load jobs.

select job You can select a job from the list.

counter The counter will count the number of marking processes and marked parts for each job separately.

message In the message window you can read some details about the detection and marking processes.

start/stop For Vario-systems you confirm the job by pressing the start icon. From now you can insert work pieces and start the marking process by using the hand or foot switches.

For standard systems with manual doors first insert the work pieces, close the safety doors and start the marking process by using the start-icon.

Fobagraf

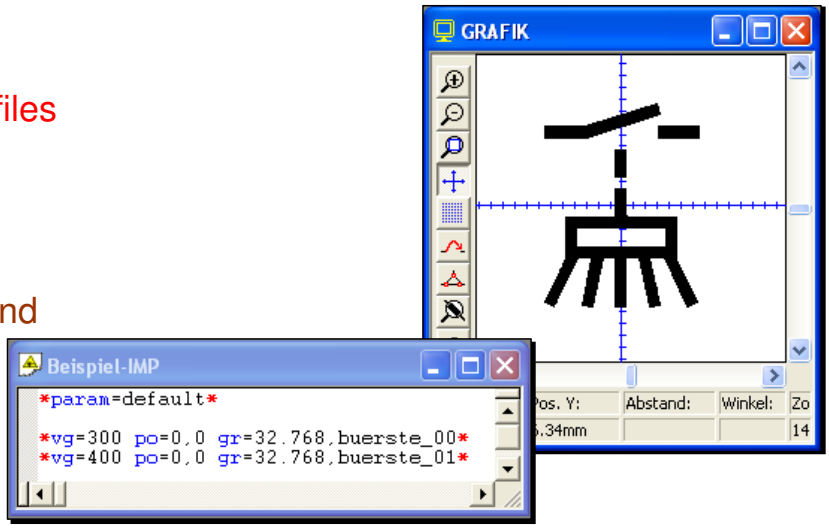
define laser parameter

note position of Z-axis

create graphics as MCL files

create and save BIA file

- separate symbols
- center graphics
- avoid ZAXIS command



laser parameter

Before working with the IMP software you can determine the laser parameters in Fobagraf. Optimise the parameters and create a separate laser parameter for each material.

z-axis

Note: Optimise z-axis. Don't use the z-axis command in the BIA file, it is better to to set it in the IMP job directly.

graphics

You can use all BIA-files. **MCL files** are generated the common way via graphic imports or the **Lasertype** software.

BIA files

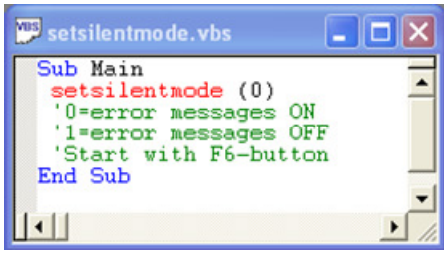
For each symbol you have to generate a separate BIA file. If a BIA file contains more than one graphic, they can't be moved relatively any more.

All graphics should be **exactly centered** in the marking area.

Don't use the z-axis command in the BIA file. The height of the work piece should be entered into the IMP software directly.

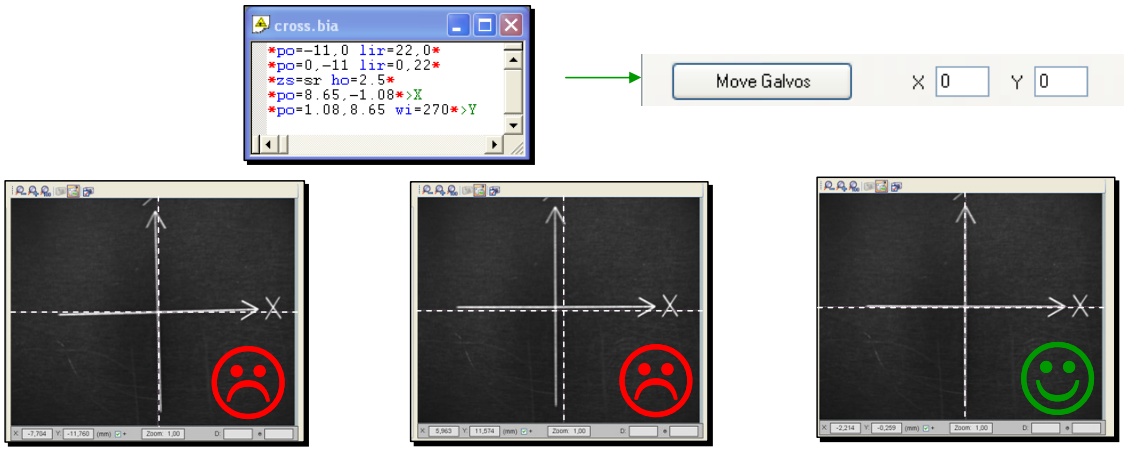
silentmode

If Fobagraf is controlled by IMP software all error messages are switched off. But for generating the BIA files these messages are helpful. They can be activated by the VBS-command "SETSILENTMODE" manually:



camera system

check calibration



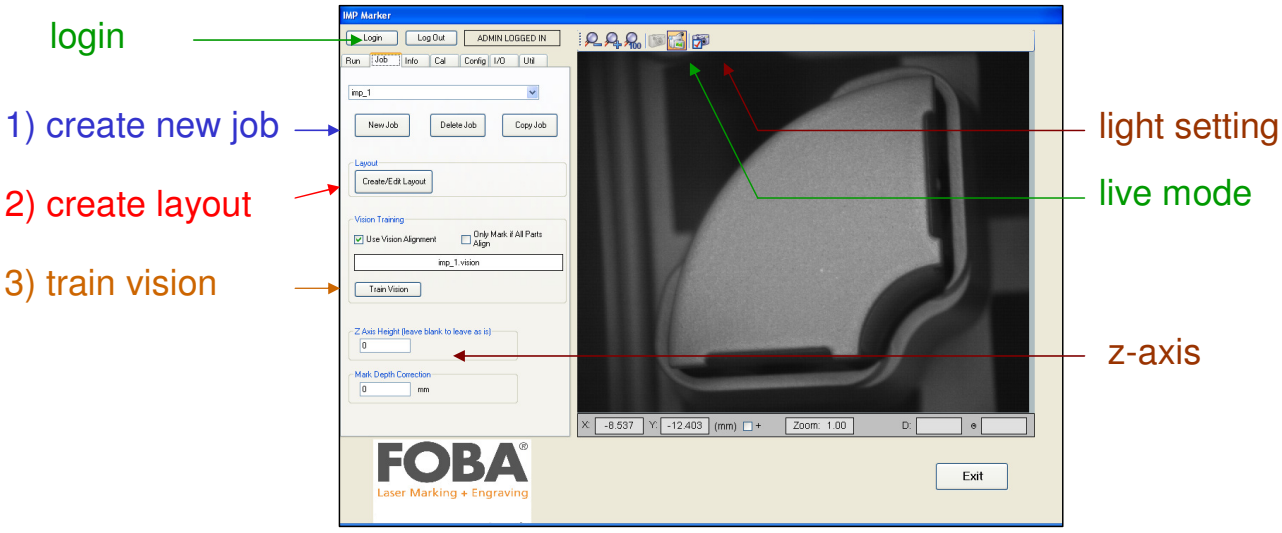
Set up new parts on well calibrated system only!

Set up new parts on well calibrated systems only! If the system is not calibrated tolerances in positioning will appear after the next calibration of the system!

check calibration

1) Put any work piece into the marking area and protect it against shifting.
2) Mark an exact cross hair on the work piece!
3) Move the scan head mirror onto the zero position!
4) Activate the cross hair in the live view (tag „+“-field)!
5) Both crosses must be overlapped completely. If the crosses are shifted or rotated it is absolutely necessary to calibrate the system first.

Creating a new job



login — You can log in as **operator** or as **admin**. The operating scope for operator is limited to select and run complete jobs. The administrator can use all functions of IMP software.

The passwords can be changed in the menu *config*.

create new job — After using “new job” or “copy job” icon you have to enter a name for the new job.

create layout — Here you have to pre-define the positions of the work pieces. A detailed description of this menu you can find on the following pages.

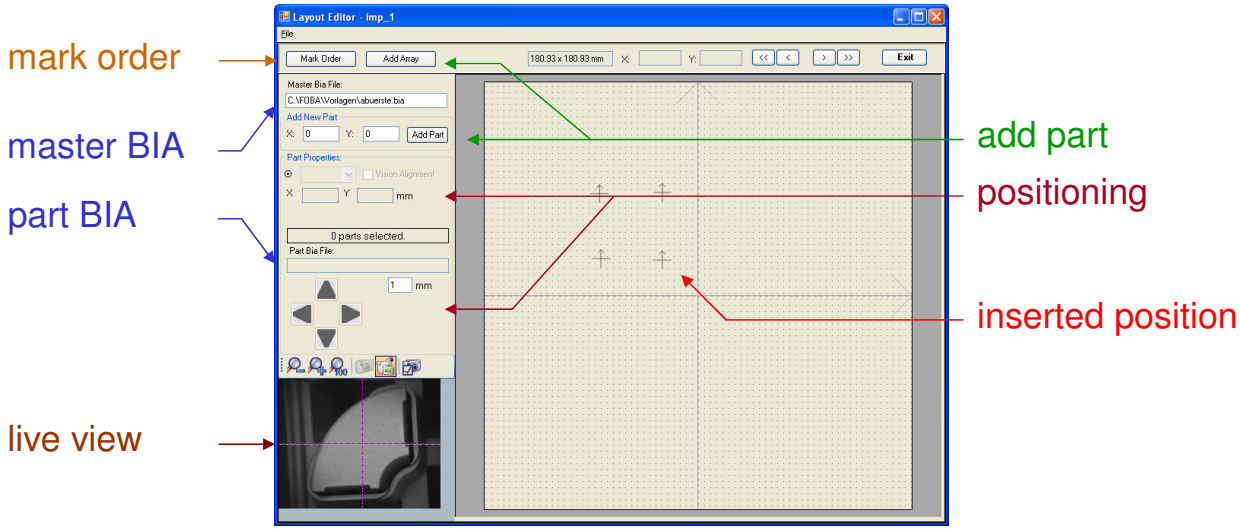
train vision — With this function you have to teach the software which contours are necessary to detect the position. A detailed description you can find on the following pages.

z-axis — Insert the optimised z-axis value for you application. The software is searching for contours and marking with this height.

light setting — You can change the lighting you the values **gain** and **exposure**.

live mode — The live mode can be started and stopped with the icon. The mirror position can be moved in the layout menu or in the menu *Util –> move Galvos*.

Layout editor



The layout contains the pre positioning of the work pieces. It contains one or more positioning. For each positioning you can select a separate marking file.

add part With the icon **add part** you add a single part, with the icon **add array** a matrix of new elements.

inserted position Inserted elements are displayed in the right window. For modification you have to mark the element first. Marked elements are displayed with a blue rectangle.

live view If a single element is selected the live view shows the actual field of view.

positioning The positioning is changeable with the drag&drop function of the mouse, or by using the arrow or values on the left side.

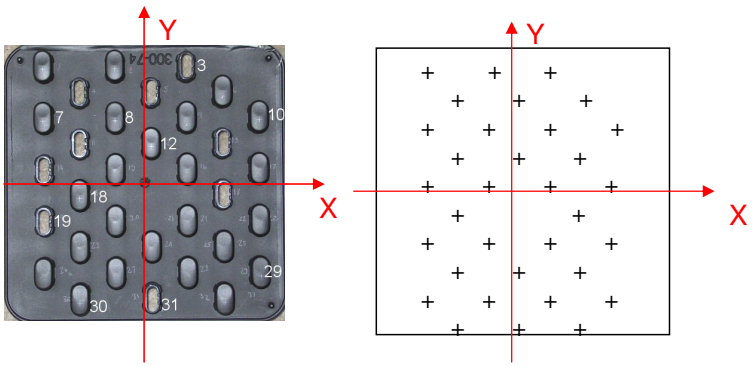
master BIA Select the BIA-file you want to mark. On all positions the **same** BIA file will be marked.

part BIA Select the BIA-file you want to mark. On each position you can select a **separate** BIA file.

mark order The icon displays the marking order. By clicking on the elements the mark order can be changed step-by-step.

Example 1: Layout editor

Create a layout of any tray!



- **requirements:**
- select laser parameter
- create BIA file
- insert z-axis position
- adapt lighting

- assign BIA file
- check mark order

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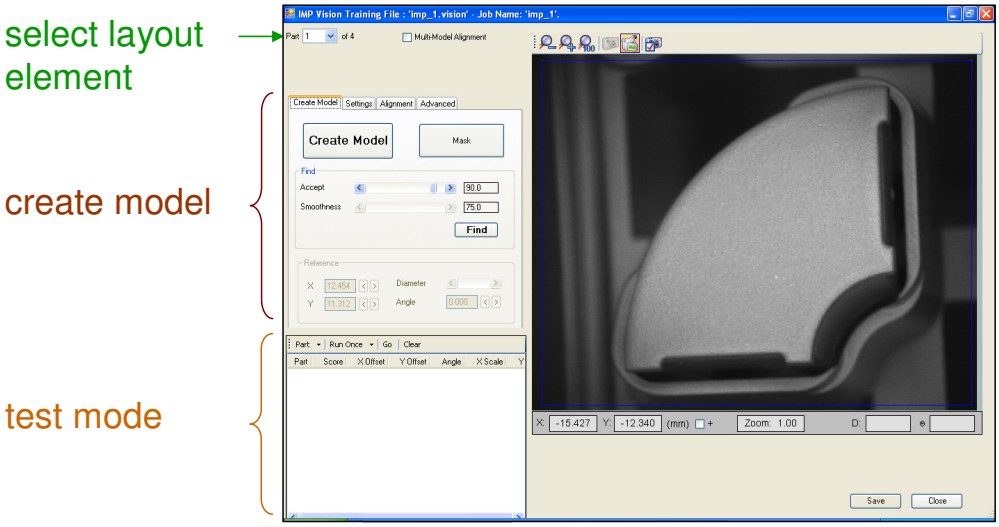
laser parameter	Determine or select laser parameter for you material. Add the parameter into you BIA-file.
BIA file	Create all necessary MCL-files and prepare separate BIA-files for all necessary graphics.
Z-axis	Add the optimised z-axis value in the job file! For determine the optimised z-axis value the **manual axis control** of Fobagraf is very helpful.
lighting	Optimise the lighting (gain and exposure) of the work pieces.
assign BIA file	Assign a BIA-file to each layout element.
mark order	First the mark order is equivalent to the order you insert the element into the layout. If necessary you can change the order.

Train Vision



one **model** for each **layout element**

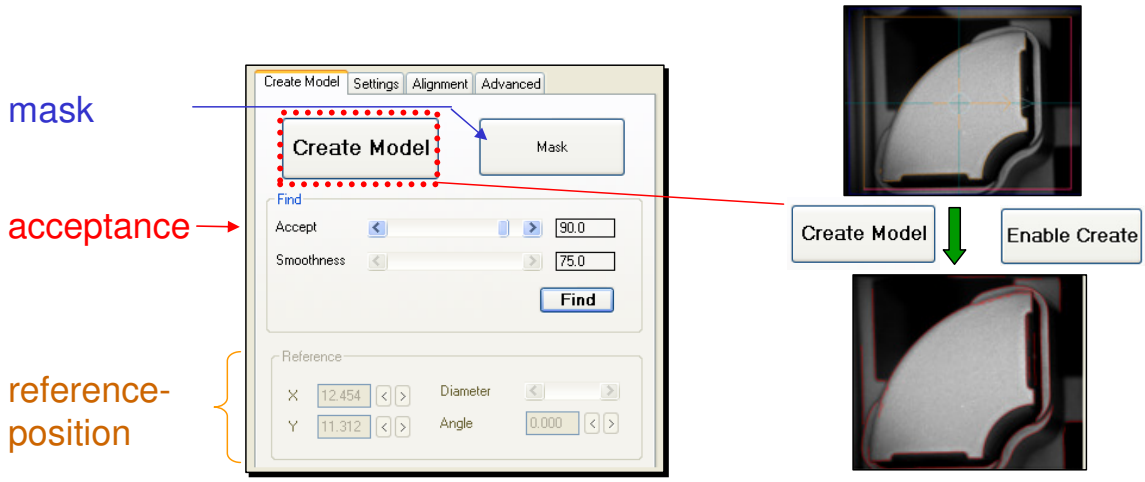
When the layout is ready you have to add a model to **each** layout element. Because the angle of view of the camera and the lighting is different on each position the models can't just be copied.

select layout element — Select which layout element you want to set up.

create model — This is the **main function of Train Vision**. Here you have to define the contours to optimise the recognition of the work pieces. A detailed description of the opportunities you will find on the following pages.

test mode — After the teaching of new models you can test the recognition with the test run function.

Create model



Model = outline contour, the camera is searching for

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create model — The software detects contours with the actual settings. The result will be displayed in the graphic window. Contours are marked red.

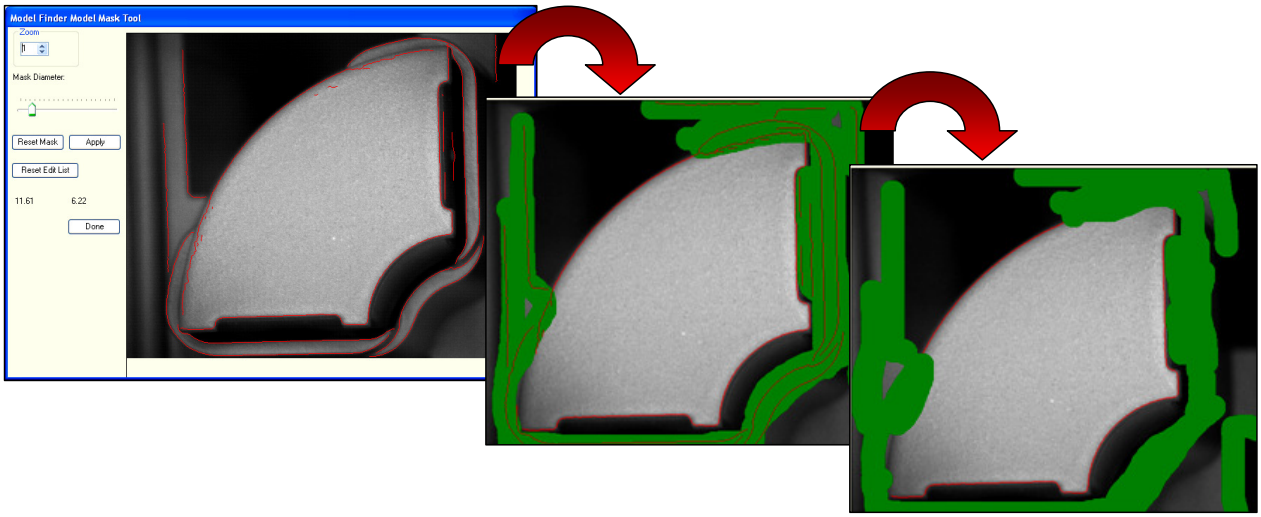
If a model already exists the icon switches into “enable create”.

acceptance — The **accept value** has to be defines. The software has to detect the contours better than the accept value otherwise the laser will not mark the piece. Typical accept values are 80-95%.

reference position — The reference position defines the **center position of the BIA-file**. The reference point contains the position and a rotation.

mask — All unnecessary contours or shadows have to be removed with the mask editor.

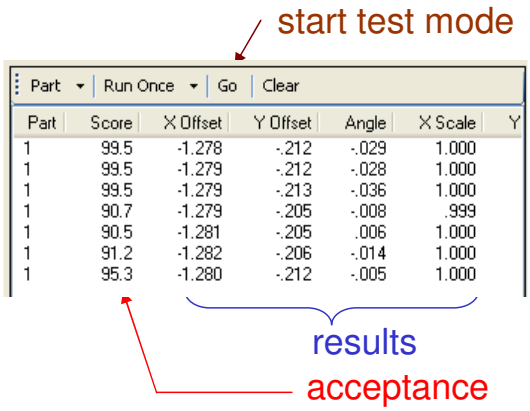
Mask tool



Mask = eraser, removes all unnecessary contours

	The mask editor works as an eraser. Delete all not necessary contours (shadows, ground plate, fixing) with the green mask. These contours doesn't effect the positioning any more.
mask diameter	Change the diameter of the erasure to work on large areas. Remove details with a small diameter.
apply	You have to apply to all modifications in the mask editor.
reset edit list	If too many contours are removed you can reset the mask completely.

Example 2: create model



Create the models of any layout!

- **requirements:**
- create mask
- move reverence point
- optimize acceptance
- test run

You can test the actual settings in the test run mode. In this mode the camera is searching for contours, calculates and displays the position and acceptance but doesn't start the marking process.

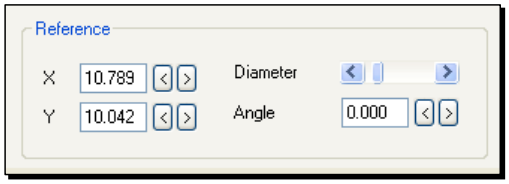
part/ model In the test mode you can search for the actual or for all parts and models.

loop/ run once You can run the test mode in a loop for the actual or for all models. With a second click on the loop-icon you stop the loop again.

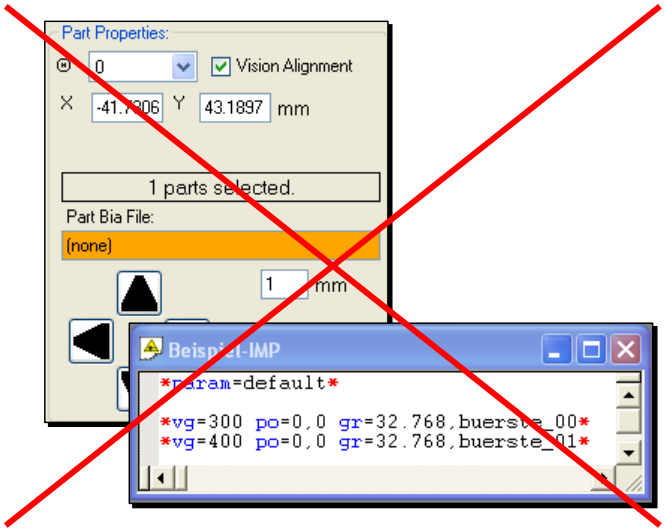
acceptance The acceptance value shows how precise the contours are compared to the trained master work piece.

results The results are the calculated values the graphics will be moved.

Positioning



Set up position with reference position of model



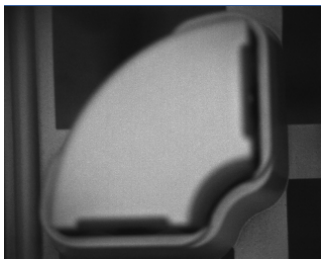
Don‘t use layout menu or Fobagraf for positioning

Set up the precise position of a marking **just with the reference position** of the model! The reference position stands for **the center position of the BIA-file**. Don’t change the BIA-file or the positioning in the layout menu!

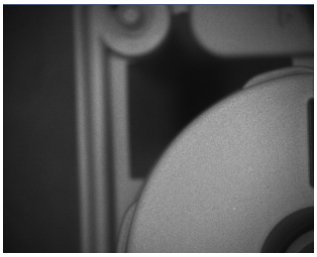
create model When creating a new model („create model“, change „smoothing“ or change „detail level“) you get a new relationship between contour and position of marking. Check and optimize the position after each change!

model box The reference position is related to the upper left corner of the model box. Attention: All changes of the model box will effect the positioning of marking!

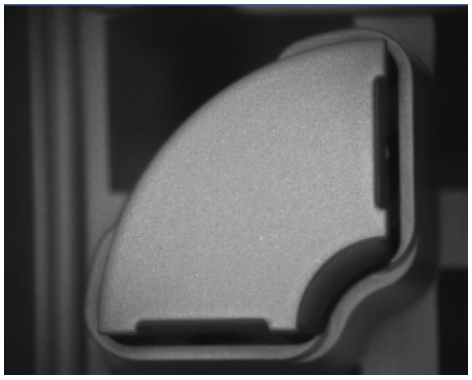
Basic conditions



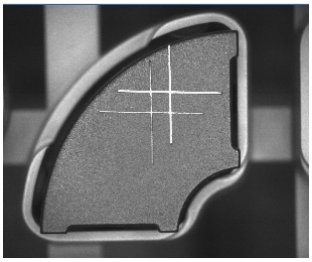
☹ focus



☹ layout position



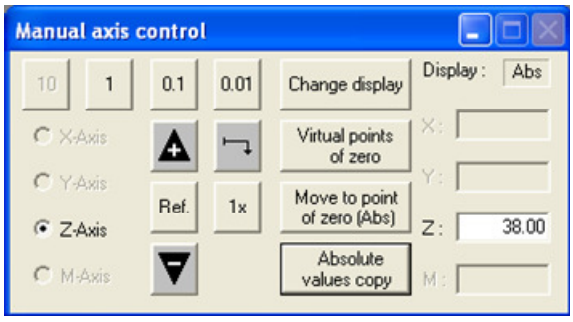
☺



☹ marked

☹ damaged

focus Make sure that you are working with the correct working distance. The Z-Axis position must be added to the IMP-job, but will move just in the “RUN” mode. Check and move the axis position with the “manual axis control” window of Fobagraf.



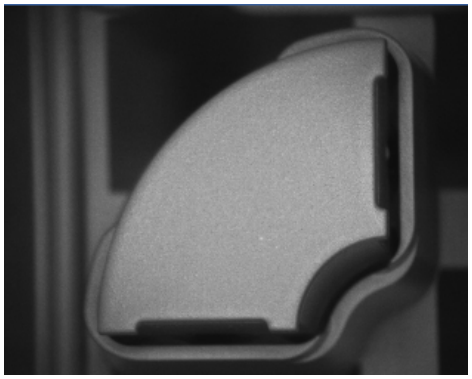
layout position The characteristically contours of a work piece must be inside the field of view. Optimize the layout position that both the reference position and the contours are in the field of view. If the work piece is too large you have to use the function “multi model alignment”.

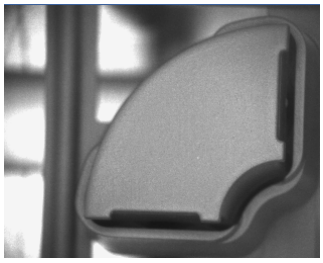
marked To train new parts use unmarked work pieces only. An existing marking can effect the results of the camera, even you use the mask functions

damaged Don’t use damaged pieces. The trained parts should not have any differences to the serial products (painting defects, gloss level and colour).

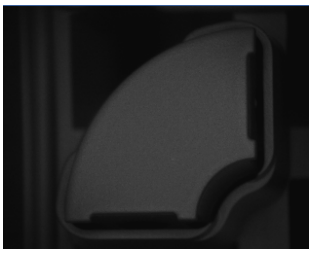
Lighting

overexposed





reflections



underexposed

Lighting situation depends on position in marking area

The lighting is a basic setup. It effects the performance of IMP system very much. Therefore you should check the lighting for each new part before train the new models. **It is not necessary to generate a black/white contrast!** Far from it: it will reduce the capabilities of the camera system!

overexposed/ underexposed

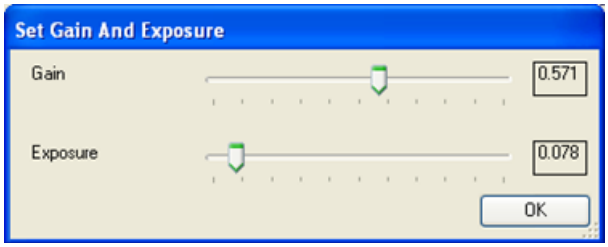
Avoid overexposed or underexposed lighting. Both will reduce the performance of the camera system.

reflections

Reduce reflections if possible. Us a low contrast background.

lighting

You can set up the lighting with the gain and exposure values. Both values are saved in the selected job.



Attention: **The Exposure effects the cycle time!**
The gain is an amplification factor, which doesn't effect the cycle time.

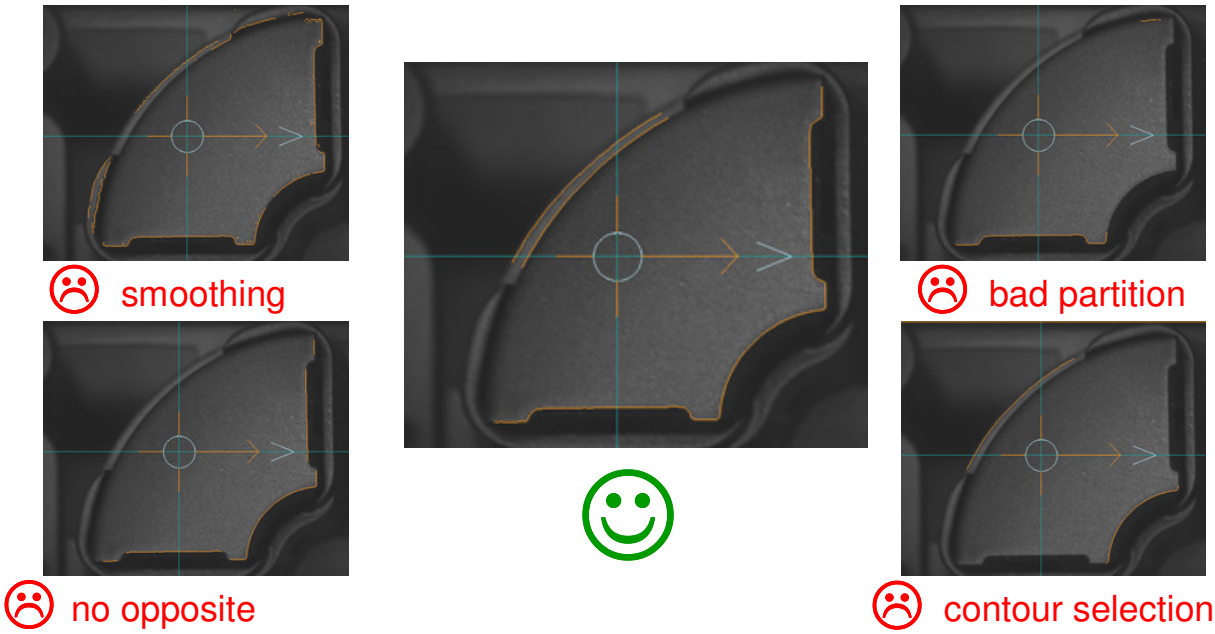
position dependency

Typically in the boundary of the marking area the lighting will be lower than in the center.

It is possible to change the lighting for each model, but is not recommended. It will cost cycle time.

Never change the fixture of the light bars!

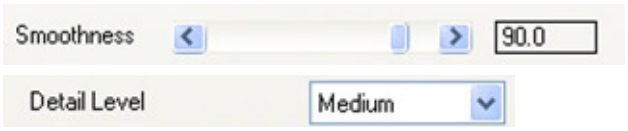
Models



You can change each model to optimize the acceptance. Check each modification with the test mode. Use different parts and positioning for testing the setup!

smoothing

Optimize the smoothing that all necessary contours will be detected well. While using lower smoothing value or higher “detail level” (in the “advanced” window) the camera detects low contrasts.



Attention: When changing that values a new model is created immediately!

no opposite

If possible use opposite contours in each coordinate direction to detect your work piece. Otherwise the software can’t detect the scaling.

bad partition

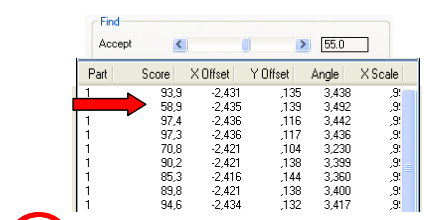
Use approximately the same contour length for X- and for Y-direction. Otherwise the detecting is very good in one direction, but has tolerance in the second direction.

contour selection

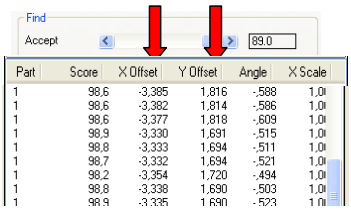
Pay attention on the selection of contours. With the selected contours the camera should be able to detect a clearly defined position, scaling and rotation.

remark: For error diagnostic in the “Config”-menu you can find additional tools.

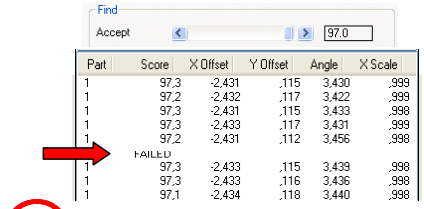
Acceptance



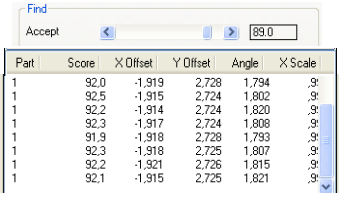
acceptance too low



high tolerances



acceptance too high



positioning OK

typical value : 85-90%

acceptance

Each part is different. A 100% matching of part and model is not possible. So you have do define an acceptance level how much the part has to match to the trained model. If the acceptance is lower the system doesn't mark this part.

A too low acceptance value can be the reason for high tolerances in positioning. A typical acceptance value is around 85-90%

Attention: **The stability of positioning is more important than the score!**
If the model is bad trained it is possible to get very good scores but high tolerances in positioning. Check each trained model.

part failed

During the test run you can reduce the acceptance rate to see the actual scores.

If the work piece is not detected you should check the following things:

work pieces:
- actual work piece is different to the trained work piece
- the trained work piece is different to the serial work pieces
- location of work piece not OK

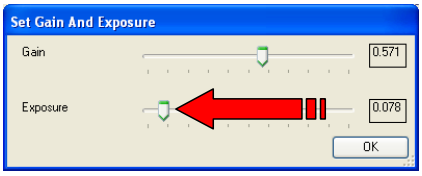
Train Vision
- angle + scaling limits too low
- region of interst too small (blue rectangle)
- model not OK
- lighting not OK

target accept

With this function it is possible to aviod a marking if additional elements contours are detected by the camera.

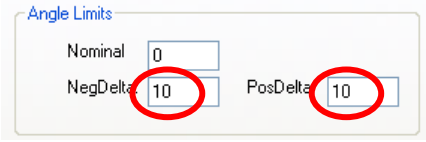
With this function the work pieces are marked only if **all** models of the job are found successfully.

Processing time



- reduce expose

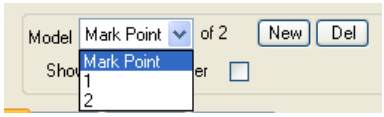
- constant lighting



- reduce search area

- increase smoothing

- increase speed
- reduce details



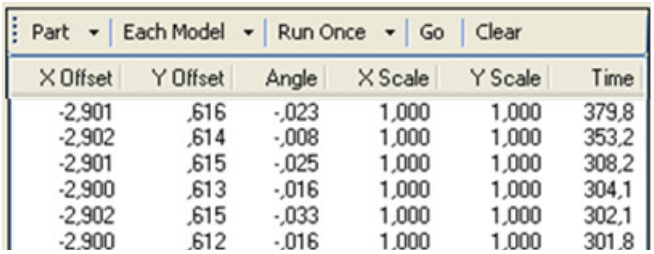
- multi model alignment: less model positions

A couple of parameters are effecting the searching and processing time. A list of the most important values you can find in the list above.

Reducing the time can increase the tolerances in positioning. Therefore each modification should be tested in the test mode first.

test mode

In the test mode you can check the detected values (position, angle, scaling) and the processing time. Here you can control the efficiency of time optimising.
(Remark: the first test run need additional time, use the loop-mode for testing!)



X Offset	Y Offset	Angle	X Scale	Y Scale	Time
-2,901	,616	-,023	1,000	1,000	379,8
-2,902	,614	-,008	1,000	1,000	353,2
-2,901	,615	-,025	1,000	1,000	308,2
-2,900	,613	-,016	1,000	1,000	304,1
-2,902	,615	-,033	1,000	1,000	302,1
-2,900	,612	-,016	1,000	1,000	301,8

others

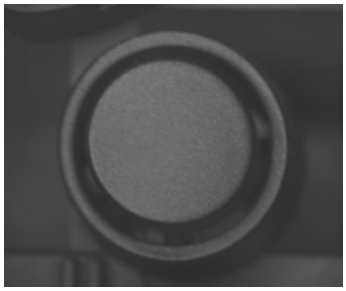
Other setup has just limited effect to the search and processing time, but interesting for time critical applications:

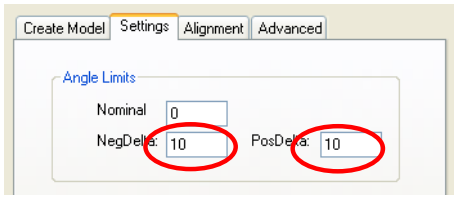
- Reduce region of interest (ROI: blue window)
- Don't display search results (function in master configuration)
- Train less contours

without vision alignment

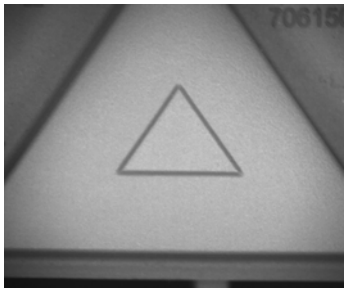
For each single element you can switch off the camera function in the layout menu. These elements are marked statically without using the camera.

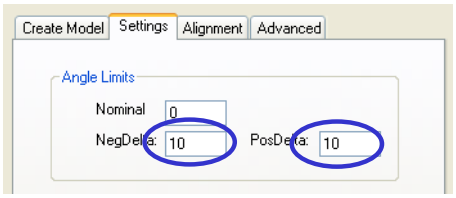
Symmetric pieces





rotation not detectable:
mark without rotation





limit rotation

Wrong marking results on symmetrically work pieces can be avoid when reducing the maximum rotation angle or scale factor.

rotation not detectalbe

The rotation is not detectable if the work pieces are round. The angle of the marking will change for each marking randomly. The marking will appear with a constant angle when the angle limits are set to 0 degree.

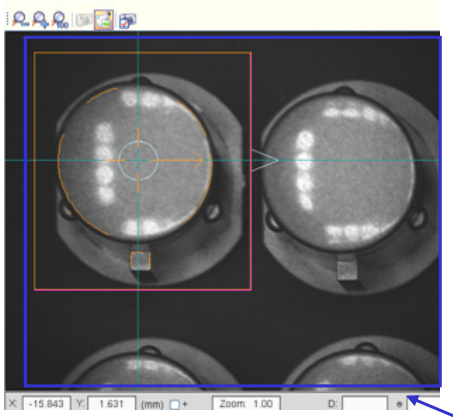
limit rotation

Limit the rotation for symmetrical work pieces. Otherwise the marking can appear with different orientations.

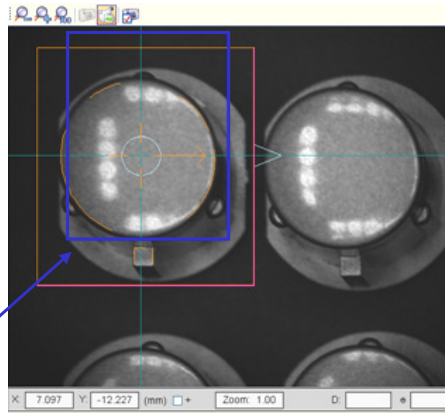
scaling

It is possible to limit the scaling, too. But for laser systems set up for day-/night marking the scaling functions are switched off as default, because the work piece size will not change for these kind of products.

Small pieces



ROI to large



ROI OK

blue: region of interest (ROI)
magenta: model box

For the marking of small work pieces the region of interest (ROI) can be limited.

region of interest

The reference position of a model must be inside the region of interest to be detected. Reducing the size will reduce the search and processing time. Reducing in the size is also very important if more than one similar work piece is visible inside the field of view. So you can select which work piece should be marked.

model box

Don't mix up the model box and the region of interest. The model box will just reduce the size of the model to limit the work you have to do with the mask editor. Later, e.g. during production, the work pieces can be outside of the original model box.

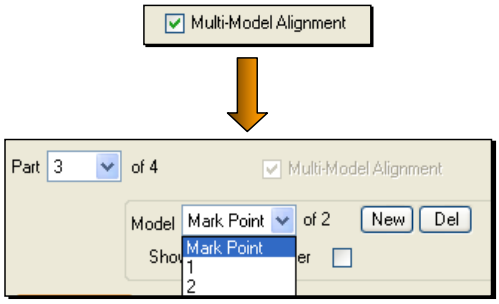
copy models

The function „apply model to all parts" is very helpful when a lot of similar work pieces must be trained. The actual model will be copied to all other parts.

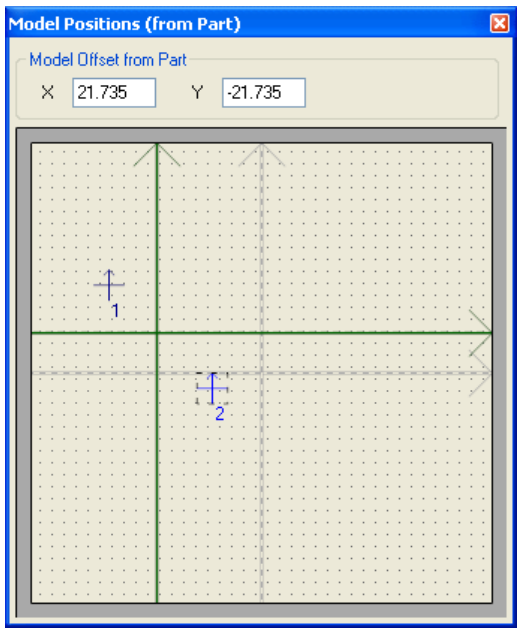
But the lighting and view angle of the camera will be different on every position of the marking area. Check each position and optimize the models on each position if necessary.

(-> in window „advanced")

Large pieces



work piece larger than field of view:
separation of
- marking position
- model position



The necessary contours of large work pieces can be outside of the field of view. In this case you have to run the function „multi model alignment“. Here the positions of marking and the position of the models are separated.

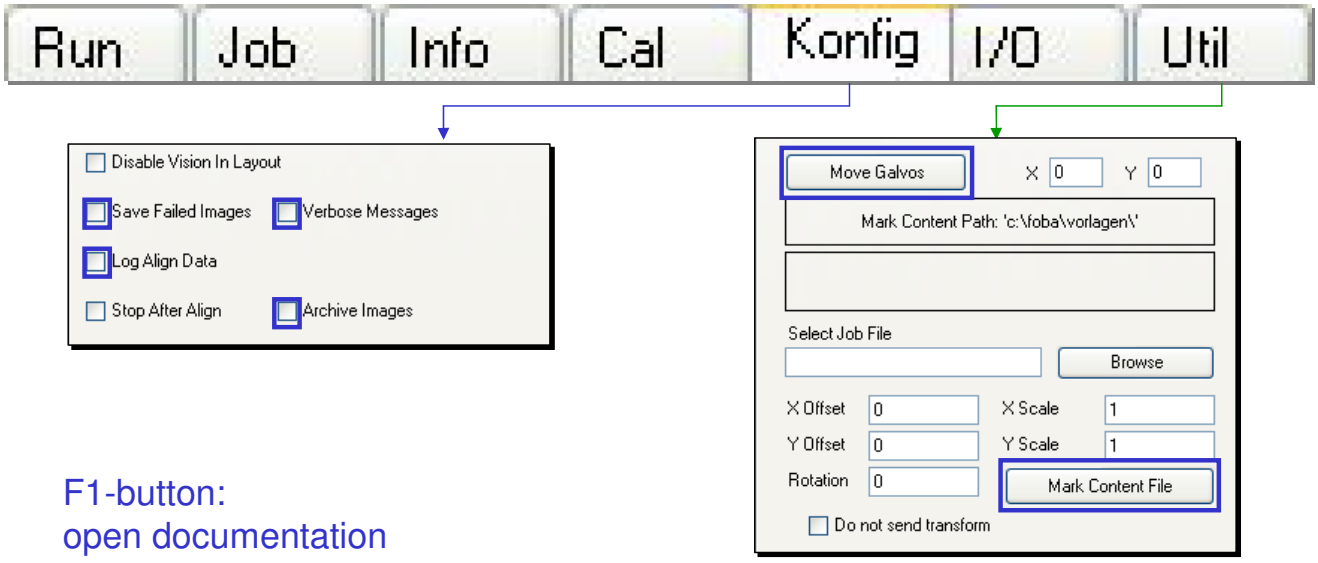
mark point (=mark position)

The rough position of the marking will be selected in the layout menu. With the reference position you can optimise the marking positioning. In the window “show model positions” the mark position is shown as a green cross.

model position

At these positions the software is searching for contours. You can create more model positions. It will increase both the precision and the processing time. In the window “show model positions” you can move the model positions.

Set up tools



F1-button:
open documentation

Here you can find a list of tools which are helpful to setup new work pieces or to test and optimise the actual setup. These opportunities are switched off after each restart of IMP-software.

log align data All transfered values are saved in the file */logs/app_diag_log.csv. You can open this file with any text editor. Because the file size will increase very fast, the file will be deleted with every new start of IMP software. As default the function is switched off.

save failed images Failed images will be saved as BMP files in the folder */failedImages.

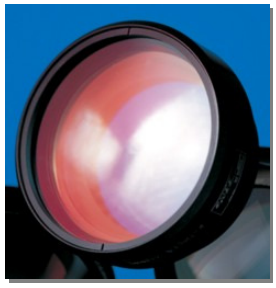
archive images All images will be saved as BMP files in the folder */Images. Both image save functions need a lot of memory. You should use them just if really necessary.

log file In the file */logs/system_event_log.txt all errors and events are saved with time and date information. You can open this file with any text editor.

verbose messages With this function you get additional information when running a job (e.g. marking time, search and processing time, total cycle time).

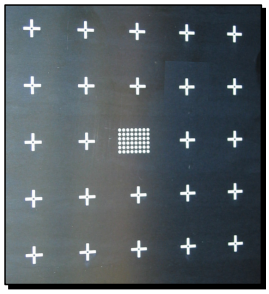
util The tools in the util-window are helpful for setting up new work pieces. You can move the galvo mirrors to any position or you can mark a BIA-file from here without return into Fobagraf software.

Maintenance



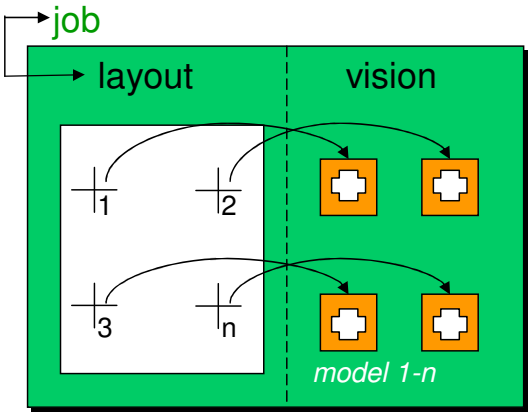
• clean lens and light bars

Do **not** remove lens!



• 1 x month: calibrate IMP system

• backup



file structure IMP

lens and light bars

Clean the lens and the cover of the light bars with a soft detergent. **Don't remove the lens for the cleaning**, otherwise you have to calibrate the IMP system again.

calibration

It is necessary to calibrate the IMP system (once a month). For each changing of lens, dismounting of the scan head, transport of the system and marking with too large tolerances it is necessary to calibrate the system immediately.

Aluminium plates for calibration can be ordered at Foba:

lens	size	Art.-No.
100 -163mm	130x130x1	106 284
254mm	210x210x2	106 285
420mm	310x310x2	106 287

software backup

Backup all necessary file on an external drive. Start with Fobagraf files (BIA-files, parameter, MCL graphics and INI-files) and save IMP files:

job	set of layout, vision and model files.	
layout	preposioning of galvo mirrors, allocation of BIA files	*.layout *.marklist
vision	set of all models	*/.vision/ *.*
model	shape of contours, acceptance values, individual lighting for each layout position	*.mmf

If you have any question don‘t hesitate to contact our service department:

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