

SmartSight

User guide



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1. Introduction

1.1. General information

This document is the exclusive property of Asyrl SA; it may not be reproduced, modified or communicated, in whole or in part, without our prior written authorisation. For the purposes of product improvement, Asyrl SA reserves the right to modify any information contained in this document without prior notice. Before using the product, please read this entire document in order to ensure that the product is used correctly. However, if you encounter difficulties when using the product, do not hesitate to contact our customer service department.

In this manual, the safety information that must be respected is split into three types: "Danger", "Important" and "Note". These messages are identified as follows:



DANGER!

Failure to observe this instruction may result in serious physical injury.



DANGER!

This instruction identifies an electrical hazard. Failure to respect this instruction may result in electrocution or serious physical injury due to an electric shock.



IMPORTANT!

Failure to respect this instruction may result in serious damage to equipment.



NOTE:

The reader's attention is drawn to this point in order to ensure that the product is used correctly. However, failure to respect this instruction does not pose a danger.



Reference ...

For more information on a specific topic, the reader is invited to refer to another manual or another page of the current manual.



IMPORTANT!

Asyrl cannot be held liable for damage to property or injuries to people caused by failure to follow the instructions specified in the "Safety instructions" paragraph. It is the customer's responsibility to inform the personnel concerned.



NOTE:

All dimensions and measurements in this manual are expressed in millimetres (mm)

1.2. Other manuals

The table below provides a list of documents supplied with the product. Each of these manuals forms an integral part of the set of documentation associated with the product.

This manual contains all the necessary information for a user to configure and use a new process (feeding and visual recognition).

Manual name	Reference	Description of the content
Operating manual	SMARTSIGHT_Operating_Manual_EN	Contains a technical description of the product and its functionalities together with instructions for its transportation and maintenance
Programming guide	SMARTSIGHT_Programming_Guide_EN	Contains information about communication and use of the product at the programming level
User guide	SMARTSIGHT_User_Guide_EN	THIS MANUAL
HMI Manual		Directly accessible via the HMI

Table 1-1: Other manuals

2. Structure of the SmartSight

The SmartSight can be broken down into 3 main elements which are described in the following table and detailed in subsequent sections.

Element	Content	Description
Image configurations	<ul style="list-style-type: none"> • Image region • Items relating to the camera • Camera calibration • Asycube calibration • Process calibration 	Fixed configurations, but it is possible to define them as often as necessary, as this is only a software configuration. Each vision model will simply use one of these image configurations as required.
Recipes	<ul style="list-style-type: none"> • Vibration set • Vibration process • Vision models • Image acquisition parameters 	Variable configuration that can be saved and reloaded as required. For each model contained in the recipe, there will be a link to a specific image configuration that will be used to calculate the positions of the parts using the calibrations.

2.1. Image configuration and recipes

2.1.1. Definition of the image configuration concept

An image configuration is an element consisting of parameters which are not dependent on the parts and which enable AsyView to function correctly and send the position of the parts accurately. This configuration is not defined for each part specifically, but it is essential to choose one for each model programmed. An image configuration can therefore be used for several parts or models.

Note that everything defined in the image configuration is closely related to the camera setting, and therefore to its field of view and resolution (see (A) in the image below).

2.1.1.1. The parameters of an image configuration

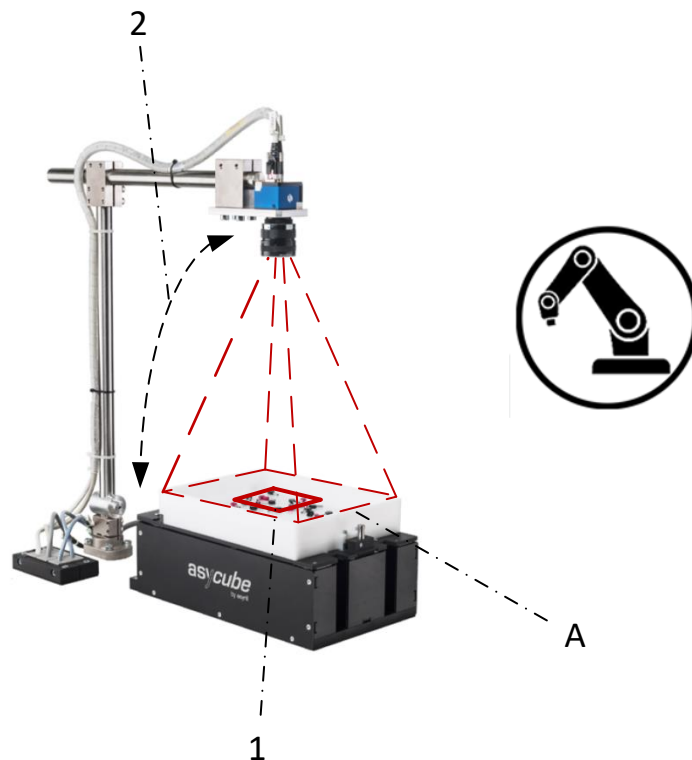


Figure 2-1: Parameters of the image configuration

1. Image region: Defines which part of the image is used to look for parts (an area of the image in pixels). In most cases, this will be the whole image, which is why a default region is already defined for this particular case.
2. Linked element: Defining the links between the elements allows you to specify "what the camera is looking at in the defined region". There is no linked element for a control camera since the camera is not looking at Asycube.

2.1.1.2. Calibrations

Calibrations make it possible to match the coordinate systems of the various elements in the system. They are closely related to the field of view and the image region, so each image configuration will have its own calibrations.

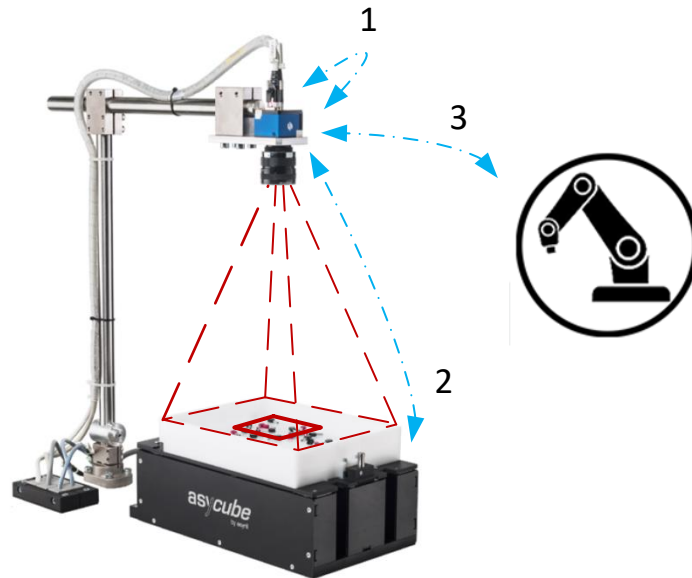


Figure 2-2: Calibrations

1. The pixel/mm calibration makes it possible to convert the world coordinate system of the camera (in pixels) to the physical system of mm (more practical). A calibration plate with a "chequerboard" is used to define the correlation of the size of the chequerboard squares in mm and the number of pixels in these squares. This plate can also be used to correct distortions associated with the optical system.

This calibration is not mandatory but, if used, it is important to understand that this calibration must be performed in the same plane as that in which the parts will be detected (and not that in which they will be placed). There are two reasons for this:

- If the calibration is performed in another plane, one mm in the calibrated coordinate system will not correspond to one mm in the part viewing plane (see Figure 2-3: Example of a calibration problem).
- The process calibration (see below), which will give the handling arm the picking position of the part, is dependent on the pixel/mm calibration, so it is necessary to calibrate in the same plane as the process calibration.

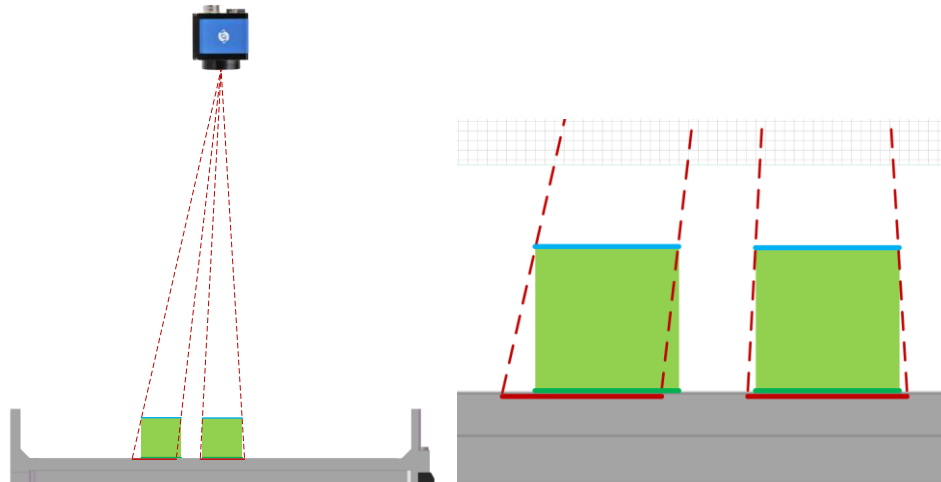


Figure 2-3: Example of a calibration problem

- Theoretical distance calibrated in the plane of the platform surface
- Distance measured by the camera if calibrated in the plane of the platform surface
- Distance measured by the camera if calibrated in the part viewing plane

It can be seen that there is an error which appears if the calibration is not carried out in the correct plane (size and position). This can be considered negligible when the height of the part is small, but becomes problematic if the height of the part is large or if the application requires a high degree of accuracy.

Calibration should therefore ideally be carried out at the height of the blue plane and not of the green plane.

2. The feeder calibration is used to transform the world coordinate system of the camera (in pixels or in mm if the pixel/mm calibration has been performed) into the Asycube coordinate system:

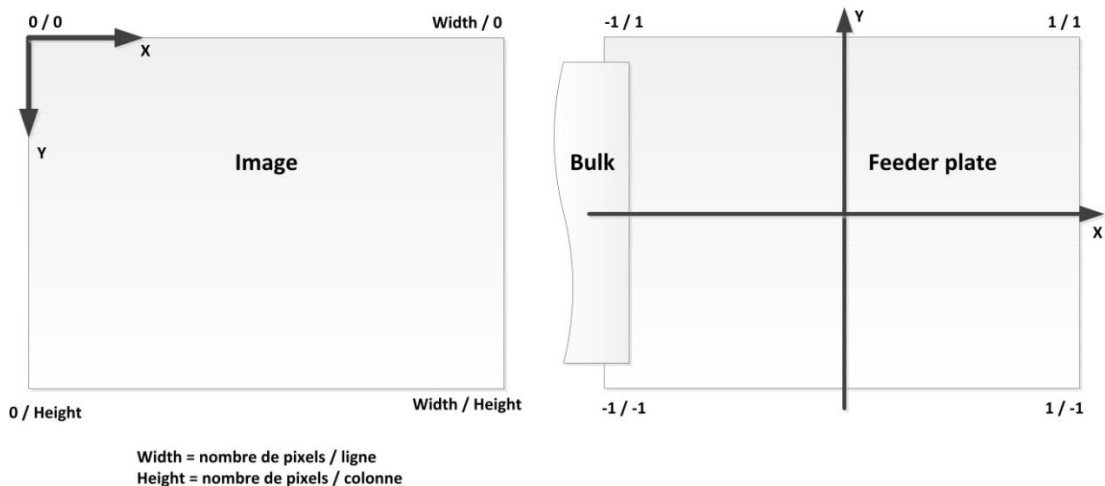


Figure 2-4: Correspondence between the vision coordinate system and the feeder

The coordinates of the 4 corners in the two coordinate systems allow the correspondence and orientation of the feeder to be established so that the vibrations are carried out in the right directions (according to the orientation of the camera and/or the use of mirrors).

According to the figure shown above, this gives:

Element	X (feeder)	Y (feeder)	X (image)	Y (image)
Point 1	-1	1	0	0
Point 2	-1	-1	0	Height
Point 3	1	1	Width	0
Point 4	1	-1	Width	Height

This calibration is automatically carried out when a pixel/mm calibration of the camera is performed. Otherwise, it must be done manually according to the orientation of the camera in relation to the Asycube.

- The calibration of the process (a generic term designating a robot, handling arm, etc.) makes it possible to convert the coordinate system of the camera (in pixels or in mm if the pixel/ mm calibration has been performed) into the coordinate system of the process. This is essential in ensuring that the coordinates sent to the process allow it to come and pick up the part at the right position.

The angle to be sent can be that of the vision coordinate system or that of the process, i.e. taking into account or ignoring the process calibration.

This calibration must be performed each time the pixel/mm calibration of the camera is changed (because the process calibration depends on the positions converted by the pixel/ mm calibration and sent by the camera).

As with the pixel/mm calibration, it is important to calibrate at the same plane as that viewed by the camera (therefore at the height of the parts and not in the plane of the platform surface).

Example of calibration points (viewed in pixels):

Element	X (vision)	Y (vision)	X (process)	Y (process)
Point 1	0	0	0	0
Point 2	0	Height	0	200
Point 3	Width	0	250	0
Point 4	Width	Height	250	200

2.1.1.3. Links

As you can see, there are many links between the various elements described above:

- Link between image region, linked elements and calibrations.
- Link between the different calibrations.

Here is a summary table showing the effects of changing one of these elements:

Element modified	Region	Pixel/mm calibration	Feeder calibration	Process calibration
Field of view	x	x ⁽¹⁾	x	x
Region		x ⁽¹⁾	x ⁽²⁾	x
Linked element			x	
Pixel/mm calibration			x ⁽²⁾	x

(1) Only if the pixel/mm calibration is used.

(2) The feeder calibration is automatically performed when pixel/mm calibration is carried out.
However, pixel/mm decalibration requires feeder calibration to be performed again manually.

The inseparable links described above mean that all of these elements are incorporated into what is known as an "**image configuration**". The system allows you to define as many of them as are necessary according to the different parts or uses of the system.

2.1.2. Defining the image configuration to use

An image configuration must be created in the following cases:

- The image region to be used for detection is different.
- The elements linked to the camera are not the same.
- The calibration of the camera must be different, for example, when the parts to be detected have a geometry which is very different from the previously detected parts (mainly part height).

In these cases, the first thing to check is whether an image configuration already exists with the required parameters. If this is not the case, you must create a new configuration.

Then decide on the image region you want to use (usually the whole image) and the camera-related element(s) (usually an Asycube).

Once it has been created, perform the calibrations for this image configuration (look out for high parts in order to properly calibrate at the viewing plane and not at the platform plane).

Then program your model(s) using the created image configuration. If the model has already been created and you have been using a pixel/mm camera calibration, you can simply choose the new image configuration for your model without having to recreate it.

2.1.3. Recipes

The recipes include the elements necessary for the operation of the system that are specific to the part(s) to be fed. This includes:

For the Asycube:

- the vibration set
- the vibration process

For the vision part:

- the vision models
- the image acquisition parameters

More details on recipes in section 0.

3. Configuring the system

The system is pre-configured by Asyrl according to the components ordered and the corresponding architecture. By default, the manual describes the "1 Asycube + 1 camera" system.

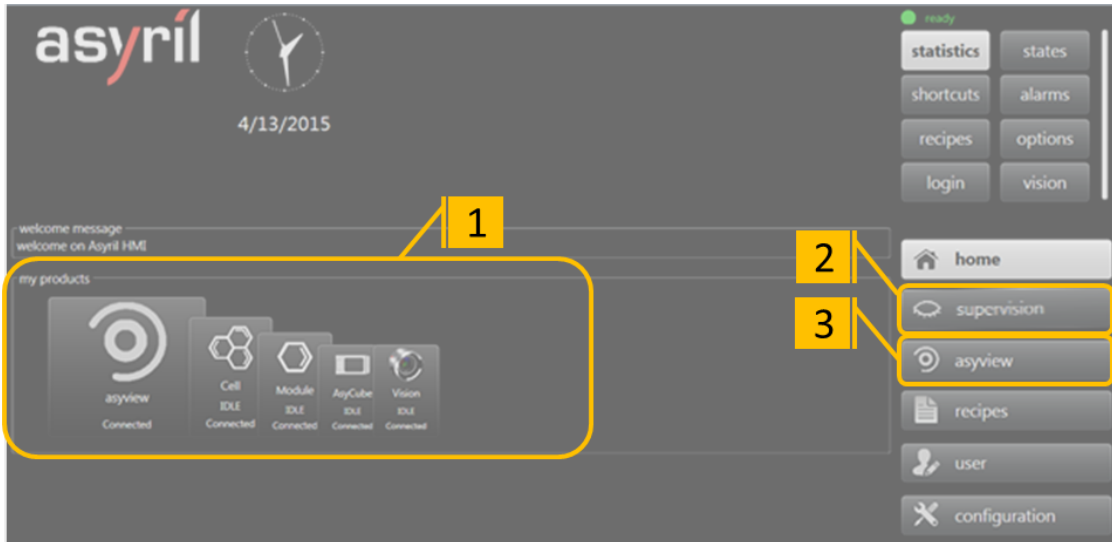


Figure 3-1: HMI home screen

1	Displays the architecture of connected and pre-configured peripherals
2	Access to display of all the cameras for monitoring purposes
3	Access to the configuration steps

The figure below describes the parameters to be adjusted and the main procedure to be applied after installation of the Asycube and the viewing devices on the machine.

IMPORTANT!



These parameters must be set at the beginning of the machine adjustment procedure. Each modification of these parameters alters the calibration and the recipes.

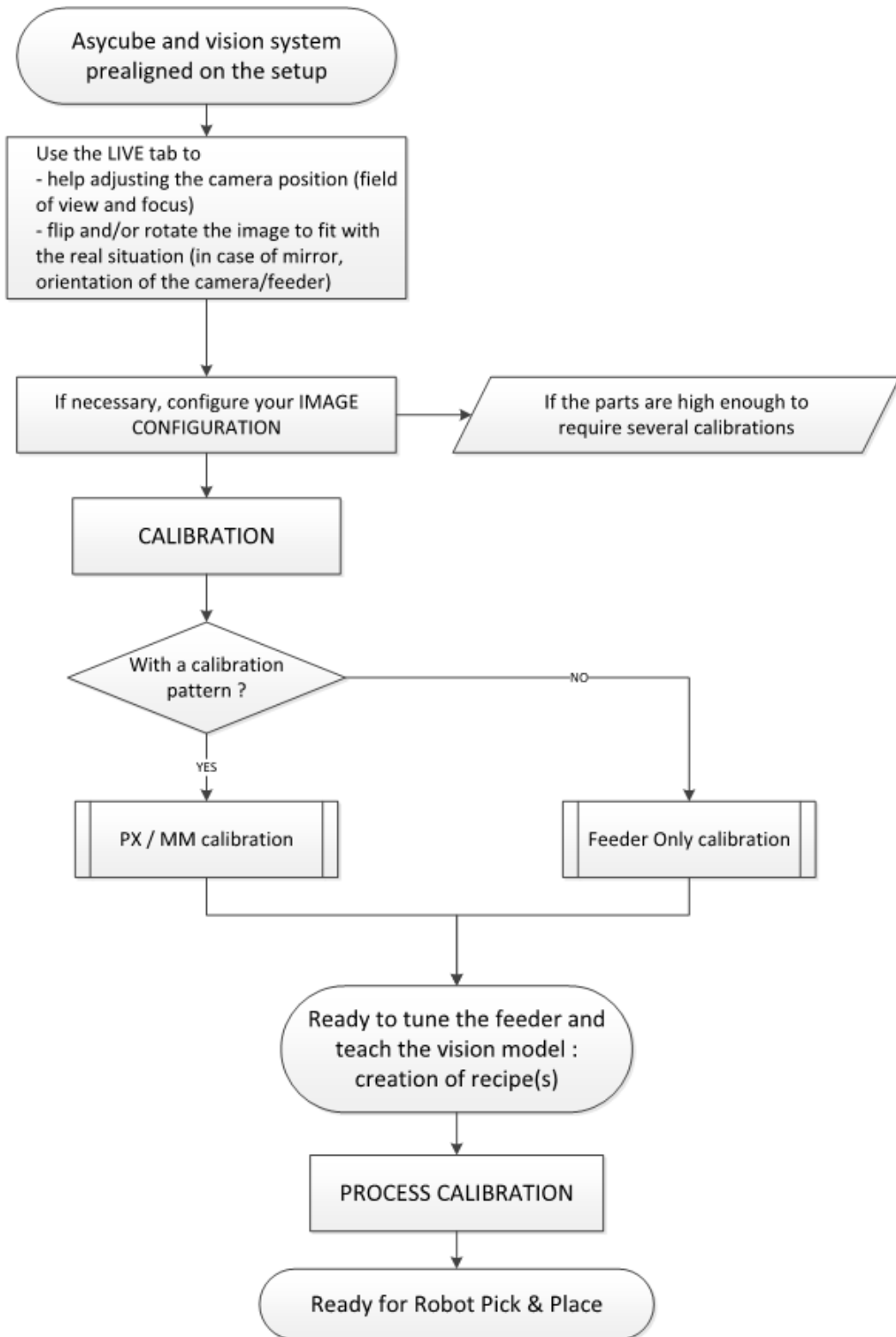


Figure 3-2: Simplified description of the different tasks to perform when implementing a new SmartSight configuration



See the HMI manual via the interface for detailed information on these functionalities: Live image, image configuration, calibration.

3.1. Pixel/mm calibration

First of all, it should be noted that this calibration is not essential. It converts the coordinate system from pixels to mm, which is more convenient for users. In addition, this enables a created recipe to be reused with this calibration if the camera moves or is changed (e.g. creating a recipe using a 2 MPx camera and then switching to a 5 MPx device). This calibration is also used to correct geometrical distortions of the optics used (which may be substantial at low focal lengths, i.e. 8 mm). Finally, by carrying out this calibration, the Feeder calibration will be performed at the same time thanks to the two rectangles in the centre of the plate.

If you do not want to use this calibration, then skip to the next step.

To perform pixel/mm calibration, a calibration plate is required (sold by Asyrl or Cognex).

Once the calibration plate is mounted on your Asycube, go to the calibration tab of the HMI:

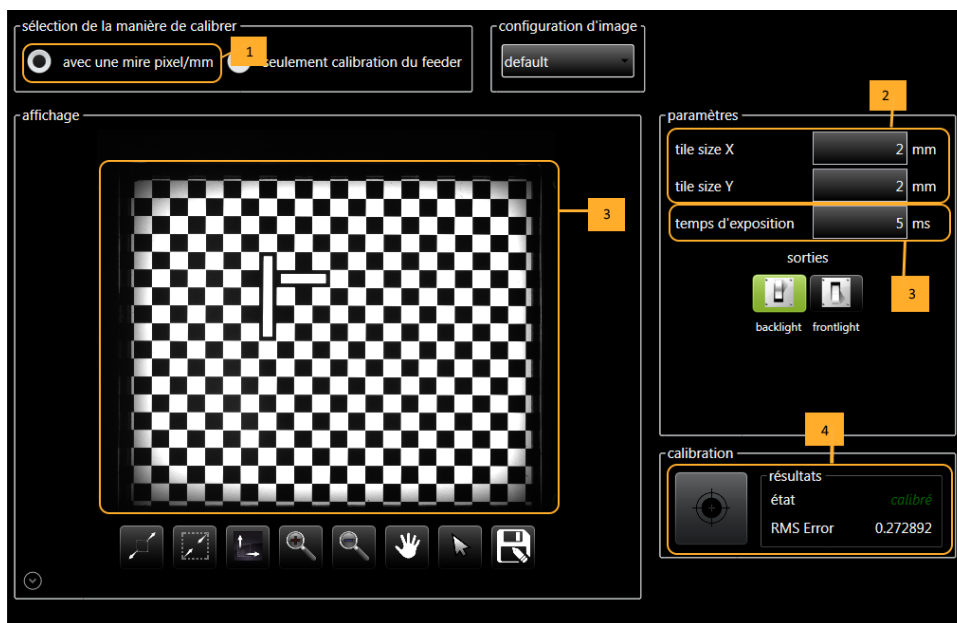
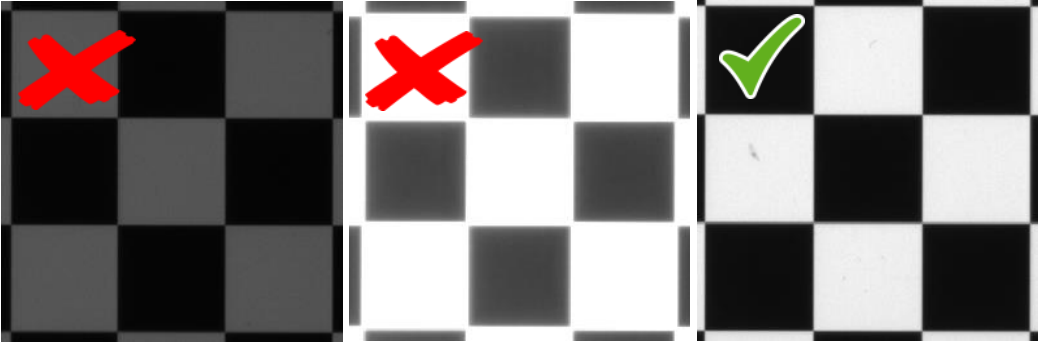


Figure 3-3: Pixel/mm calibration

Step 1	Select the pixel/mm calibration of the camera in the HMI and check that the selected image configuration is the one you want.															
Step 2	<p>If necessary, change the size of the chessboard squares (tile size X and Y) according to your plate. The squares on the standard plates for Asycubes have the following dimensions:</p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>Asycube 50</th> <th>Asycube 80</th> <th>Asycube 240</th> <th>Asycube 530</th> </tr> </thead> <tbody> <tr> <td>Tile size X</td> <td>2 mm</td> <td>2 mm</td> <td>6 mm</td> <td>-</td> </tr> <tr> <td>Tile size Y</td> <td>2 mm</td> <td>2 mm</td> <td>6 mm</td> <td>-</td> </tr> </tbody> </table>		Asycube 50	Asycube 80	Asycube 240	Asycube 530	Tile size X	2 mm	2 mm	6 mm	-	Tile size Y	2 mm	2 mm	6 mm	-
	Asycube 50	Asycube 80	Asycube 240	Asycube 530												
Tile size X	2 mm	2 mm	6 mm	-												
Tile size Y	2 mm	2 mm	6 mm	-												

<p>Step 3</p>	<p>Adjust the image acquisition time so that the intensity is sufficient but the squares are joined correctly:</p> 
<p>Step 4</p>	<p>Click on the "Calibrate" button. Once calibration is complete, the calibration result changes to "calibrated".</p>

IMPORTANT!



As shown earlier in this document, it is important to calibrate close to the height at which the parts will be seen by the vision system and not systematically on the platform surface.

To do this, use the platform raising kits to adjust the calibration height.

3.2. Calibrating the feeder

If you use the pixel/mm calibration, this calibration is performed automatically. Otherwise, simply define which side of the camera image the hopper is on, in the image sent by the camera. This will allow AsyView to perform the feeder calibration.

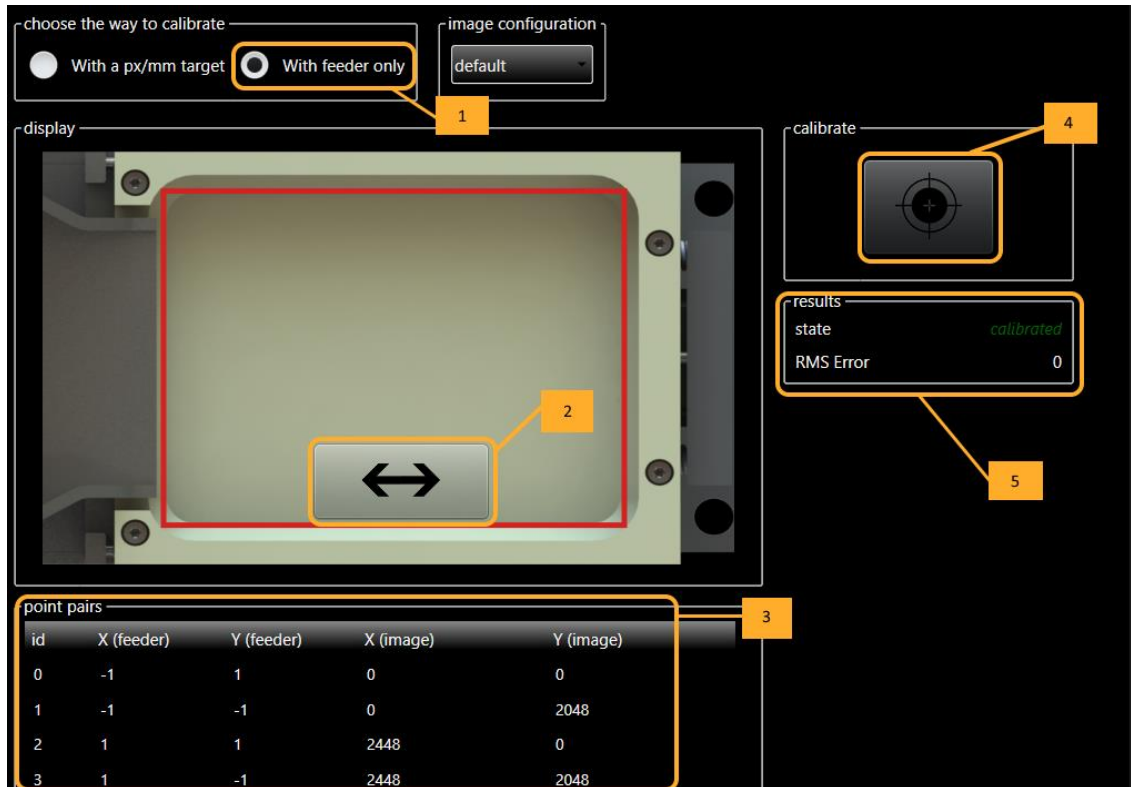


Figure 3-4: Feeder calibration

Step 1	Select feeder calibration.
Step 2	Click on the double arrow to define which side the hopper is on, in the image taken by the camera. This affects the values in the correspondence table.
Step 3	If required for special configurations, enter the values in the table.
Step 4	Click on the "Calibrate" button.
Step 5	Once calibration is complete, the calibration result changes to "calibrated".

3.3. Calibrating the process

The purpose of this calibration is to create a correspondence between a position sent by the camera and the identical position in the coordinate system of the process (robot, handling arm, etc.).

To do this, Asyrl offers a calibration platform, which is a plate with holes.

It is therefore necessary to create a model that detects these holes, which will acquire the positions in the vision coordinate system of the 4 external points of the platform.

The HMI process calibration tab then allows you to run the model and choose from among the positions found those which will be used for calibration (the outermost positions of the work surface, if possible).

As regards the positions of the process coordinate system (robot, handling arm, etc.), the robot specialist defines the optimal method of obtaining the positions of the 4 holes in the process coordinate system. For example:

- feeling with a calibration tool fitted with a ball.
- using the dedicated tool sold by Asyrl
- feeling with a pin which is inserted into the holes of the platform.
- inserting a pointed pin into the platform hole and aligning this point with another point held by the robot.
- etc.

3.3.1. Loading and testing the calibration recipe

NOTE:



This chapter considers that the pixel/mm calibration is already done. If it is not the case, the process calibration recipe will not work. If you have calibrated only the feeder, you must create a calibration recipe in the same way as described in section 4.2.

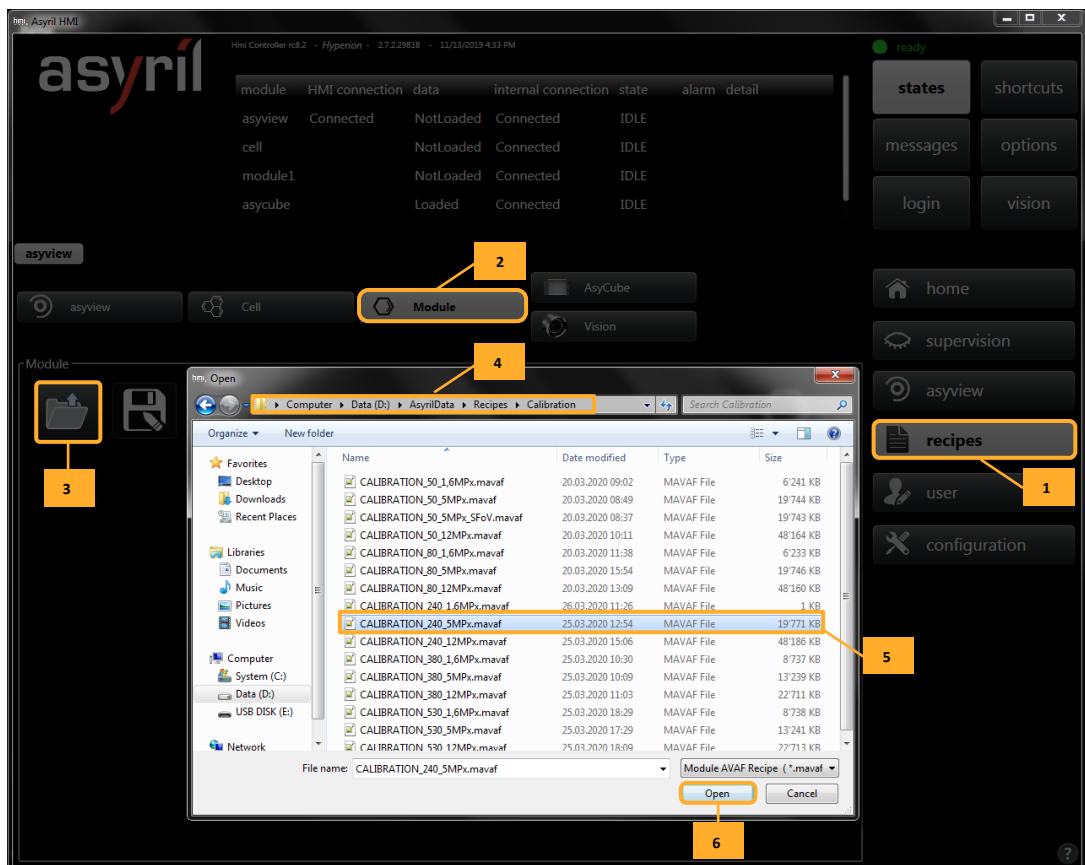


Figure 3-5: Loading the calibration recipe

Step 1	Go to the “recipes” tab.
Step 2	Select “Asyview” → “Cell” → “Module”.
Step 3	Click on the “loading” icon.
Step 4	Go to “D:\AsyriData\Recipes\Calibration”.
Step 5	Select the proper file.
Step 6	Click on “Open”.

NOTE:



The file names depend on the architecture of the module. The general name is "CALIBRATION_XXX_YMPx", XXX being the size of Asycube and Y the resolution.

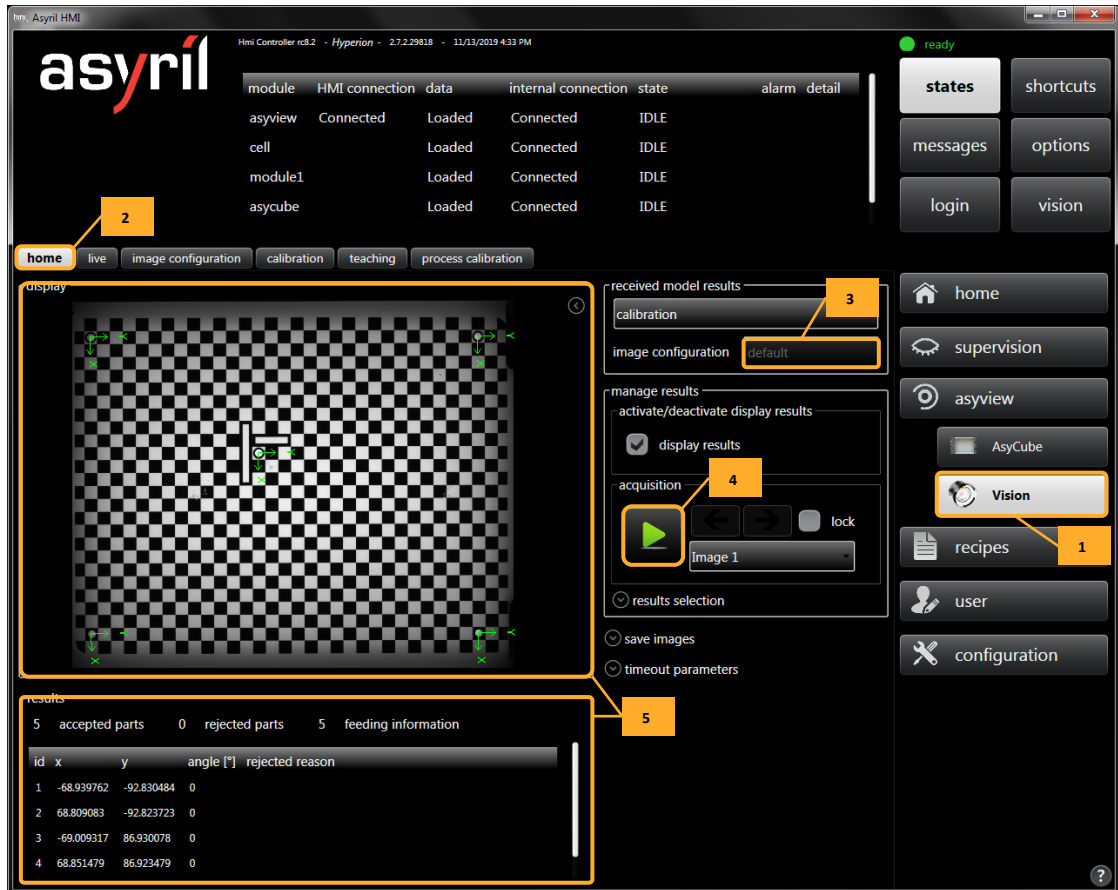


Figure 3-6: Detection control

Step 1	Select “asyview” → “Vision”.
Step 2	Click on the “home” tab.
Step 3	Check that the selected image configuration is the one you want.
Step 4	Take a picture by clicking on the “play” button.
Step 5	Check that the five holes are well detected.



IMPORTANT!

If the five holes are not detected or if the selected image configuration is not the one you want, please refer to section 3.3.3 to adjust the calibration recipe.

3.3.2. Process calibration

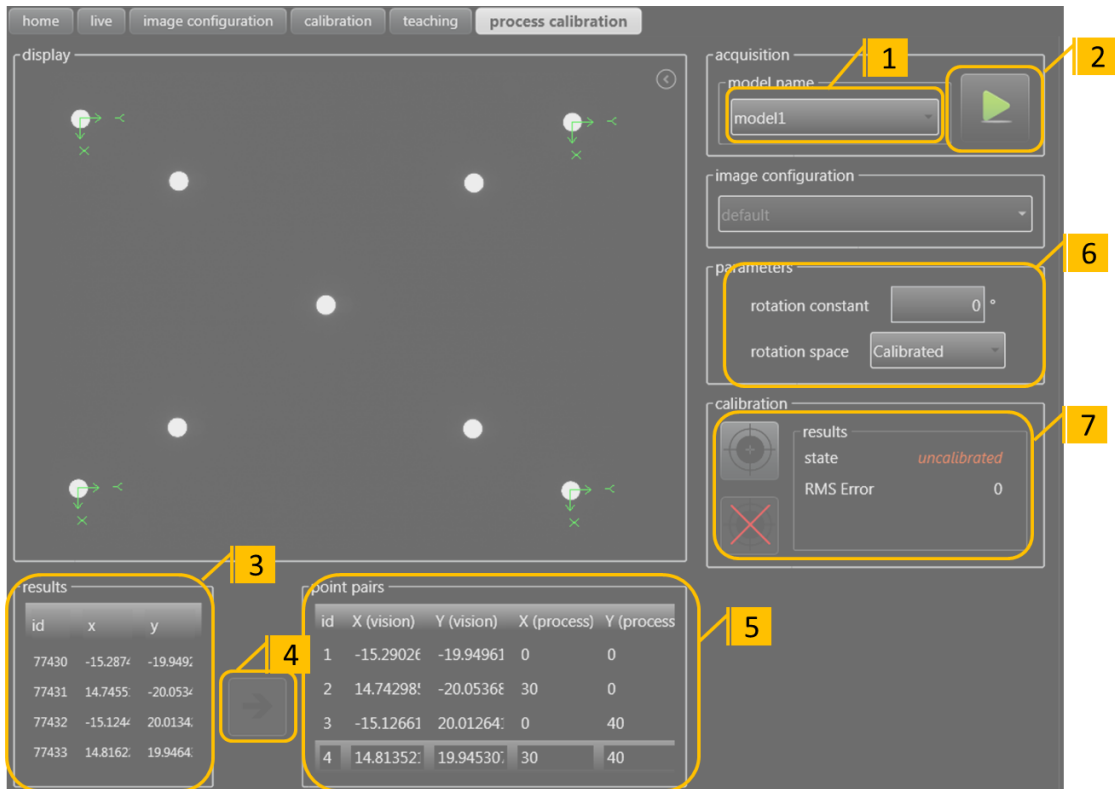


Figure 3-7: Process calibration

Step 1	Choose the model which allows the calibration elements to be found (in this case, the holes).
Step 2	Take the image and analyse the selected model.
Step 3	Choose one of the results obtained and the pair of points in the table into which you want to copy the position.
Step 4	Click on the arrow to transfer the position of the selected result to the "vision" position of the selected pair of points.
Step 5	Fill in the 4 positions with the positions measured by the camera, and the "process" positions according to your method of programming these points with your robot or handling arm (in the image above, dummy values of 30 and 40 have been entered).
Step 6	If necessary, choose the source of the value of the angle you wish to receive (either the one returned in the coordinate system of the process (robot, handling arm, etc.), or that of the vision coordinate system (the process calibration is therefore not applied to the angle). A constant value can be chosen if a constant angle is needed.
Step 7	Click on the "Calibrate" button. Once calibration is complete, the calibration result changes to "calibrated".

IMPORTANT!



If this calibration has already been done before, it will be necessary to decalibrate before starting the vision analysis, otherwise the results obtained will have values in the process coordinate system. It is essential to have positions in the vision coordinate system (pixel or mm) to complete the table of pairs of points.

3.3.3. Adjusting the calibration recipe

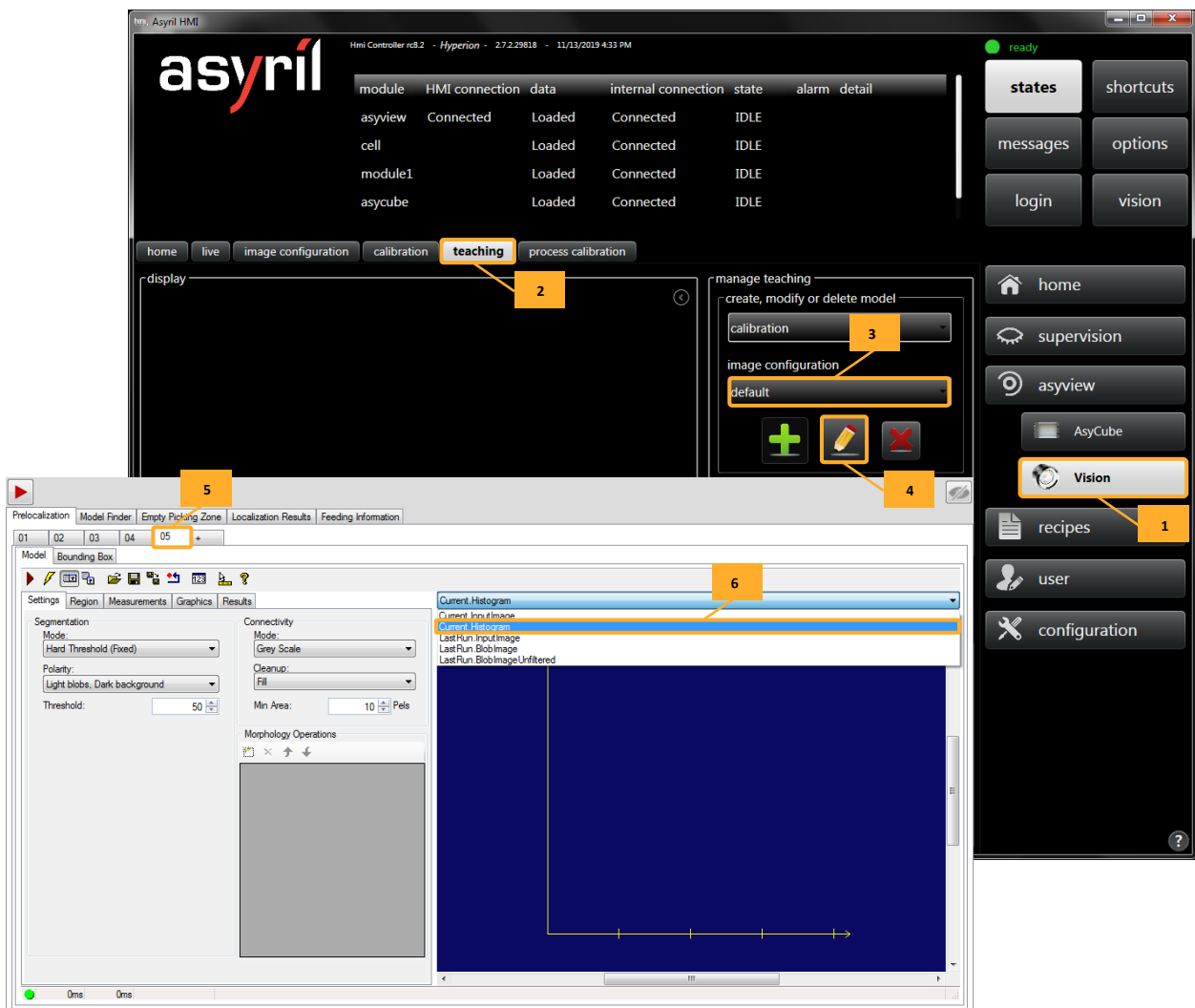


Figure 3-8: Editing the calibration recipe

Step 1	Go to the “Vision” tab by clicking on “asyview” → “Vision”.
Step 2	Select the “teaching” tab.
Step 3	Select the desired image configuration.
Step 4	Click on the “edit” icon.
Step 5	Select the prelocalization “05”.
Step 6	Choose “Current.Histogram”.

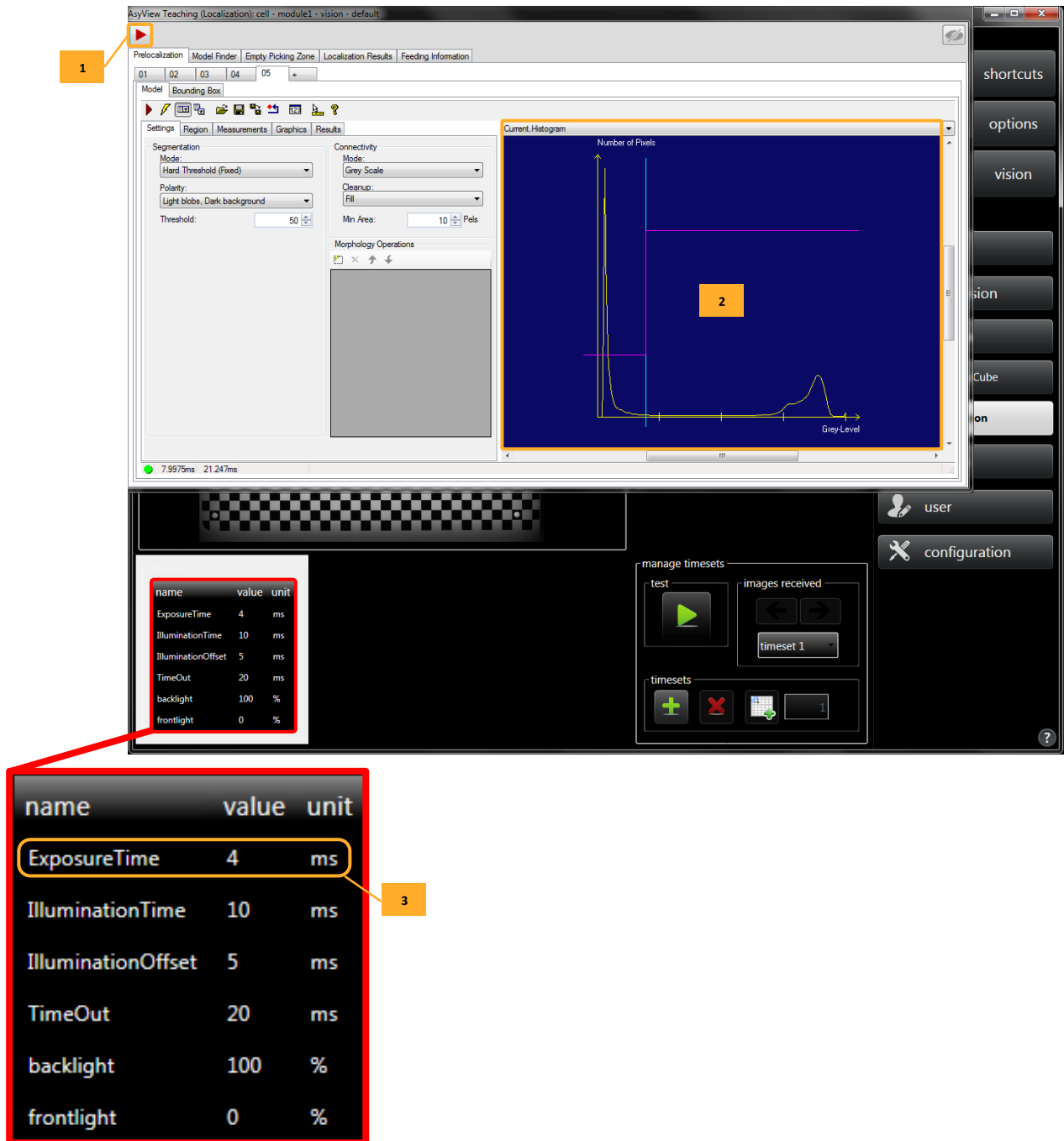


Figure 3-9: Adjusting the exposure time

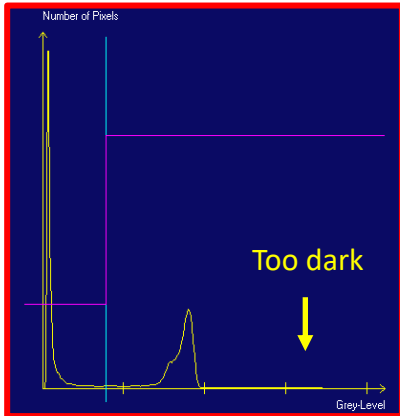
Step 1	Run the algorithm by clicking on the “play” icon.
Step 2	Check the histogram. It must be similar as described in the next page.
Step 3	Adjust the “exposure time”.
Step 4	Redo these steps until the histogram matches with the description.

NOTE:

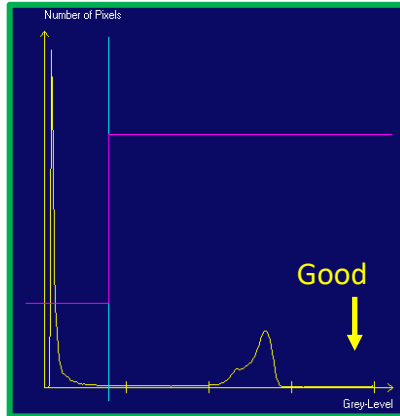


The histogram is a graphic which shows the amount of pixel according to their brightness. In our case, we look for a histogram **without saturation**. It means we want an amount of **0 pixel** on the right side of the histogram.

X Exposure time **too short**



✓ Good exposure time



X Exposure time **too long**

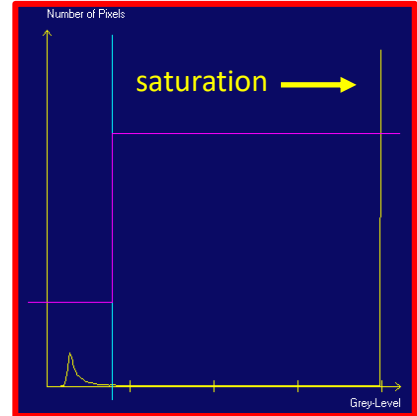


Figure 3-11: Advise to set the exposure time

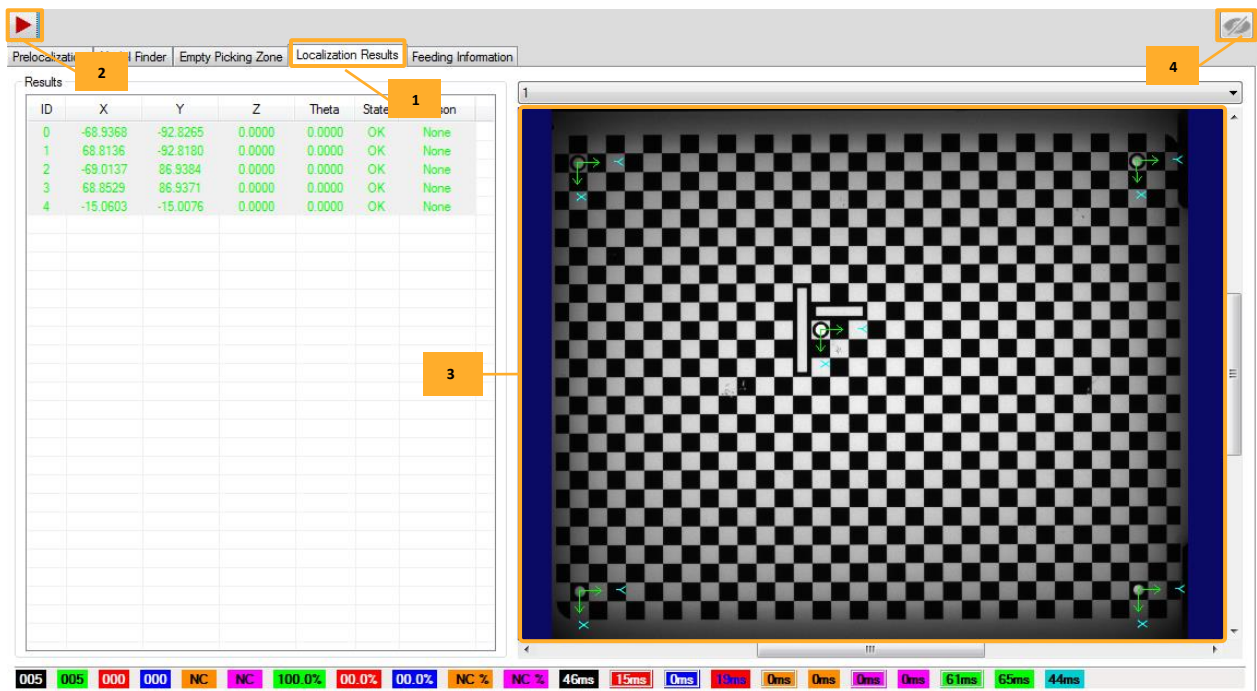


Figure 3-10: Checking the arrow positions

Step 1	Select the "Localization Results" tab.
Step 2	Run the algorithm by clicking on the "play" icon.
Step 3	Check that the five holes are well detected with arrows in the center.
Step 4	Click on the "crossed out eye" to hide the window.

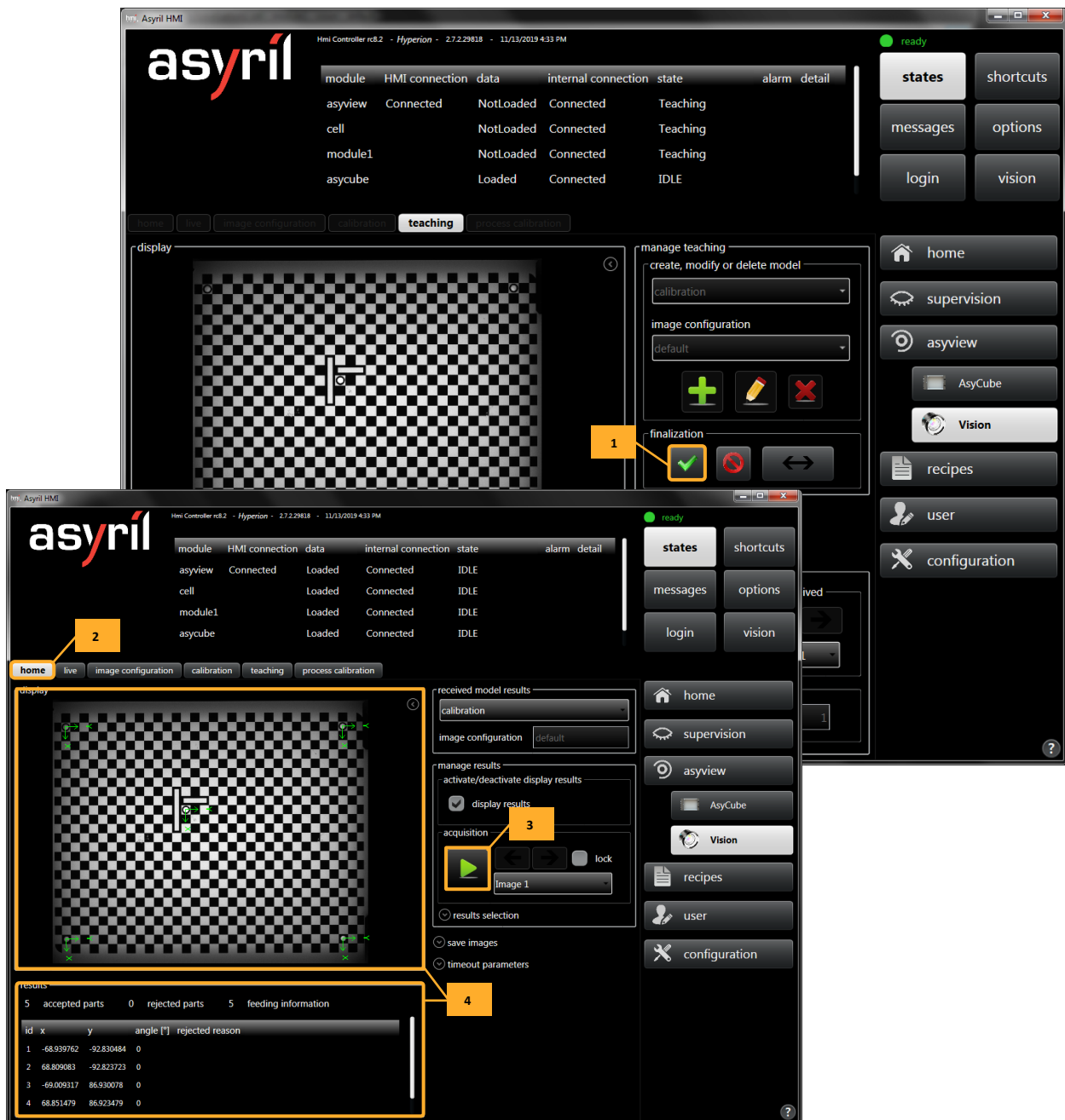


Figure 3-12: Detection control

Step 1	Apply the teaching by clicking on the “green tick”.
Step 2	Click on the “home” tab.
Step 3	Take a picture by clicking on the “play” button.
Step 4	Check that the five holes are well detected.

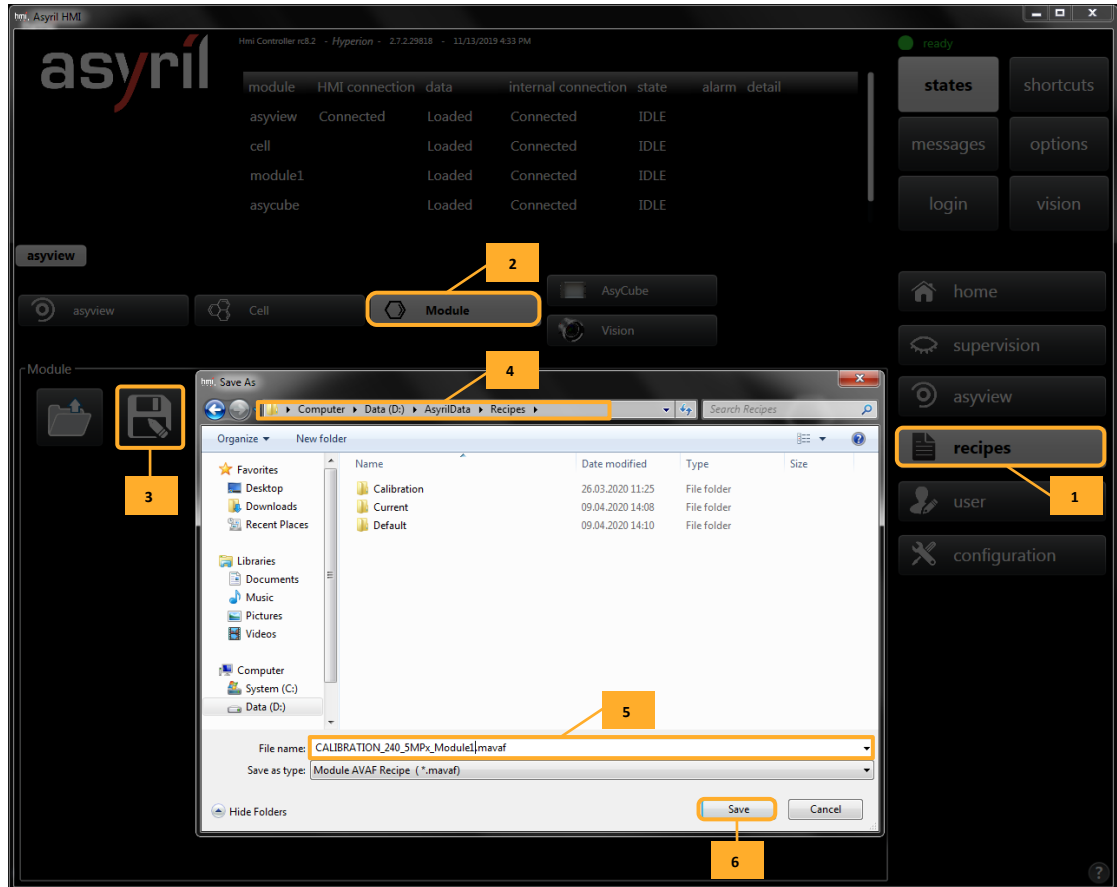


Figure 3-13: Saving the adjusted calibration recipe

Step 1	Go to the “recipes” tab.
Step 2	Select “asyview” → “Cell” → “Module”.
Step 3	Click on the “saving” icon.
Step 4	Go to “D:\AsyrlData\Recipes”.
Step 5	Name the file as described in the notes below.
Step 6	Click on “Save”.



NOTE:

The file names depend on the architecture of the module. The general name is "CALIBRATION_XXX_YMPx", XXX being the size of Asycube and Y the resolution.

NOTE:



If you have several modules, we suggest you add the module number at the end of the file name:

- "CALIBRATION_240_5MPx_Module1"
- "CALIBRATION_240_5MPx_Module2"...

4. Creation and configuration of a new recipe

Different levels of recipes are available to make it easier to access, load and save the different levels of the machine as well as to combine the configurations according to the application.

A recipe is identified by the *.vrec file extension and contains all the data needed to configure the complete vision and feeding system. The following sections contain a tutorial type description of the configuration of a new recipe. However, the information contained in this section also applies to modification of an existing recipe.

The various steps described in this chapter are shown in the following figure.

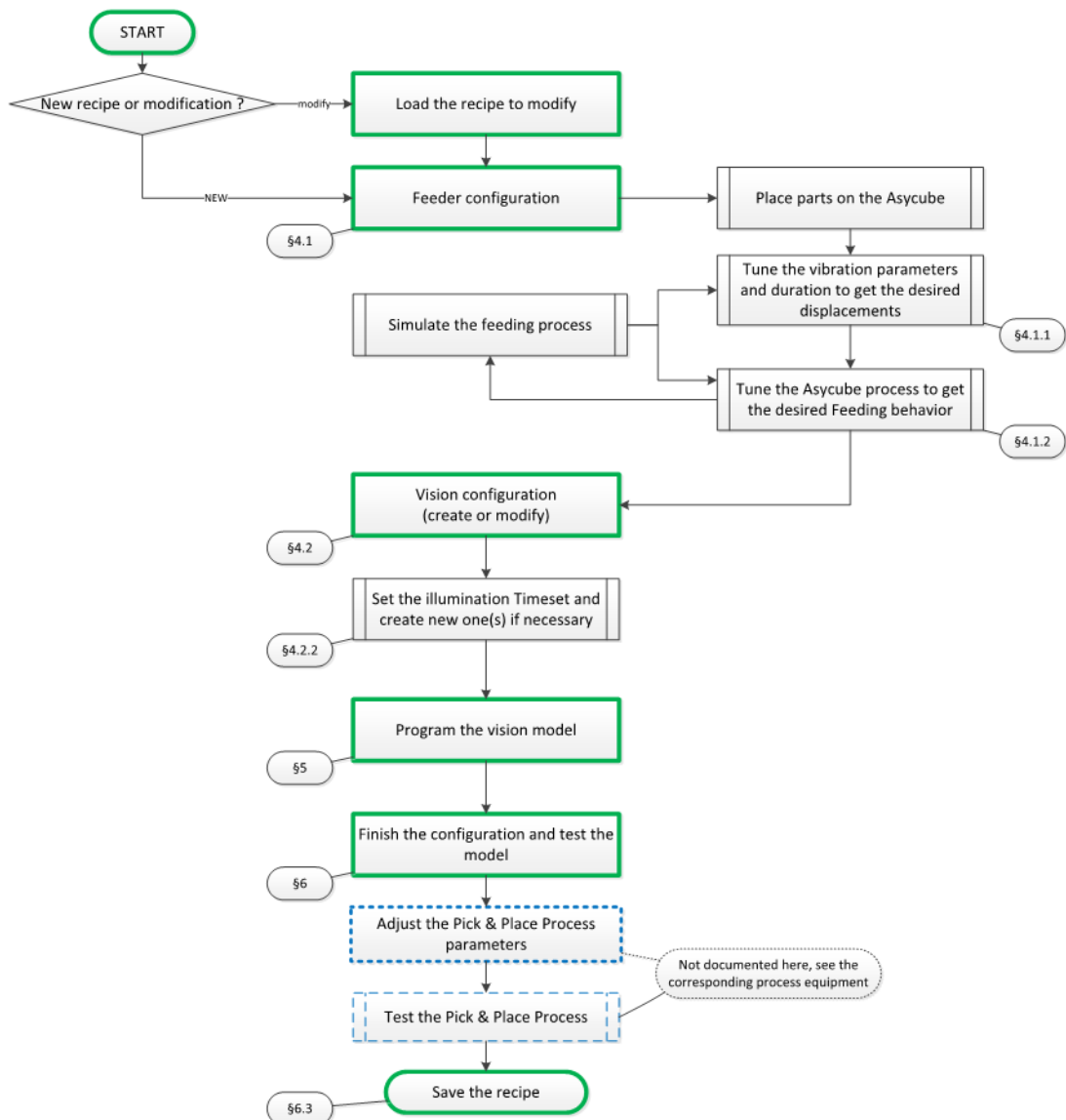


Figure 4-1: Standard scenario for configuring or modifying a vision and feeding recipe

4.1. Configuring the Asycube



Reference

More details on the configuration of the Asycube in the specific documentation of the Asycube used.

4.1.1. Vibration of the Asycube platform and reservoir

Step 1	Click on the "Asycube" button.
Step 2	Click on the "adjustment" tab, then select what you want to adjust: easy tune, platform or hopper (vibration or outputs).
Step 3	In easy tune mode, modify the orientation settings for the selected vibration if required. Otherwise, manually adjust the actuators to achieve the required behaviour.
Step 4	Adjust the amplitude parameters and select a frequency which ensures your parts move in the right direction (Important: Not all of the frequencies available will necessarily produce good results for all part geometries).
Step 5	Test the settings made. If the settings are not satisfactory, go back to step 3.

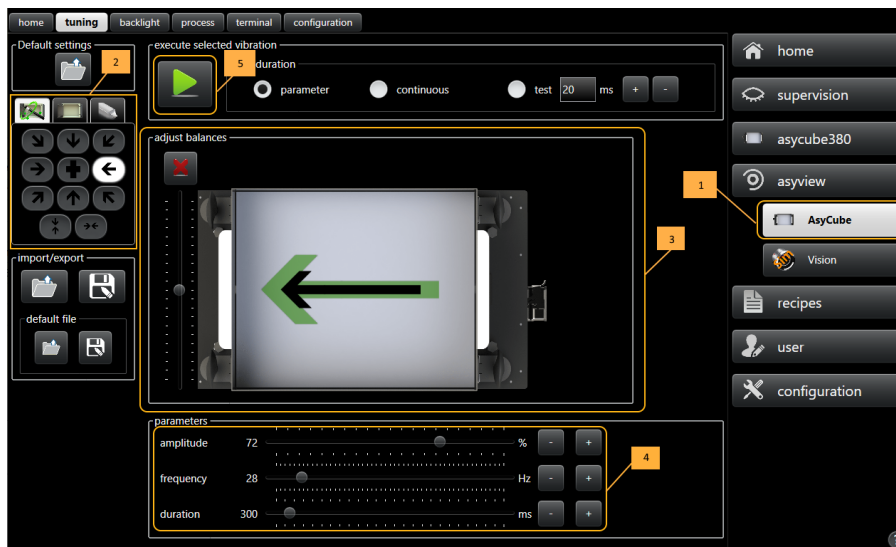


Figure 4-4-2: Adjusting the part feeding parameters




IMPORTANT NOTE:

The vibration duration must always be configured according to the time required for the parts to cross the platform in the corresponding direction.

4.1.2. Configuring the vibration process

Step 1	Click on the "Asycube" button
---------------	-------------------------------

Step 2	Click on the "Process" tab
Step 3	You can load a default sequence by clicking on this button, if desired. This is a good starting point in most cases. This file is also the default file loaded if you do not load your own at start-up.
Step 4	If necessary, modify the parameters for the process sequences
	NOTE: <i>These parameters can be readily modified (duration, sequence, order of vibrations), but do not forget to finish with a <u>stabilisation</u> phase ("Wait") to prevent the parts from moving when an image is being taken.</i>
Step 5	If required, activate the platform/hopper synchronisation option (see 4.1.2.1)
Step 6	Use the simulator to monitor the process.

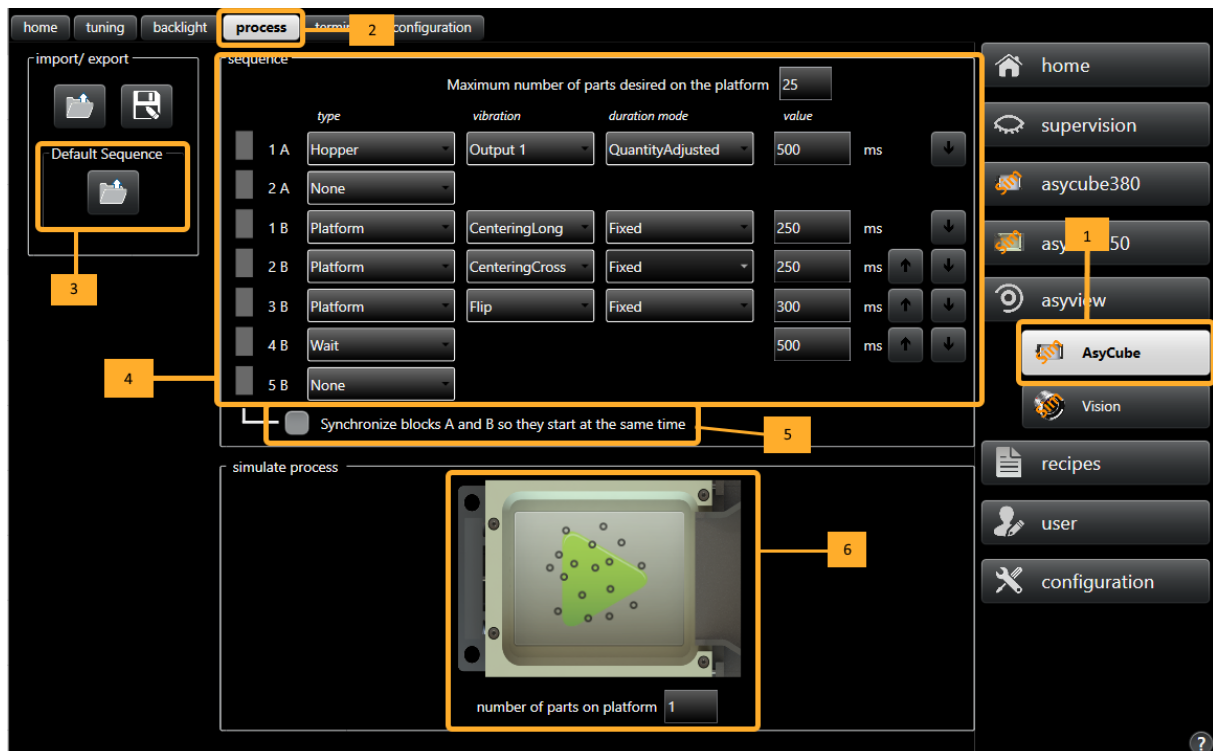


Figure 4-2: Defining the vibration sequences

It is possible to set the system to adapt the vibration duration depending on the number of parts on the platform by selecting the "Quantity Adjusted" option as the duration mode.

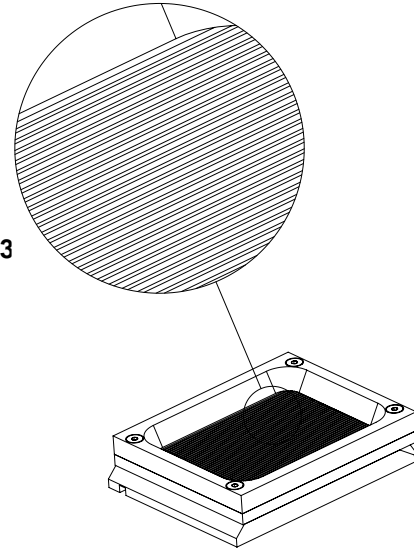
To take account of the position of the parts on the platform in order to distribute them uniformly, the "centering" option is included in the sequence. In this case, the algorithm automatically sets the vibration duration and the optimal motion to be applied. A typical platform sequence of vibrations may be:

- Centering
- Flip
- Wait

In order to reduce the component stabilisation time, the Asycube platform may be machined (grooves, holes, etc.). In this case, the vibration sequence must be adapted to the type of platform (so that the parts are directly positioned in the grooves or holes for example). In the case of a grooved platform, a typical vibration sequence may be:

- Flip
- Forward
- Backward

Figure 4-3



List of parameters for the available commands:

Location	Direction	Vibration	Usability
Reservoir	Output 1/forward	A	Outputs for Asycube 240/380/530, Forward for 50/80
Reservoir	Output 2	B	Outputs for Asycube 240/380/530
Reservoir	Custom	C–Z	Execute a custom vibration with one of the vibrations C to Z as defined.
Platform	Forward	A	
Platform	Forward left	B	
Platform	Forward right	C	
Platform	Left	D	
Platform	Right	E	
Platform	Backward	F	
Platform	Backward left	G	
Platform	Backward right	H	
Platform	Flip	I	
Platform	Short axis centering	J	Only for Asycube 240, 380 and 530
Platform	Long axis centering	K	Only for Asycube 240, 380 and 530
Platform	Custom	L–Z	Execute a custom vibration with one of the vibrations L to Z as defined.
Platform	Centering	None	Execute a custom vibration with one of the vibrations L to Z as defined.
None	Stabilisation	None	Wait a defined time (usually until the parts are stabilised).

4.1.2.1. Synchronisation mode

The first block of the process (the first two lines) correspond to the vibrations of the hopper. The second block (the subsequent lines) correspond to platform vibrations. It is possible to

synchronize these blocks so that the hopper and the platform start to vibrate at the same time (in order to save time) by activating the synchronisation option, as shown in the figure below.

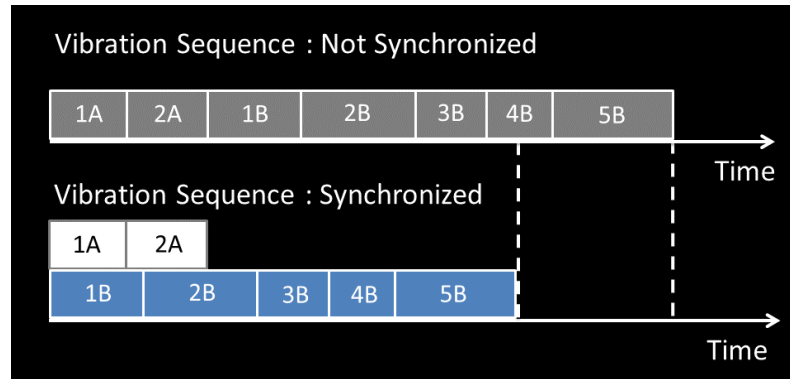


Figure 4-4-3: Effect of synchronisation mode on the cycle time

4.1.3. Configuring the process for two components and two hoppers

If using two components (and therefore two models, with one type of component per hopper), the process must be configured so that the two hoppers vibrate depending on the number of each component model remaining on the platform.

To do this, Asyrl has provided an easy tuning system. Simply adjust this in the same manner as for a single hopper. In this simple case, the objective is always for the duration of the hopper vibration to enable the platform to be filled with the number of parts required on the platform (100 parts in the example shown above).

Let's take an example:

- Number of parts required on the platform: 100
- Required distribution between the parts: 50 A parts and 50 B parts
- Vibration duration to feed 100 A parts: 2000 ms
- Vibration duration to feed 100 B parts: 1000 ms

If the platform contains ten parts (five A parts and five B parts), the system will calculate that 45 A parts and 45 B parts are missing and the vibration therefore must last 900 ms for hopper 1 ($T = \frac{2000}{100} \times 45$) and 450 ms ($T = \frac{1000}{100} \times 45$) for hopper 2.

If the platform contains 60 parts (30 A parts and 30 B parts), the system will calculate that the vibration will last 600 ms ($T = \frac{2000}{100} \times 30$) for hopper 1 and 300 ms ($T = \frac{1000}{100} \times 30$) for hopper 2.

If the platform contains 60 parts (20 A parts and 40 B parts), the system will calculate that the vibration will last 400 ms ($T = \frac{2000}{100} \times 20$) for hopper 1 and 200 ms ($T = \frac{1000}{100} \times 20$) for hopper 2.

The duration will always be automatically adjusted according to the following formula:

$$T = \frac{\text{Time to have the max parts of the selected type}}{\text{max number of required parts on the platform}} \times \left(\frac{\text{max number of parts required on the platform}}{2} - \text{number of parts of the same type} \right)$$

Important: This formula only applies if a 50/50 distribution between the parts is required

NOTE:

If the application requires twice as many A parts as B parts (in other words, a distribution of approximately 66 A parts to 33 B parts), simply set the vibration durations out of balance. Let's return to the previous example: To feed 66 A parts onto the platform when starting from zero,



vibrations should be last $T = \frac{2000}{100} \times 66 = 1320$ ms and to feed 33 B parts, vibrations should last $T = \frac{1000}{100} \times 33 = 330$ ms. To take into account the fact that both parts are on the platform at the same time, these values must be doubled in order to calculate the right vibration duration i.e. 2640 ms for hopper 1 and 660 ms for hopper 2.

To view the method for selecting which hopper to use, please refer to chapter 5.6.

4.2. Configuration of the vision system

Step 1	Click on the "vision" button.
Step 2	Click on the "teaching" tab.
Step 3	Select the model to be used. The "new ..." choice allows you to create a new model.
Step 4a	To create a new model, click on the "+" button. The teaching window opens on the screen after a few moments.
Step 4b	To edit the existing selected model, click on the "edit" button (pencil). This will open the teaching window.
Step 4c	To delete the selected model, click on the "x" button.



NOTE:

When opening "teaching" (creation or modification), the AsyView status will change to "teaching" in the banner screen. Wait until the status has actually changed to "teaching" before moving onto the next step. The "teaching" window will be open at this stage.

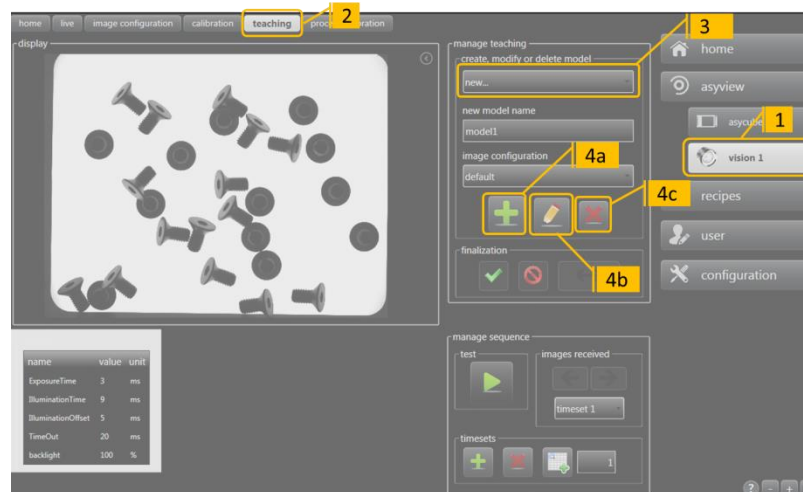


Figure 4-4: Starting the vision model configuration

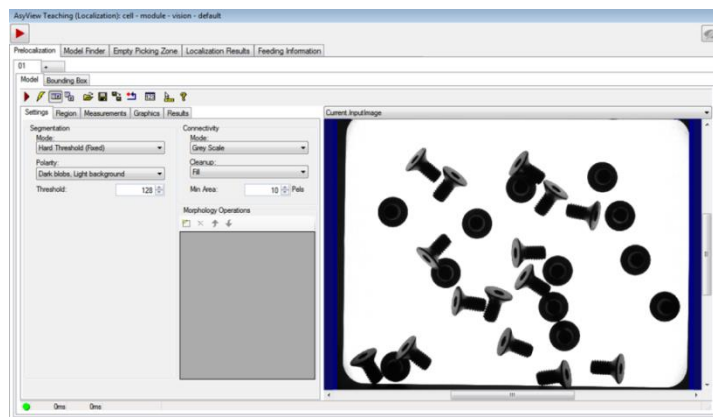


Figure 4-5: Opening the "teaching" window

4.2.1. Selection of the vision analysis type

The vision processing tools are pre-configured to make the configuration and production processes quicker, easier and more reliable.

A vision recipe is created in 5 main steps as explained in 6.3

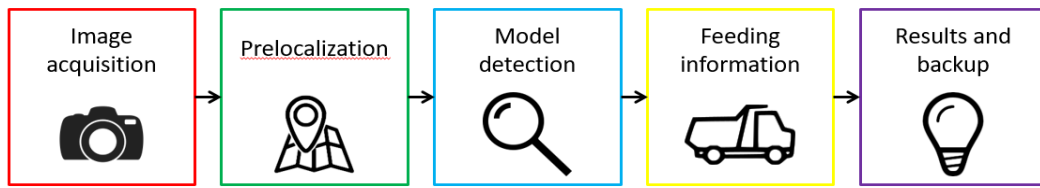


Figure 4-6: 5 main steps for creating a vision recipe







Step	Objective	Important points
1. Image acquisition 	To obtain the best image possible	<ul style="list-style-type: none"> - Favour images which have a good contrast between the components and the background - Make the details needed to differentiate the components visible - It is possible to acquire multiple images with different lighting and exposure times
2. Pre-localization 	To quickly locate all good candidates	<ul style="list-style-type: none"> - An image with a good contrast enables better Pre-localization - Filtering the good candidates reduces the total calculation time
3A. Detection of the model 	To detect correctly oriented components	<ul style="list-style-type: none"> - Definition of the picking point - It is possible to perform a second detection to differentiate the components - It is possible to perform the detection(s) on different images
3B. Exclusion zone 	To avoid collisions during picking	<ul style="list-style-type: none"> - The size and shape of the exclusion zone can be adjusted according to the gripper
4. Feeding information 	To determine the number of components remaining after picking and their average position on the Asycube	<ul style="list-style-type: none"> - The approximation of the remaining number of components is used to optimise feeding and the vibration sequence
5. Results and saving 	To display the results. To save parameters in a recipe	<ul style="list-style-type: none"> - To obtain the precise coordinates of at least 1 correctly oriented component as quickly as possible.

Table 4-1: Purpose and content of the steps for configuring a vision recipe

4.2.2. Configuring the illumination parameters

Step 5	<p>Set the type of lighting, exposure time and number of images.</p> <p>This tab is used to test the images acquired.</p>
---------------	---

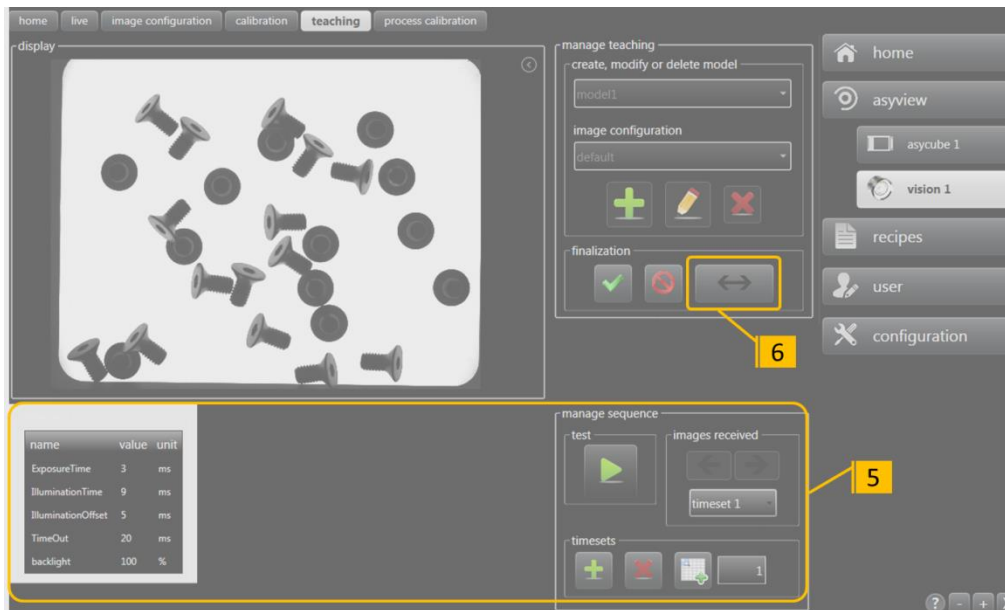


Figure 4-7: illumination parameter on the HMI

The parameters available on the timesets are used to configure the image acquisition process:

- exposure time [ms]: actual acquisition time of the camera for taking the picture
- illumination time [ms]: period during which the illumination is activated
- illumination offset [ms]: period of illumination prior to taking the picture
- waiting period [ms]: minimum time between two image acquisitions
- intensity of back-lighting [0 or 100%]
- intensity of front-lighting [0 to 100%]

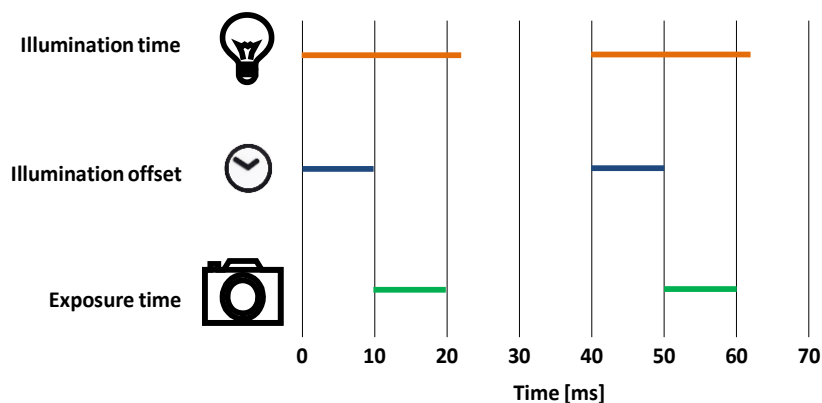


Figure 4-8: Definition of exposure time and duration of illumination

The illumination time must be longer than the exposure time. In order to ensure that the lighting (DOAL or back-lighting) is at full power when the photo is taken, it is necessary to delay the image acquisition by using the illumination offset function and to switch off the lighting one to two milliseconds after the image acquisition is completed. Figure 4-8. illustrates the management of these times.

NOTE:



In general, it is sufficient to modify only the duration of exposure and the intensity of the illumination. The other parameters are then automatically adjusted to optimise the sequence. For more advanced configuration, however, it is still possible to manually set all the parameters.

The HMI makes it possible to add or delete an image acquisition and to test the entire acquisition and illumination sequence. The displayed image is available by clicking on the corresponding duration setting or by using the arrows and the selector in the image management area.

IMPORTANT NOTE 1:

In the location process on an Asycube:



- *The first timeset (and therefore the first image acquired) is always used for the Pre-localization operation. This acquisition is done with back-lighting in 99% of cases.*
- *In general, the second timeset (and therefore the second image) is usually configured with front-lighting, but can also be done with back-lighting (or both).*

IMPORTANT NOTE 2:



Visually check that the images acquired are correct because the entire vision model will be based on these images!

4.3. Programming the vision model

Step 6


Change to programming the vision model via the "teaching" window. Click on the "↔" button in the HMI window to access the teaching window. This is only valid when the HMI is active on the same PC as AsyView.



See section 4.3 Programming the vision model" for information on the different parameters and options available in the "teaching" window.

IMPORTANT NOTE:



Click on the "Run"  button at the top left to run image acquisition and full analysis of the model.

This action must be performed at least once when programming a new recipe to allow correct allocation of images to the different tools.

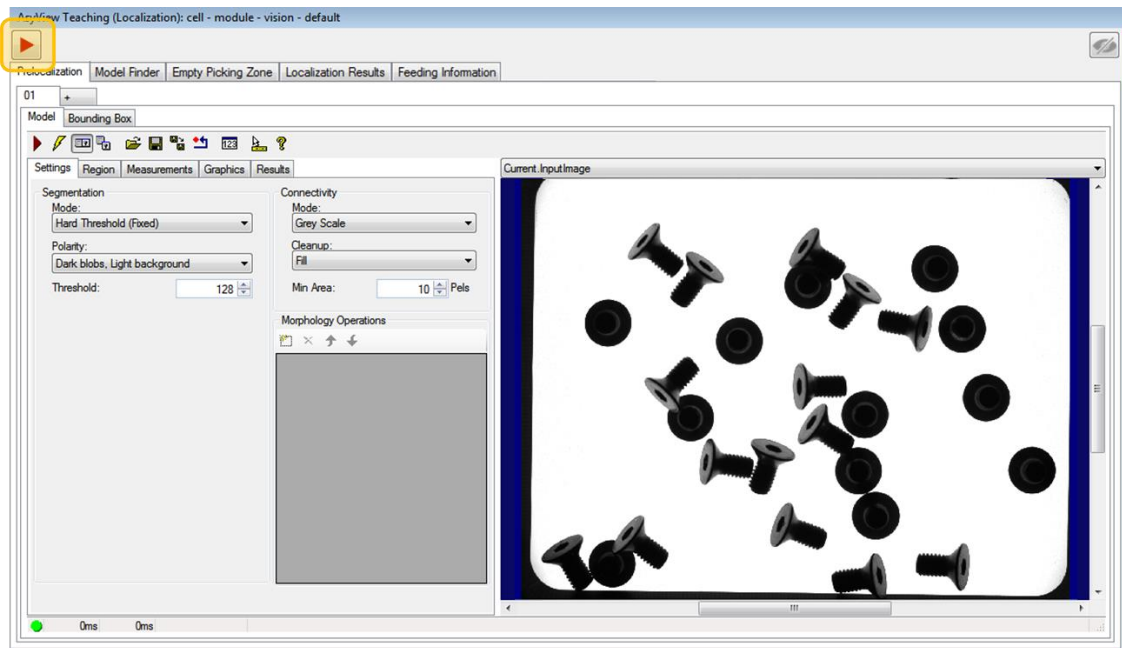


Figure 4-9: Vision teaching window

5. Programming the vision model

5.1. Overview

Click on create ("+" button) or edit ("pencil" button) in the HMI teaching tab to open the following window:

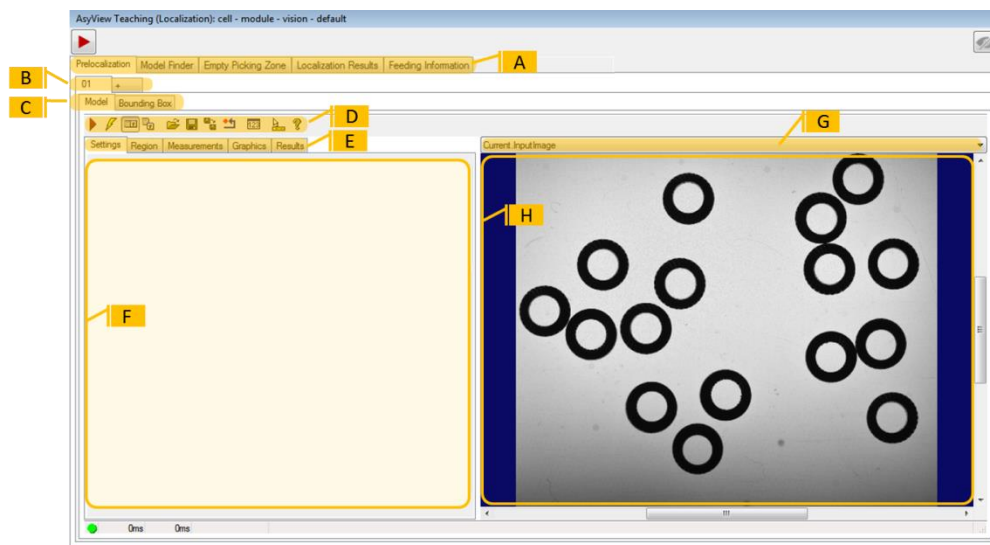




Figure 5-5-1: General overview of the AsyView Teaching window

Ref.	Designation	Description
(A)	1 st level of tabs	Each tab corresponds to a specific tool: <ul style="list-style-type: none"> - Pre-localization. - Model finder - Empty Picking Zone (growing and region) - Location Results - Feeding information
(B)	2 nd level of tabs	This series of tabs includes a "+" tab which allows you to add a tool and consequently to apply several models to detect valid parts (for example when it is necessary to detect different parts as valid parts). In this case, the system adds the results of each detection and ensures that the same position is not detected twice (only with a Pre-localization).
(C)	3 rd level of tabs	The content of these tabs will be described in the following sections
(D)	Buttons associated with the 3 rd level of tabs.	The main buttons used include: <ul style="list-style-type: none"> - "Run the tool"  - "Run the tool on each parameter edit" 
(E)	4 th level of tabs	Clicking on the tabs will display the specific content in zone (F).
(F)	Zone specific to each tab	The content of this zone will be described in detail in the following sections
(G)	Image selector	Use this tab to select the image you want to display (original image, reference image, with result markers, etc.)
(H)	Image	This screen displays the image chosen in the selector (G)

5.1.1. Tips and shortcuts

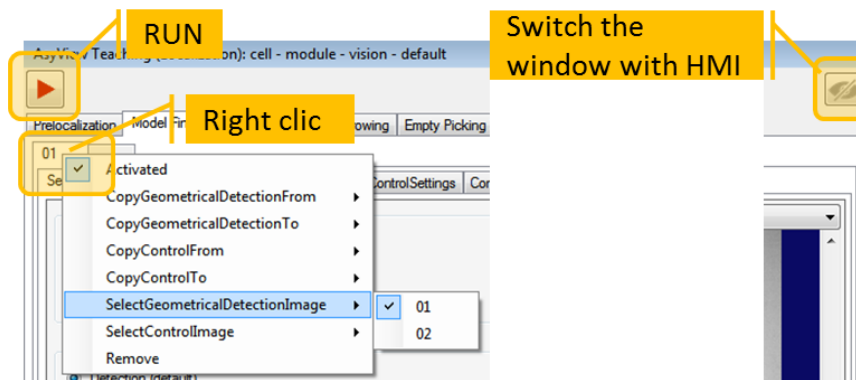



Figure 5-2: Tips and shortcuts


Right-click on the 2nd level of tabs (B) to access various functionalities:

- Activation and deactivation of a tool:
 - o The tool is kept in memory but can be deactivated, e.g. for testing purposes.
 - o Note that the system operates correctly providing there is at least one detection model (Model Finder) and one Feeding Information tool.
- Deletion of a tool:
 - o This deletion is final, there is no way to reload the deleted tool (unless you have previously saved a recipe)
 - o Note that the system operates correctly providing there is at least one detection model (Model Finder) and one Feeding Information tool.
- Copy From/To:
 - o Allows parameters to be imported from a previously configured tool or exported to a specified target.
 - o Note that this function is only available in the model being configured.
- Image selection
 - o Allows you to select the image to use for each tool in the model.
 - o Note that Pre-localization is always applied to the first image, usually with back-lighting on.

The "Run" button  at the top left acquires the image and runs a full analysis of the model with the edited parameters and the correct durations for image acquisition.



NOTE:

The "Run" button  must be activated at least once during the edit or creation of a recipe to acquire images with the correct acquisition durations.

5.2. Pre-localization

5.2.1. Overview

The Pre-localization tool searches for groups of pixels (blobs) in the image which have a higher grey level (or a lower grey level, if required) at a certain defined level. These groups (blobs) can be filtered according to their geometric characteristics, mainly according to their surface.

This first step makes it possible to quickly locate all candidates for picking on the surface of the Asycube. To configure this tool, it is necessary to select the surface of the parts (in pixels or mm² according to the calibration used) together with a threshold value used to convert each portion of the image into black or white according to its grey level.

5.2.2. Configuring the tool: "Model" tab

Step 0 Click on the "Pre-localization" tab, then on "Model" and finally on "Settings".

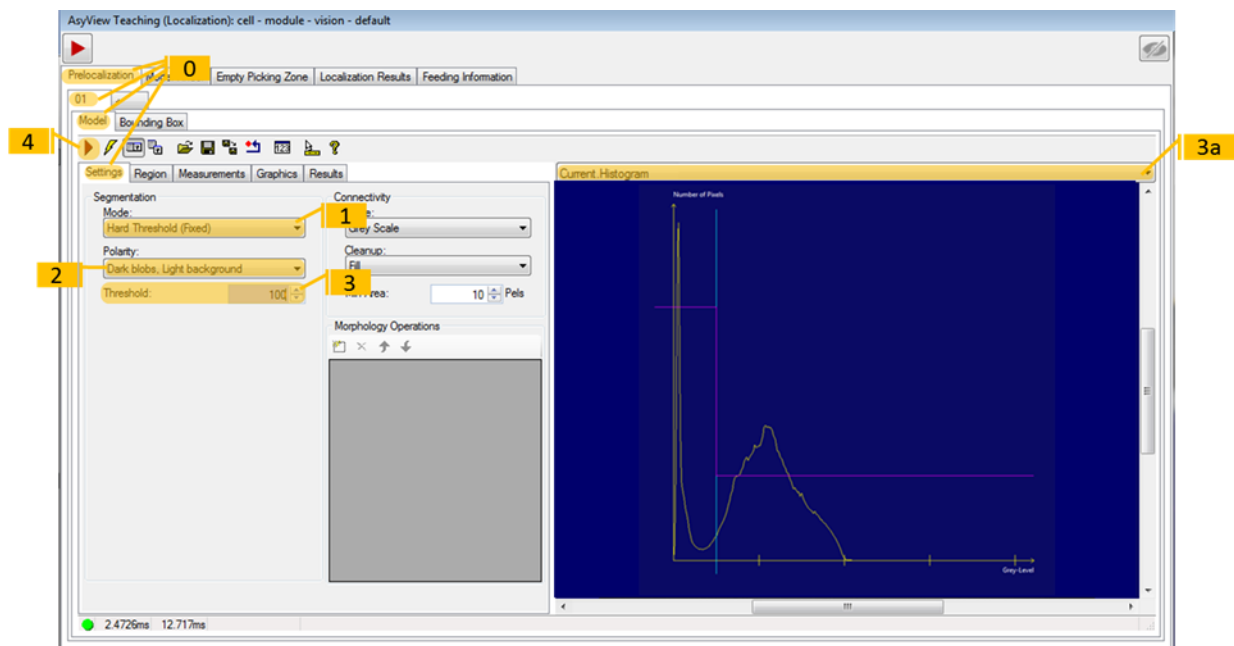


Figure 5-5-3: "Pre-localization" tool, 01\Model\Settings

Step 1	Choose "Hard Threshold (fixed)".
Step 2	Choose the polarity of your parts (black on white background or vice versa).
Step 3	<ul style="list-style-type: none"> a- In the image selector, choose Current.Histogram b- Depending on the histogram, change the threshold value for the number of pixels according to the grey level as shown in Figure 5-5-3.
Step 4	Click on the ▶ button to run the tool and observe the zone detected by selecting "LastRun.InputImage" in the image selector. Modify the threshold value if necessary and run again if necessary.



IMPORTANT NOTE:

The threshold represents the limit between a part and the background in the greyscale range (1 to 255). Depending on the illumination chosen for the 1st image, the polarity might be inverted if the parts are light on a dark background.

5.2.2.1. Picking zone

It is also possible to reduce the surface area for the zone in which you want to find components.

Step 5	Click on the <i>Region</i> tab to display the screen below:
Step 6	Select "cog rectangle" to draw a rectangle, or extend the search to the entire image by selecting "None – Use Entire Image".

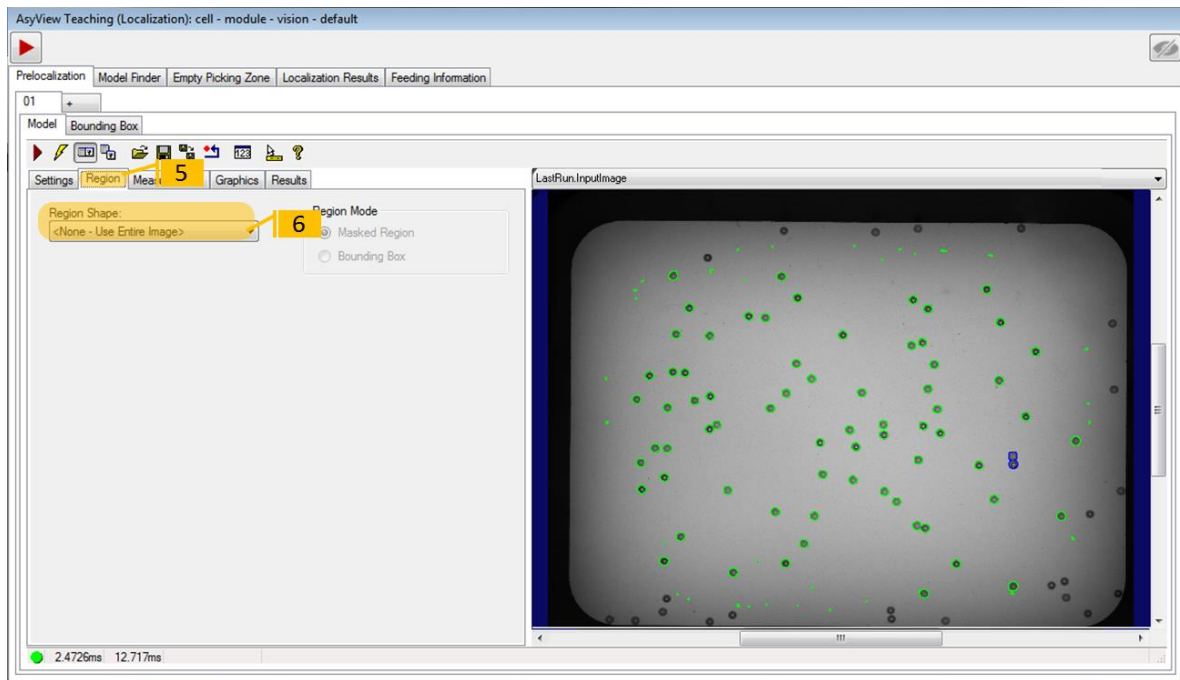


Figure 5-5-4: "Pre-localization" tool, 01Model\Region

5.2.2.2. *Filtering the results*

Step 7 Click on the *Measurements* tab to display the screen below:

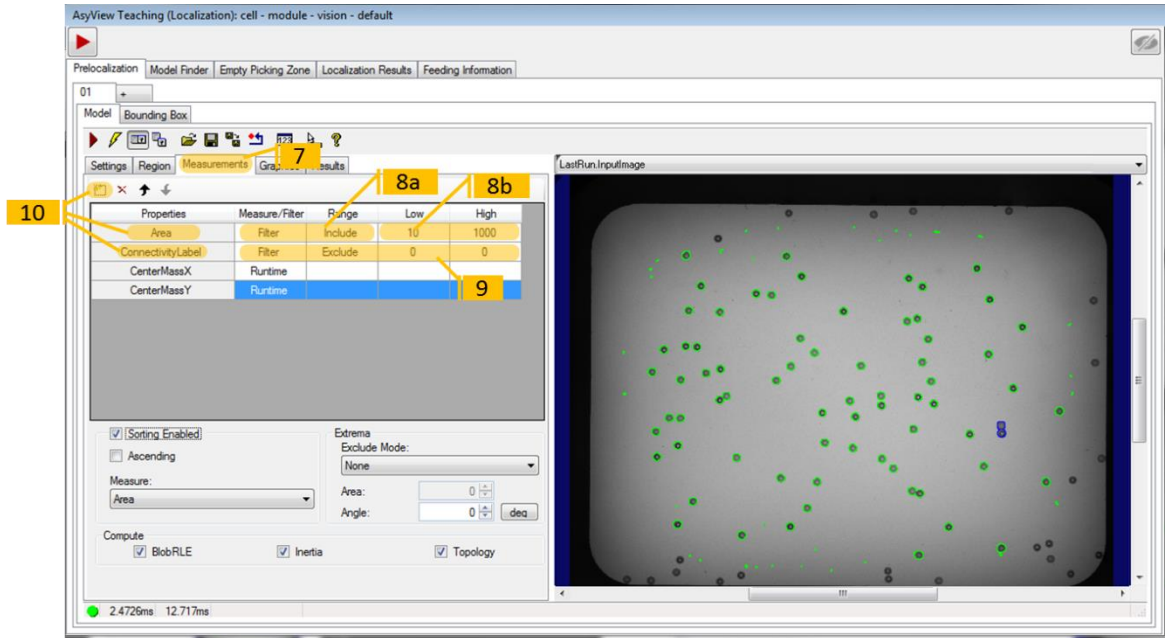


Figure 5-5-5: "Pre-localization" tool, 01Model\Measurements


Step 8	<p>Configure the "Area" property:</p> <ul style="list-style-type: none"> a- Choose "Filter" as the measurement type and "Include" as the value range. b- At this stage of the configuration process, we do not know the surface area of the parts in pixels, therefore choose a fairly wide variation range (e.g. 10 to 10,000). We will narrow this variation range later.
Step 9	<p>Configure the "Connectivity" property:</p> <p>Choose "Filter" as the measurement type and "Exclude" as the value range.</p>

IMPORTANT NOTE:



The value range must be set to "include 0-0" if you want to detect the hole in a part.

The value range must be set to "include 1-1" if you want to detect the external contour of a part.

Step 10	<p>If necessary, click on the "Add new" button  to add and configure a new property.</p>
Step 11	<p>Click on the  button to run the tool.</p>

5.2.2.3. *Analysing the results*

Step 12 Click on the *Results* tab to display the screen below:

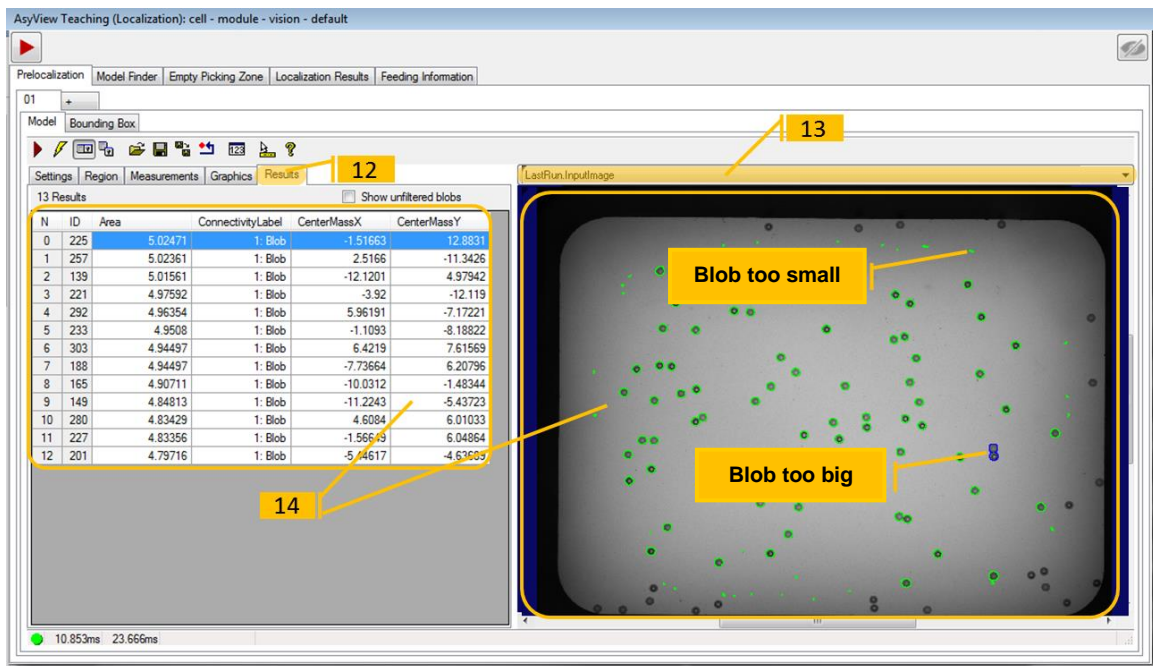


Figure 5-5-6: "Pre-localization" tool, 01\Model\Results

Step 13	Select " <i>LastRun.InputImage</i> " in the image selector
Step 14	Examine the surface area of each component found and determine the smallest and largest surface area, for which one (and only one) component is found as shown in the figure below:



NOTE:

When you select a line in the table, the corresponding blob is displayed in blue in the *LastRun* image and vice versa.

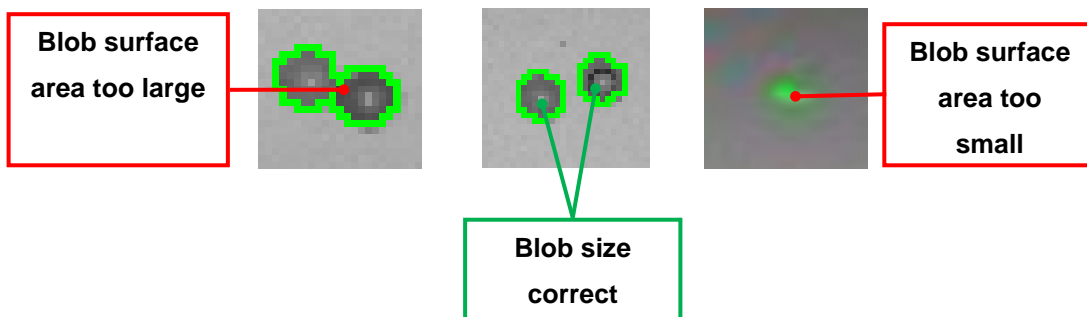


Figure 5-5-7: Definition of the acceptable surface area range

Step 15	Return to the <i>Measurement</i> tab
Step 16	Modify the acceptable surface area range based on the observations made in step 14, then run the tool again.

Check that all the blobs surround one part only. If not, adjust the surface area again.

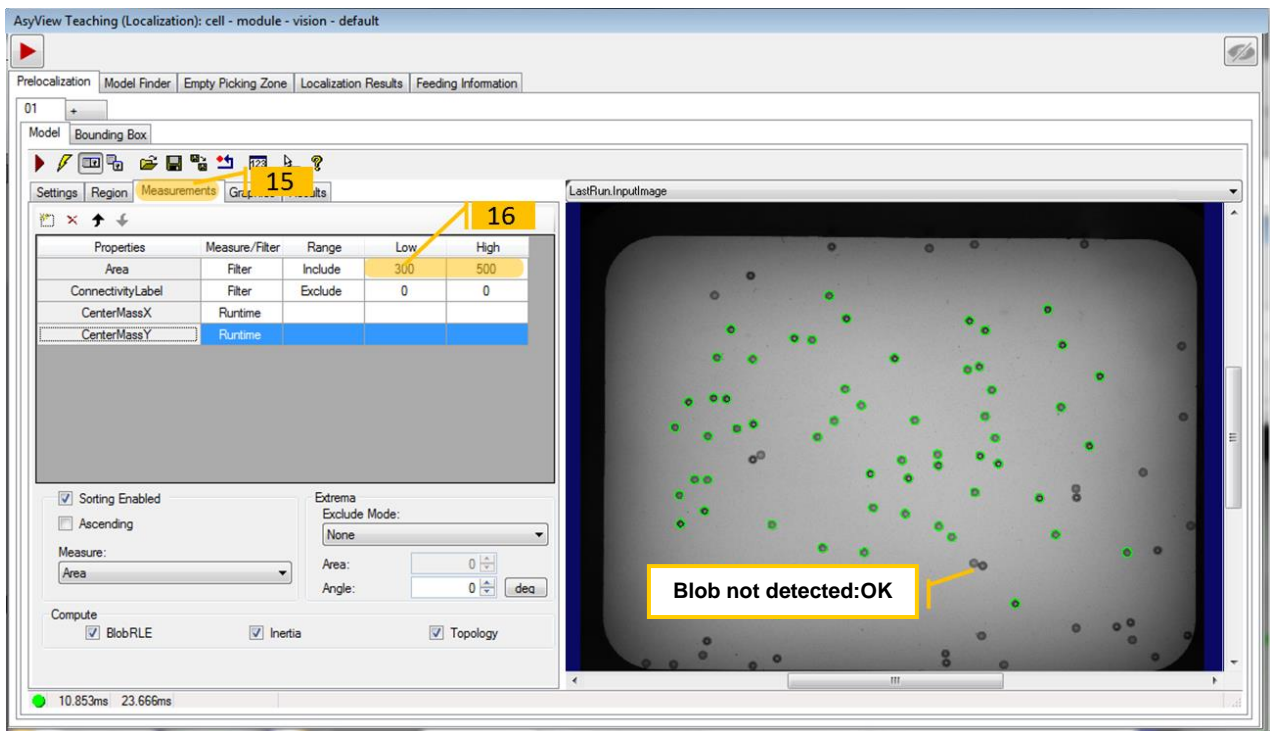


Figure 5-5-8: "Pre-localization" tool, 01ModelMeasurements



NOTE:

It may also be necessary to adjust the threshold value by changing the value selected in step 3.

5.2.3. Configuring the tool: "Bounding Box" tab

Step 17 Click on the *Bounding Box* tab to display the screen shown below:



NOTE:

Pay particular attention to the configuration of this tab if you have chosen to detect a hole in a part. In fact, the surrounding rectangle ("Bounding Box") must contain the ENTIRE part!

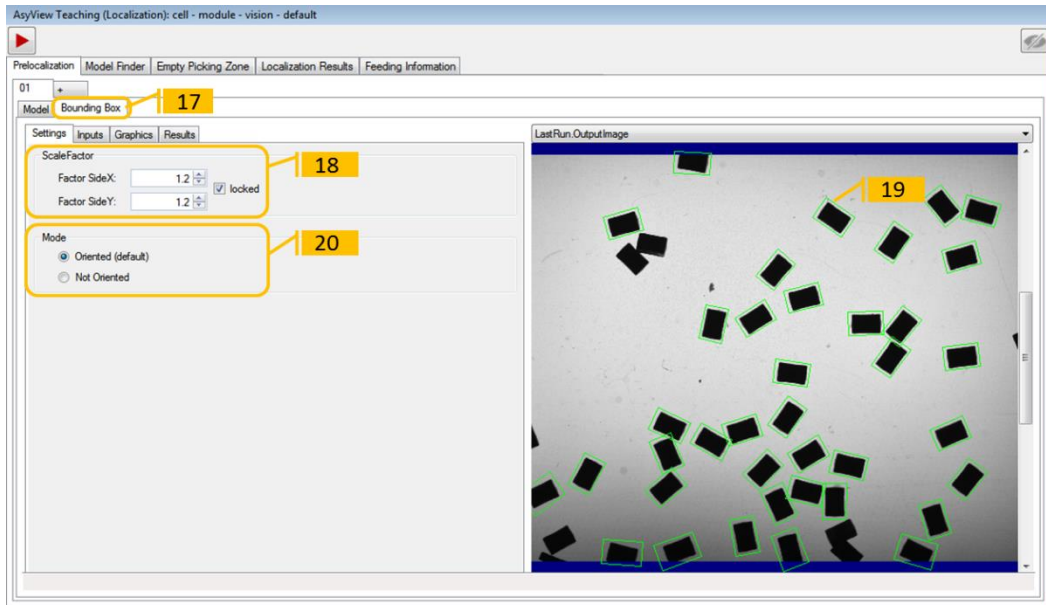


Figure 5-5-9: "Pre-localization" tool, 01\Bounding Box\Settings

Step 18

Select a multiplication factor in the scale factor input field to extend the initial bounding box. For non-symmetrical parts, it is possible to unlock the fields and choose different values for each direction.



NOTE:

The initial bounding box is defined as the smallest rectangle able to contain the entire blob:

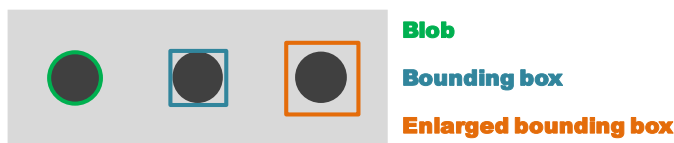


Figure 5-5-10: Defining the "Blobs" and "Bounding Box"

Step 19

Check that your "extended bounding box" contains the entire surface area of the part

Step 20

In the "Mode" setting, "Oriented" means that the bounding box is oriented parallel to the main axis of inertia of the part. For parts with a complex geometry, it may be preferable not to orient this bounding box. The main effect occurs when calculating the "Empty Picking Zone Region" exclusion zone (see §5.4.2) for which the optimal situation is obtained when the contour and the rectangle are as close as possible.

5.2.4. Advanced mode



NOTE:

This section is for advanced users of the vision model configuration using the AsyView teaching mode. If you are a beginner, go to section 5.3.

5.2.4.1. Disabling or deleting Pre-localization

It is possible to configure the vision model without Pre-localization but, before doing so, it is necessary to understand the usefulness of Pre-localization.

In Pre-localization, you use a "blob" tool to search for groups of pixels which could correspond to parts to be detected. By filtering correctly (properly defining the grey level and the surface area of the part), it is possible to very quickly discard many elements that could be poor candidates. This tool will bring up a list of credible candidates that will be sent to the following tool: the "model finder".

The "model finder" will look for a previously programmed model around each candidate found by Pre-localization, which is very fast because the search is performed within a very small area. In addition, as soon as the first positive result is found, it is sent to the next tool. It is therefore very efficient.

Disabling or deleting Pre-localization has the effect of using the "model finder" to search for all candidates within the whole image (and in all orientations if necessary). This is therefore very complicated and takes longer, as no results are sent to the next tool until the whole "model finder" analysis is complete. On the other hand, this allows potential detection of positive results for candidates which would have been rejected by Pre-localization.

In conclusion, deleting Pre-localization should only be used when computation time is not too critical and detection with Pre-localization is difficult as, for example, with semi-transparent parts.

NOTE:



Attention: deleting Pre-localization allows more candidates to be detected but the configuration of the Empty Picking Zone (EPZ) will be accordingly more complex. A good compromise must therefore be found between using Pre-localization and having easier and more efficient EPZs, and not using Pre-localization and having to find a good compromise in the EPZs.

NOTE:



Disabling Pre-localization allows Pre-localization parameters to be saved (i.e. not inadvertently lost). On the other hand, deleting it means a simpler recipe (in terms of loading, saving and size).

5.3. Model finder

5.3.1. Overview

The "*Model Finder*" tool is used to program the model for a correct part (contours) that allows the software to differentiate between correct parts and incorrect parts (especially for front/back detection). The search is applied to all the candidates defined by the Pre-localization tool. This tool allows you to match rotated objects of variable size.

5.3.2. "Settings" tab

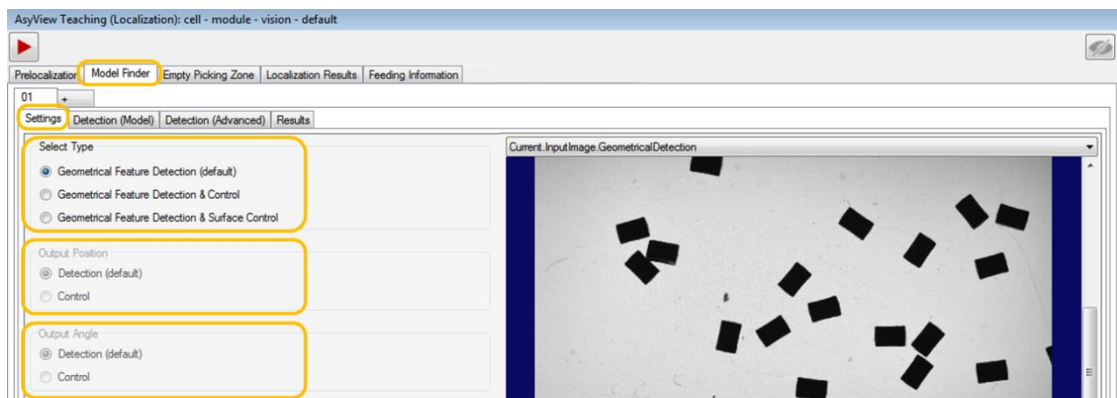


Figure 5-5-11: Settings for the "Model Finder" tool

The Model Finder tool uses Geometrical Feature Detection, optionally followed by a second control. The latter control may also be based on a geometrical model or on the surface characteristics. Their use is described in Table 5-1: Model Finder search tool type.

Type	Examples of use
Geometrical feature detection (default)	Standard case: differentiation between front and back and precise location on the 1st or 2nd image
Geometrical feature detection & control	Two successive geometrical searches, possibly on different images: one for location, the other for front/back differentiation. <ul style="list-style-type: none"> - Parts where the front and back detail do not allow accurate location - Parts where the front and back detail is not in the same position on all the parts
Geometrical feature detection & surface check	Geometrical detection followed by a check of the surface characteristics, possibly on different images: <ul style="list-style-type: none"> - Detection of the contour for location - Different surface characteristics between front and back <p>Note that the surfaces to be detected must be repeatable between parts, allowing for individual imperfections.</p>

Table 5-1: Model Finder search tool type

The picking position must be defined in the tool. By default, it corresponds to the result of the detection and it is directly specified in the geometric model. However, the precise location and differentiation of the front and back of the parts may be carried out on different images.

Therefore, the result of the positioning (picking position) is also programmable according to the specific requirement as indicated in Table 5-2.

Picking position	Output	Remark
Detection	Picking position = Result of the geometric detection	Default
Control	Picking position = Result of the geometric or surface control	Not available if "Geometrical Feature Detection" is selected

Table 5-2: configuration of the result of the picking position

The picking angle must be defined in the tool. By default, it corresponds to the result of the detection and it is directly specified in the geometric model. However, the precise location and differentiation of the front and back of the parts may be carried out on different images. Therefore, the result of the positioning (picking angle) is also programmable according to the specific requirement as indicated in Table 5-3.

Picking position	Output	Remark
Detection	Picking angle = Result of the geometric detection	Default
Control	Picking angle = Result of the geometric or surface control	Not available if "Geometrical Feature Detection" is selected

Table 5-3: configuration of the result of the picking angle

5.3.3. Configuring the tool: "Detection" tab

Step 0

Click on the *Model Finder* tab then on the *Model* tab and finally on the *Train parameters* tab to display the screen below:

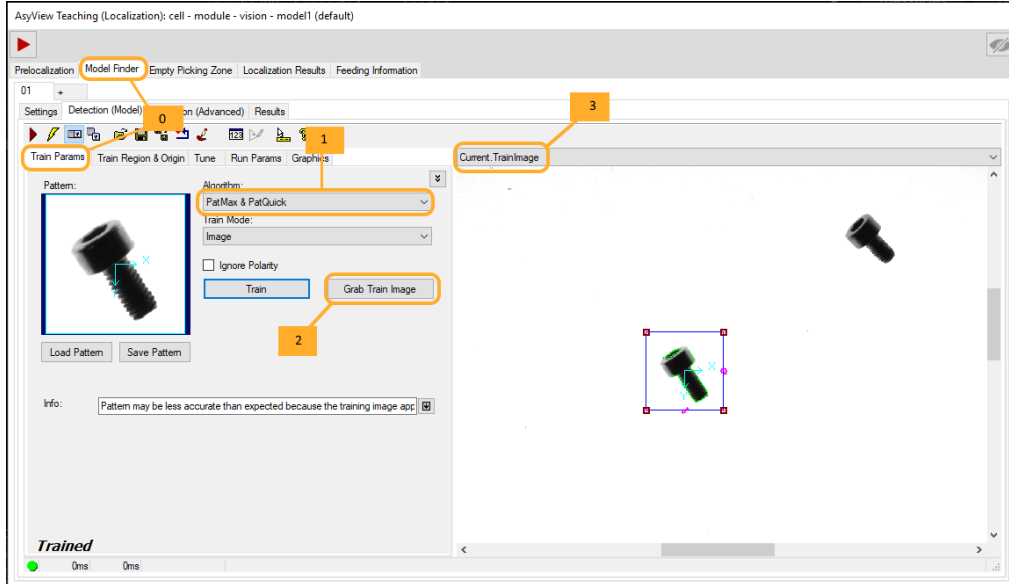


Figure 5-5-12: "Model Finder" tool, 01\Detection (Model) \Train Params

Step 1

Choose the "patMax & PatQuick" algorithm

Step 2

Click on "Grab Train Image"

Step 3

Choose "Current.TrainImage" in the image selector

Step 4

Click on the *Train Region and Origins* tab to display the screen below:

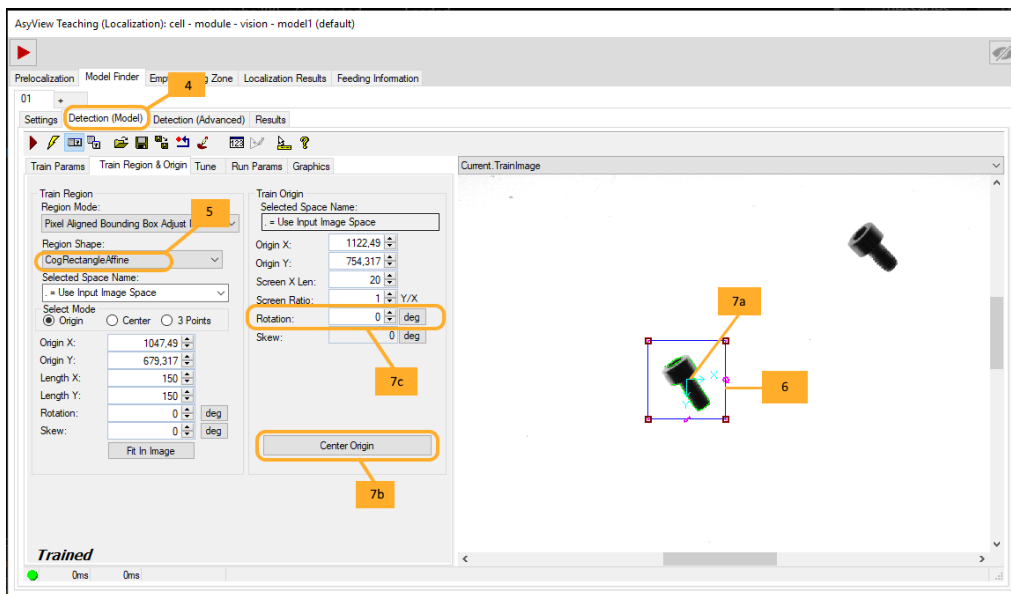


Figure 5-5-13: "Model Finder" tool, 01\Detection (Model) \Train Region & Origins

Step 5	Choose the most appropriate shape for your part (circle, rectangle, ellipse...)
Step 6	Adjust the shape to a typical part that you want to recognise as a correct part.
Step 7	Define the centre and orientation of the part <i>Tip: you can move the system of coordinates manually, but it is more accurate to use the "centre origin" button</i>

NOTE:



Pay particular attention to the definition of the centre of the mark because it is the coordinates of this point that will be sent to the robot as the picking position.

Step 8	When the model has been programmed, click on the "train" button in the "train param" tab. The image of the model programmed is displayed in the window that was initially blue
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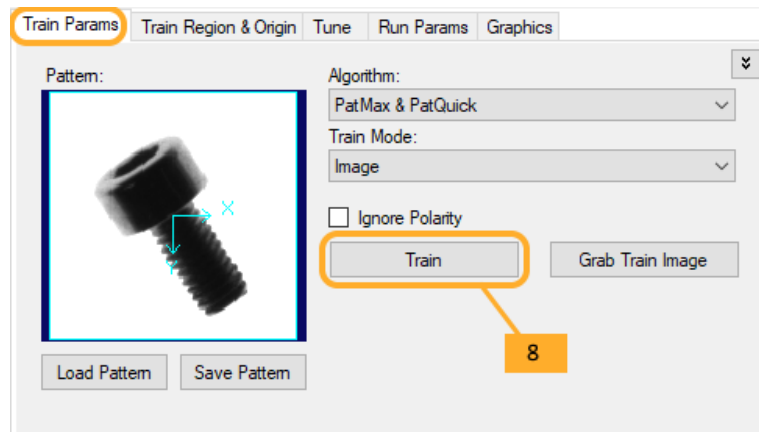


Figure 5-5-14: programming the model

Step 9	Click on the <i>Run Params</i> tab to display the screen below:
Step 10	Modify the parameters as follows: <ul style="list-style-type: none"> a- Algorithm: Best trained b- Mode: Search image c- Approx number to find: depends on the number of components to find in this image d- Accept threshold: relatively high (between 0.7 and 0.9) e- If necessary, change the value of the angle of rotation accepted for the components (compared with the programmed model) and the scale if your "correct" parts are not all exactly the same size.

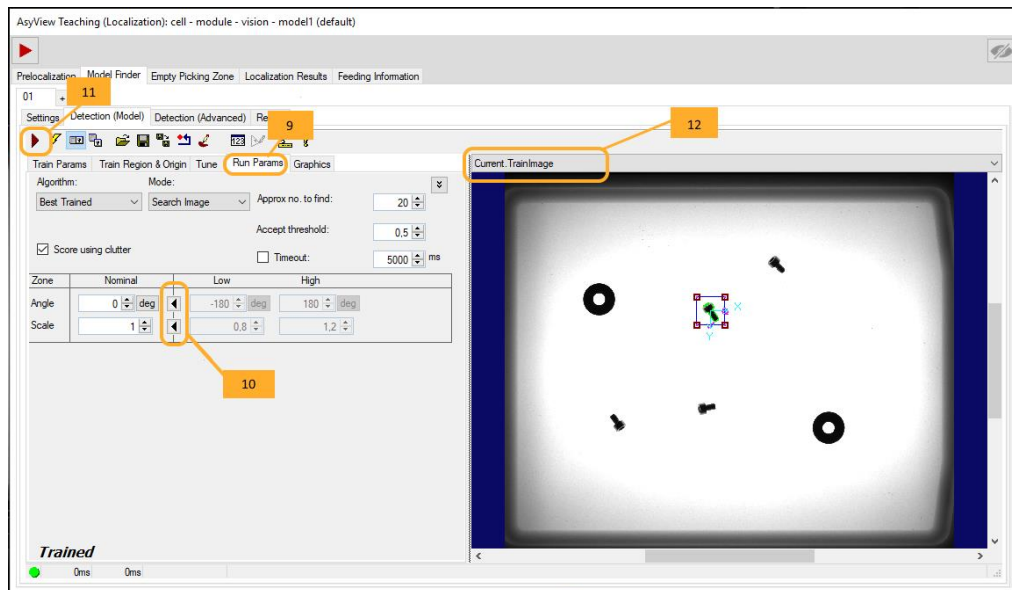



Figure 5-5-15: "Model Finder" tool, 01\Detection (Model) \Run Params

Step 11	Click on the  button to run the tool
Step 12	Select the "Detection (Advanced)" tab and " <i>LastRun.InputImage.ModelFinder</i> " in the image selector and check that the parts you have identified as "correct" are accepted and the others rejected. If this is not the case, change the threshold value according to the score of incorrect parts (displayed in the "Detection (Advanced)" table of results).

5.3.4. Configuring the tool: "Detection (advanced)" tab

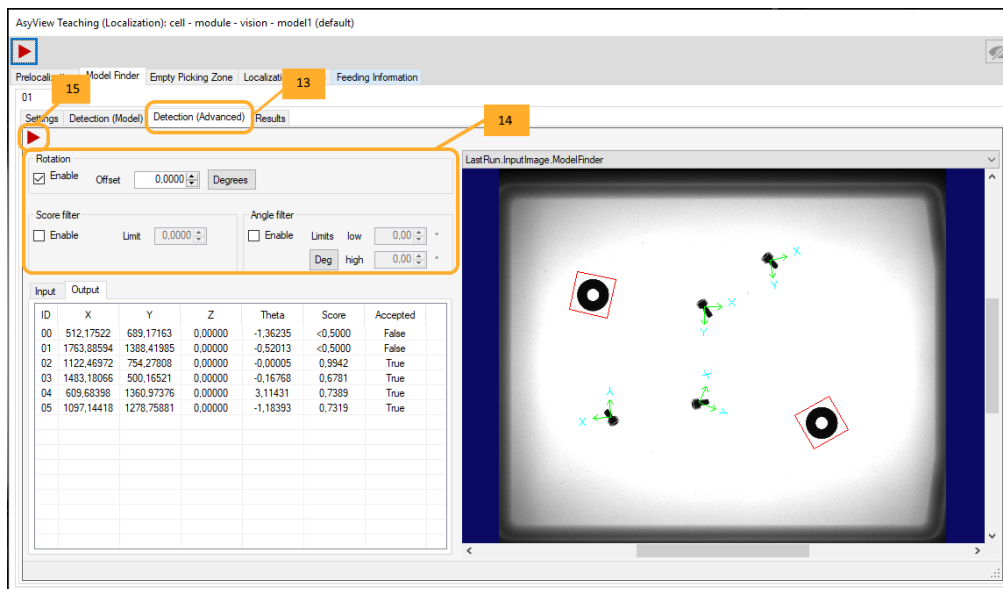



Figure 5-5-16: "Model Finder" tool, 01\Detection (Advanced)

Step 13	Click on the <i>Detection (Advanced)</i> tab to display the screen below:
Step 14	<p>Rotation: allows you to adjust the angle of rotation given in the result (picking position/orientation).</p> <ul style="list-style-type: none"> - Ticked (Enabled): the orientation will follow the detected part (only available if the search angle is not set to 0 in the Run parameters for the model). It is possible to add an optional offset. - Unticked (Disabled): constant orientation, possibly by adding an offset value. <p>Score filter:</p> <ul style="list-style-type: none"> - Ticked (Enabled): filters the results according to this score (only if this value is higher than the score defined in the "Detection (Model)/Run Params" parameters). - Unticked (Disabled): sorts the results according to the score defined in the "Detection (Model)/Run Params" parameters (step 10). <p>Angle filter:</p> <ul style="list-style-type: none"> - Ticked (Enabled): filters the results according to these angles (only if these angles are more restrictive than those defined in the "Detection (Model)/Run Params" parameters). - Unticked (Disabled): sorts the results according to the angles defined in the "Detection (Model)/Run Params" parameters (step 10).
Step 15	Click on the  button to run the tool

NOTE:



In certain cases, the use of the score can be defined with a validity threshold which is not too high in the "Detection (Model)" tab and then sorted more precisely by that in the "Detection (Advanced)" tab.



NOTE:

The image provides information on the ID of the corresponding part in the results information.

5.3.5. Configuring the tool: "ControlSettings" tab



NOTE:

This tab is not available with the "Geometrical Feature Detection" option

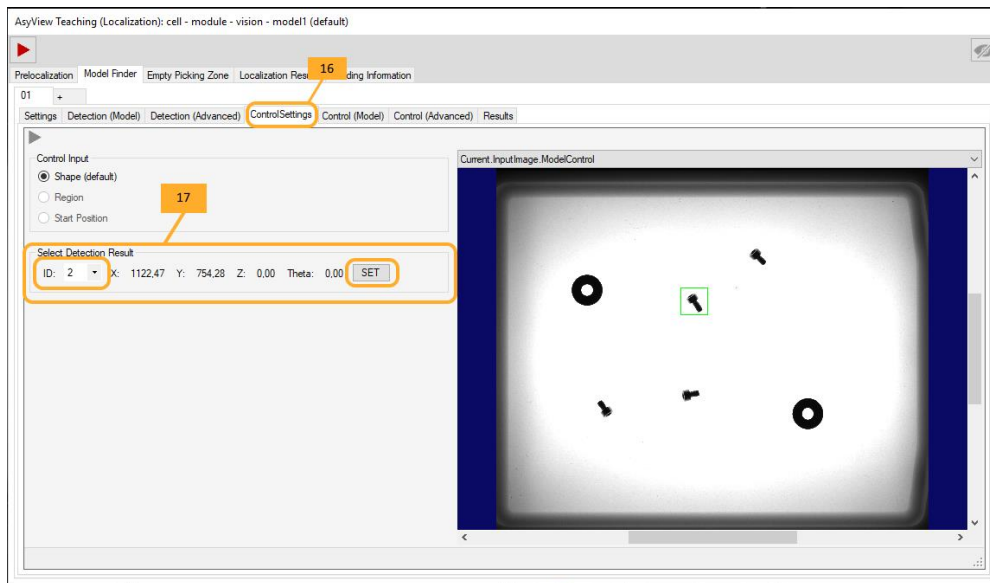


Figure 5-5-17: "Model Finder" tool, 01\ControlSettings

Step 16	Click on the <i>ControlSettings</i> tab to display the screen below:
Step 17	Select the detection result you want to define as the reference: <ul style="list-style-type: none"> - Choose the part you want as a model (ID) - Click SET => the system loads the programmed model, copies the corresponding region and focuses on the model so that you then need only click on the "Train" button.



NOTE:

With the "Geometrical Feature Detection & Surface Control" option, you must choose the component to be used as a reference before going to the next step.

5.3.6. Configuring the tool: "Control (Model)" tab



NOTE

This tab is not available with the "Geometrical Feature Detection" option

5.3.6.1. "Geometrical Feature Detection & Control"

The method is similar to detecting a model (Detection Model) .The objective is to detect the details that differentiate a correct part from an incorrect part (front/back for example) and not the whole part. The "train region" zone must be adapted to the detail to be detected.

5.3.6.2. Geometrical feature detection & surface check

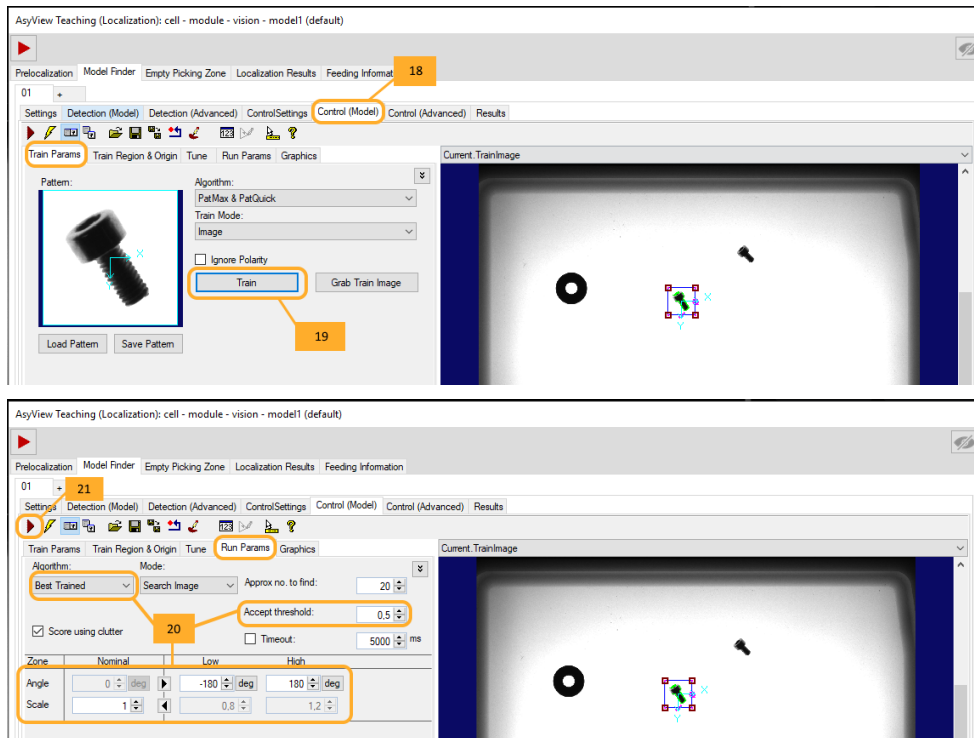


Figure 5-5-18: "Model Finder" tool, 01\Control (Model) in the case of a "Surface Control"



IMPORTANT NOTE

It is essential to have first selected the reference part and activated the "SET" button in the Control Settings before adjusting this model.

Step 18	Click on the "Control (Model)" tab to display the screen below:
Step 19	Activate the <i>Train Params</i> tab, then click on <i>Train</i> to program the model
Step 20	On the <i>Run Params</i> tab, adjust the parameters:

- The validity threshold can be quite high in this case, because it normally involves the detection of minute differences between the parts
- Angle and scale if necessary
- Type of algorithm if necessary

Step 21

Click on the  button to run the tool

5.3.7. Configuring the tool: "Control (Advanced)" tab



NOTE:

This tab is not available with the "Geometrical Feature Detection" option

Step 22

This step is similar to the "Detection (Advanced)" tab (see § 5.3.4) except that the Rotation option is only available if the picking position is the result of the Control procedure and not the Detection procedure (see § 5.3.2).

5.3.8. Configuring the tool: "Results" tab

In the previous tab, we configured the model to enable the tool to distinguish a correct part from an incorrect part. In this tab, we are going to test this model on each of the candidates selected by the Pre-localization tool.

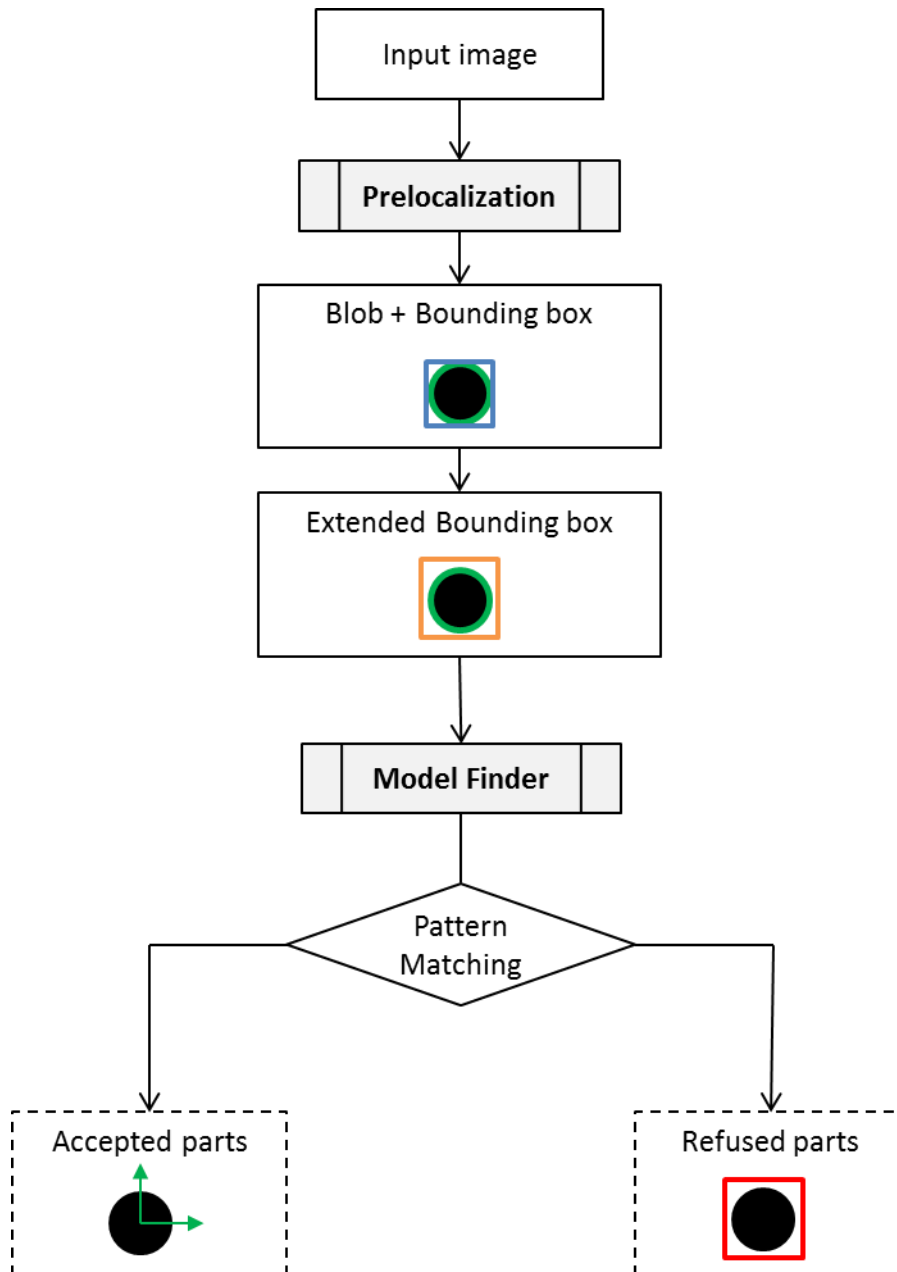


Figure 5-5-19 "Model Finder" tool, schematic algorithm

The candidates found by the Pre-localization tool are displayed in the "Inputs" tab of the tool in which we are currently working: the "model finder". This data can also be checked visually by choosing "CurrentInput.Image" from the image selector.

Step 23

Click on the *Results* tab to display the screen below:

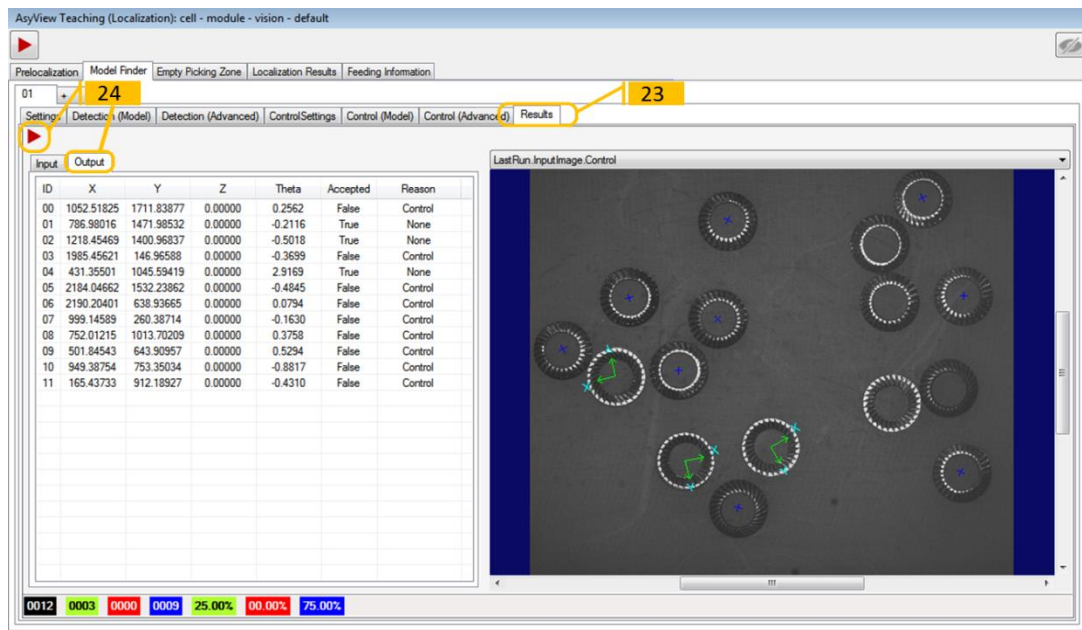



Figure 5-5-20: "Model Finder" tool, 01\Results\Output

Step 24

Click on the  button to run the tool and obtain the results (this may take some time). Then click on the *Output* tab to display the list of results.

Step 25

Select the relevant image in the image selector and check that the parts you have defined as "correct" are accepted and the others are rejected. Otherwise, modify the values in the different models.

The colour codes on the bottom of the window indicate the number of parts having successfully passed the different steps.

5.4. Exclusion zone definition

Name	Method	Characteristics
EPZG Empty Picking Zone Growing	<p>Definition of a zone of a certain thickness <u>all around the part</u></p>	<ul style="list-style-type: none"> - A method well suited to parts with a complex geometrical shape but for which a narrow border is sufficient as an exclusion zone - Very advantageous where the gripper tip is small and the part comparatively large: to be sure the parts are not touching each other - Very quick for delimiting a few pixels, but time-consuming for larger borders. - Can be combined with the EPZR
EPZR (Empty Picking Zone Region)	<p>Definition of a <u>geometric area centred on the picking point of the parts</u></p>	<ul style="list-style-type: none"> - The external shape of the exclusion zone can be defined according to the geometry of the gripper tip, for example. - Different options to optimise the exclusion zone according to the geometry and variance of the part. - Can be combined with the EPZG

Table 5-4: EPZG and EPZR general description

The exclusion zone tools are applied only to parts previously accepted through model searching, as shown below:

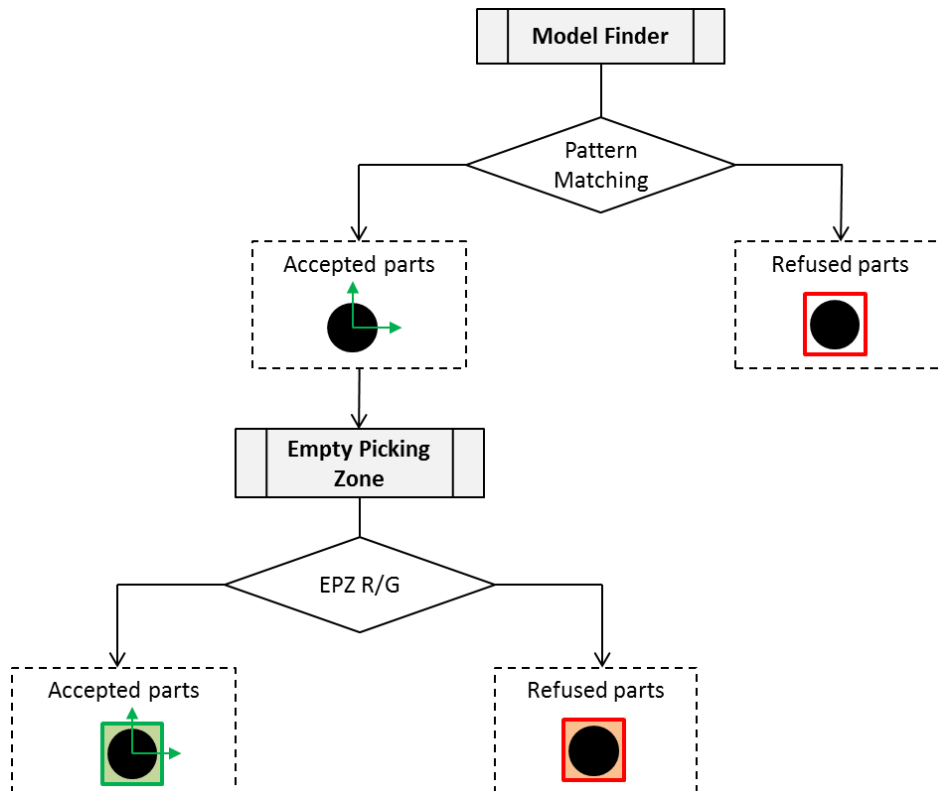


Figure 5-5-21: "Empty Picking Zone" tools, schematic algorithm

5.4.1. (Empty Picking Zone Growing) (EPZG)

The EPZG tool is used to define an area all around the part in which no other part must be located. The purpose is to avoid two parts being picked at the same time. The exclusion zone then corresponds to the enlargement of the contour of the part by adding a border around it.

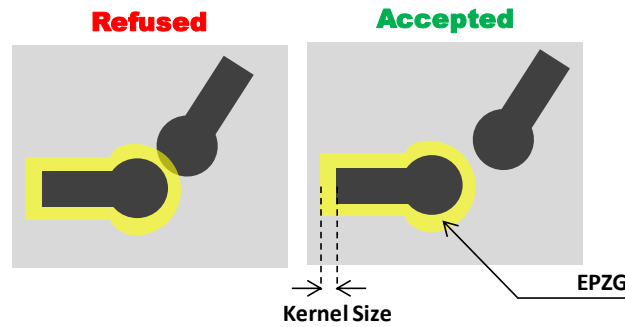



Figure 5-5-22: Empty Picking Zone Growing (EPZG)



NOTE:

This type of exclusion zone calculation is very time-consuming. The function is well suited to parts with a complex geometrical shape but for which a narrow border is sufficient.

Step 0	Click on "Empty Picking Zone" and on "+ Growing" to add an EPZG.
Step 1	The EPZG tool is configured in a very similar way to the Pre-localization tool. So, to avoid performing the same step a second time, the first step is to simply copy the Pre-localization tool exactly by right-clicking on the "01 – Growing" tab (see Figure 5-5-22). Click on the  button to run the tool
Step 2	Set the size of the exclusion zone ("Kernel size") (always an odd value, the maximum value being 49 pixels). It is necessary to select a size matching the size of the gripper nozzle of the robot, to avoid two parts being picked at the same time by suction, for example.

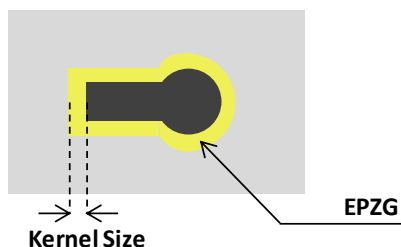


Figure 5-5-23: Defining the "Kernel size" parameter

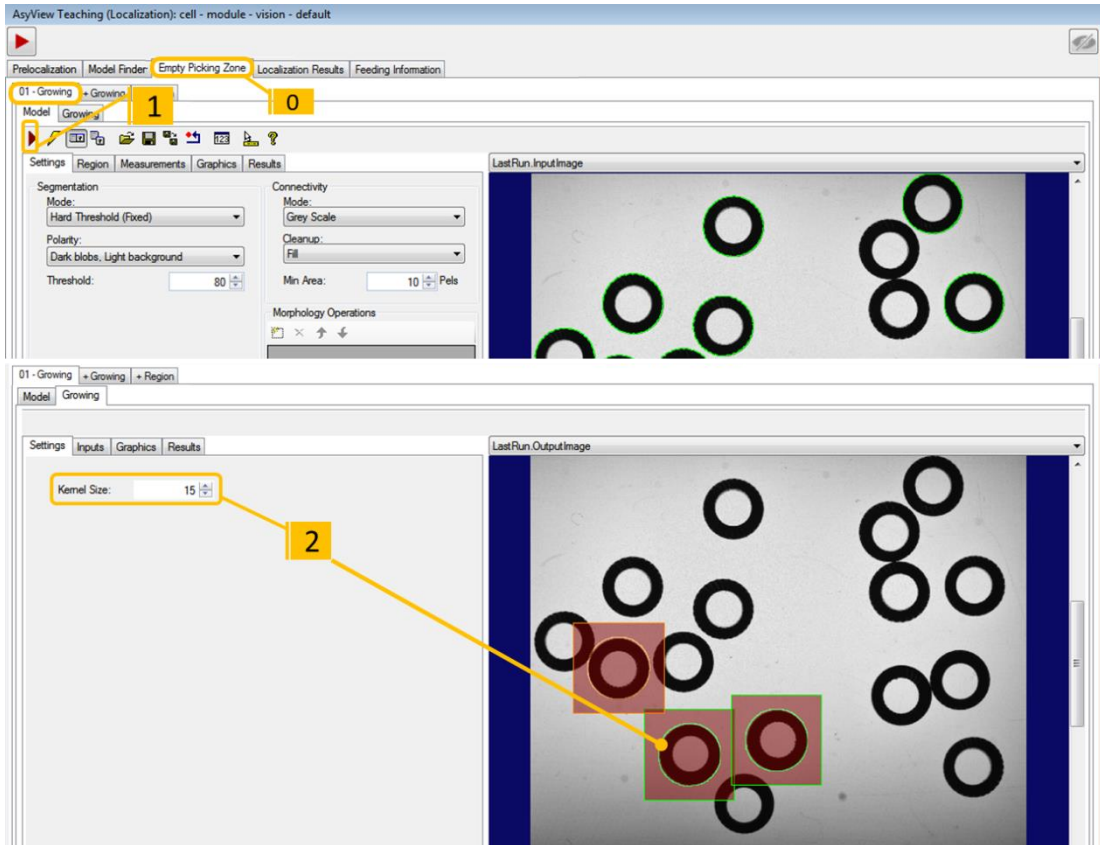


Figure 5-5-24: "Empty Picking Zone Growing" tab

5.4.2. Empty Picking Zone Region (EPZR)

5.4.2.1. Overview

The *Empty Picking Zone Region (EPZR)* tool is used to define a geometrical zone in which no other part must be present. The aim is to avoid two parts being picked at the same time.

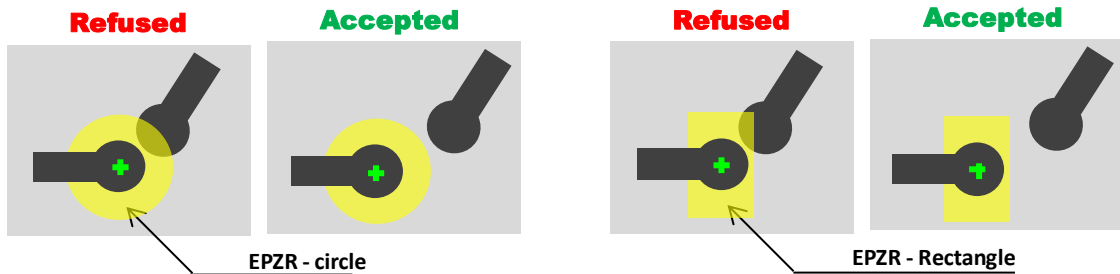


Figure 5-5-25: Empty Picking Zone Region (EPZR)

Three types of EPZR have been optimised according to the shape of the parts as indicated in Table 5-5.

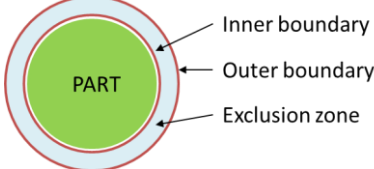
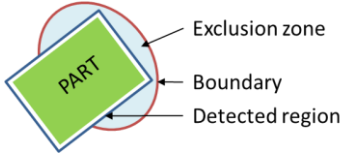
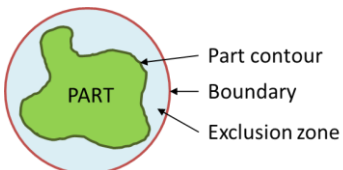
TYPE	Method	Characteristics
Annulus area (Annulus area)	Searches between <u>2 defined shapes</u> (interior and exterior) 	<ul style="list-style-type: none"> • Very fast • Only available for circular or elliptical annulus
Detected region to boundary (default) (Detected region to boundary)	Search inside the zone between the model detection <u>region</u> and a defined external shape. 	<ul style="list-style-type: none"> • For simple geometries • For parts of variable size <p>Note: The detection region must be as close as possible to the contour of the part.</p>
Part contour to boundary (Part contour to boundary)	Search inside the zone between the <u>contour</u> of the part and a defined outer shape 	<ul style="list-style-type: none"> • For parts with complex shapes • The slowest method

Table 5-5: Description of EPZR types

5.4.2.2. Tool configuration

The configuration is broadly similar for all three types of EPZR:

1. Select the type,
2. Define the outer boundary of the exclusion zone
3. Configure the exclusion model parameters to detect any element that could be present in the exclusion zone.
4. The last tab gives access to the list of results of all candidates from the previous detection.

All these steps are described below.

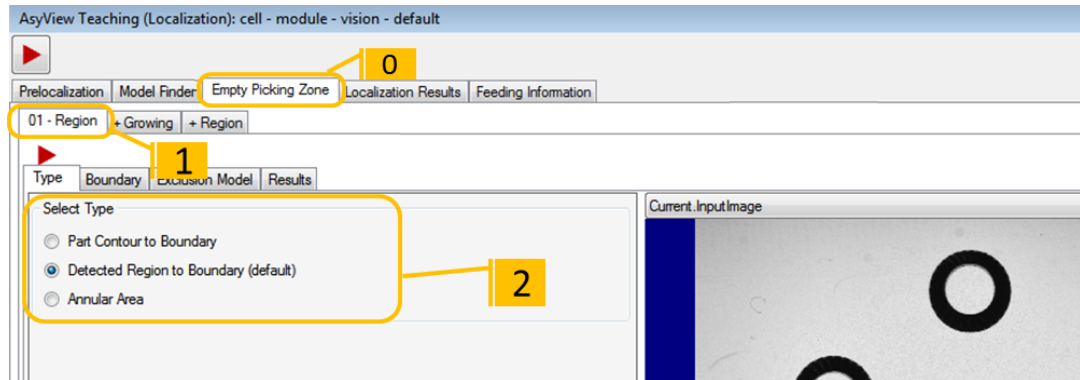




Figure 5-5-26: Empty Picking Zone Region tool, 01 - Region\type

Step 0	Click on "Empty Picking Zone" and on "+ Region" to add an EPZR.
Step 1	Add a model by clicking on the "+" button. The configuration of the exclusion model is broadly similar to the Pre-localization tool. So, to avoid performing the same step a second time, the first step is to simply copy the Pre-localization tool exactly by right-clicking on the "01 – Region " tab. Click on the  button to run the tool
Step 2	Select the type of EPZR to use (see description of the types in Table 5-5)
Step 2B	If the "Part Contour to Boundary" option was selected, copy the Pre-localization parameters to the contour model by clicking on the "01" tab. The same set of parameters can usually be used. Then click on the  button to run the tool.

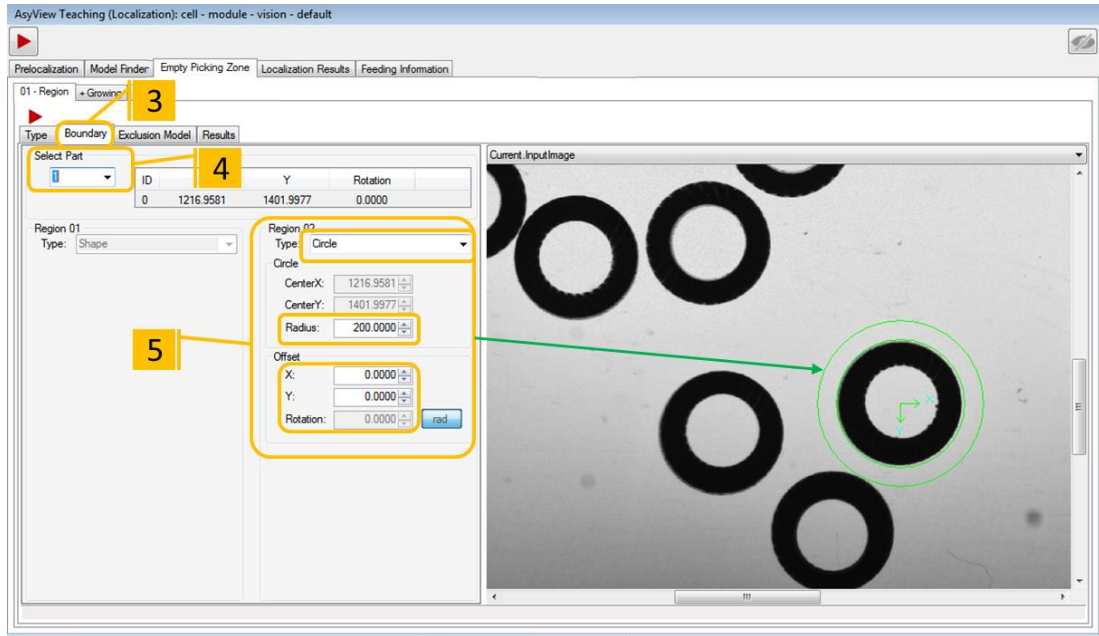


Figure 5-5-27: Empty Picking Zone Region tool, 01 - Region\Boundary

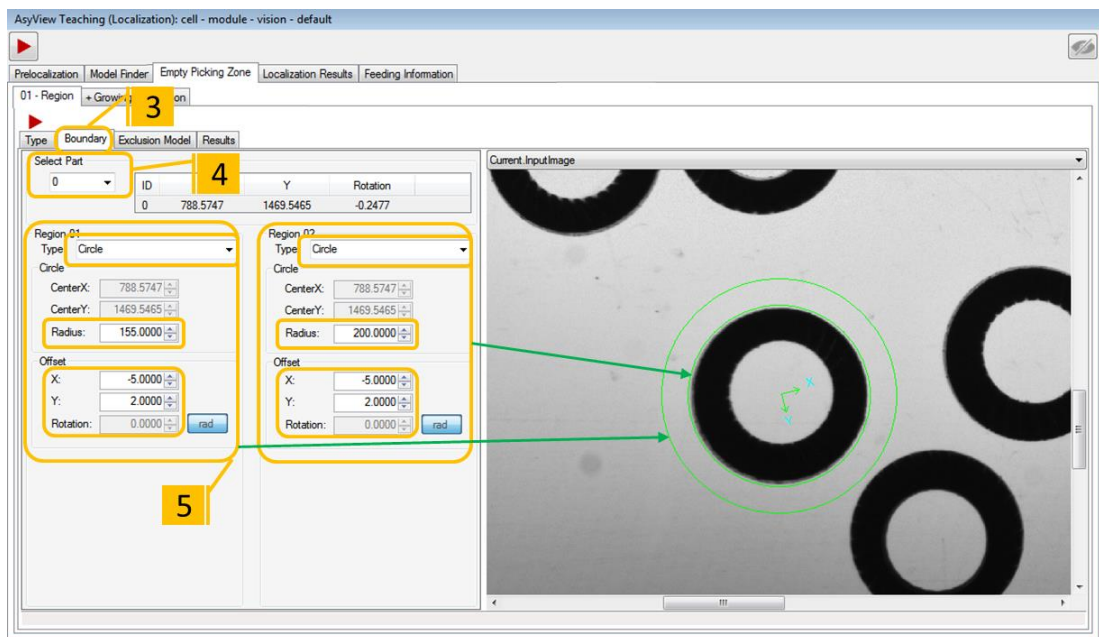


Figure 5-5-28: Empty Picking Zone Region tool, 01 - Region\Boundary with the type of annular zone

Step 3	Select the "Boundary" tab to set the size, shape, and offset of the external line.
Step 4	Select the part ID that can be used as the reference to define the boundary.
Step 5	Select the geometry, size and offset. The shape is drawn around the selected part on the image.

NOTE:



When the "annular zone" type is selected, the internal and external shapes are defined at this point (Figure 5-5-28).

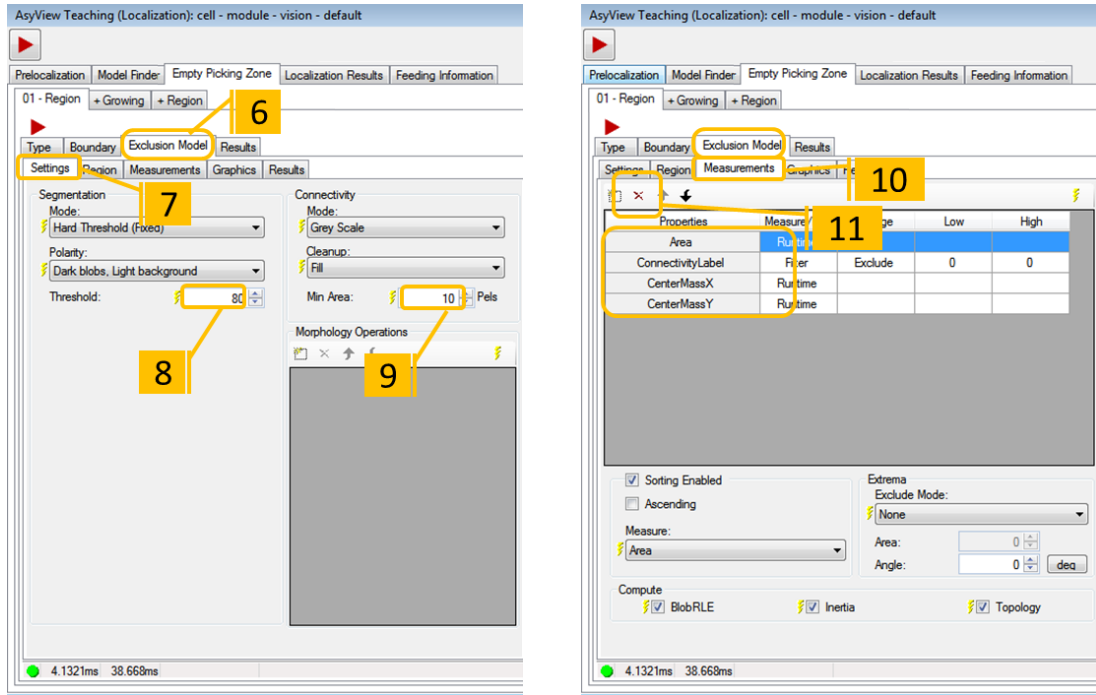


Figure 5-5-29: Empty Picking Zone Region tool, 01 - Region\Exclusion Model

Step 6	Select the "Exclusion Model" tab: the detection inside the exclusion zone is always based on the same tool as the Pre-localization. Simply adjust the minimum size and threshold for the elements to be detected (exclusion criteria).
Step 7	Select the "Settings" tab.
Step 8	Select the threshold or copy the Pre-localization tool to the Exclusion Model by right-clicking on the "01" tab.
Step 9	The "Min. Area" value defines the minimum size of any element to be detected. Normally, it can be left as the default value (10) but can be adjusted, for example, in case of a non-uniform background.
Step 10	Select the "Measurements" tab
Step 11	Clear all properties or set all filters to "Runtime" (possibly present when the exclusion model is copied from the Pre-localization model)

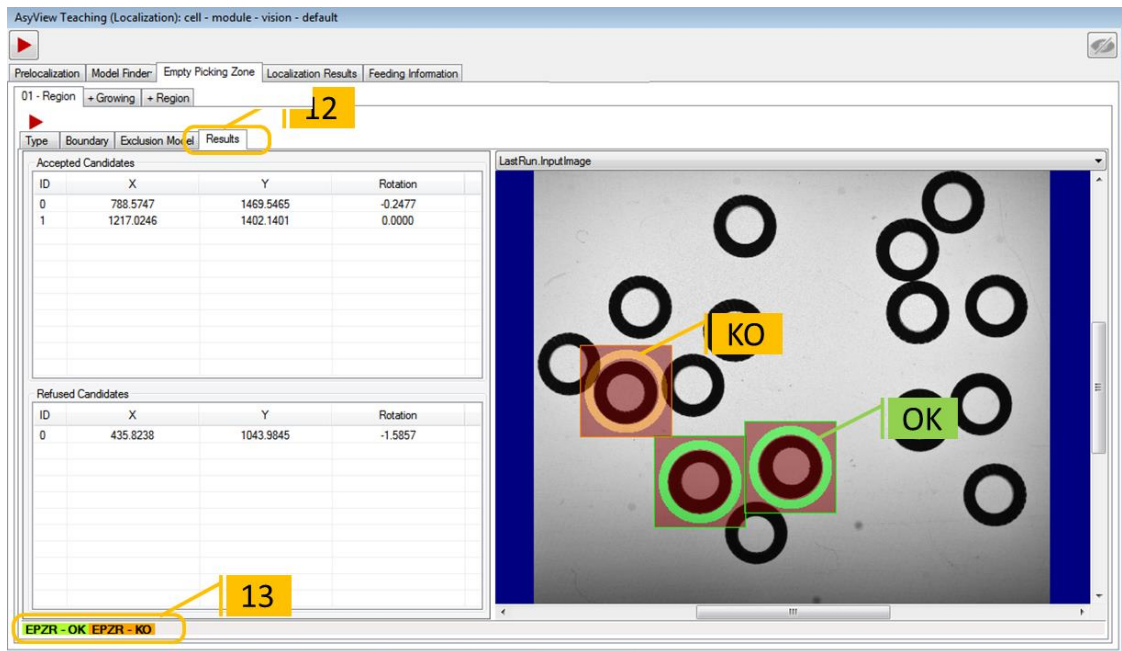



Figure 5-5-30: Empty Picking Zone Region tool, 01 - Region\Results

Step 12	Select the "Results" tab.
Step 13	<p>Click on  to run the tool and obtain the results (this may take some time)</p> <p>Choose <i>LastRun.OutputImage</i> in the image selector. Check that the accepted parts are:</p> <ul style="list-style-type: none"> - Oriented in the right direction (accepted by Model Finder) - Sufficiently distant from all the other parts (because validated by the EPZR) <p>If not, modify the values programmed in the previous steps.</p>

5.5. Location results

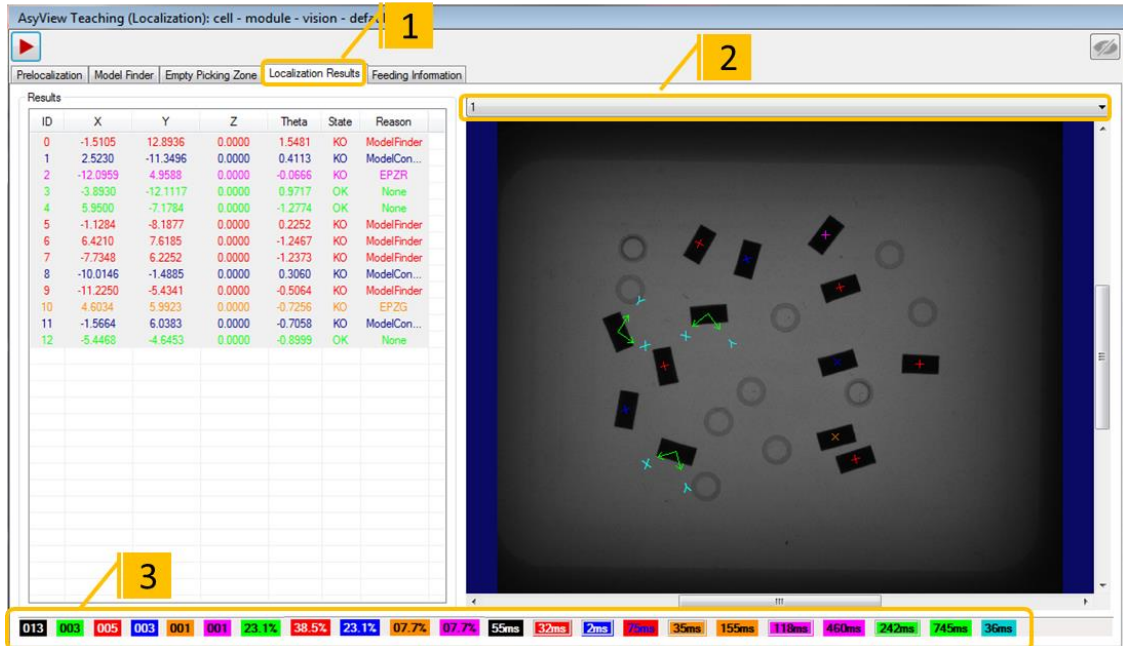


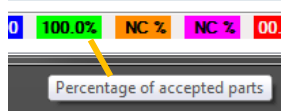
Figure 5-5-31: Location results tool

Step 1	Click on "Location Results" to display the window shown above:
Step 2	Click on the "Run" button. It is possible to select the image to check.
Step 3	Check the results in the table, on the image and with the indicators at the bottom: <ul style="list-style-type: none"> - Numbers of parts (accepted or rejected as the case may be) - Percentages of parts (accepted or rejected) - Analysis times, overall and for each tool (approximate)

NOTE:



Hover the mouse over an indicator to display its description.



NOTE:



The time shown does not represent a guaranteed time because it is calculated as part of the configuration interface and depends on the performance of the PC at the time the analysis is run. However, this time may be useful in determining the impact of a configuration change on the analysis time.

5.6. Feeding information

The "*Feeding Information*" tool allows you to obtain the exact number and the position of the parts on the surface of the Asycube, whatever their front/back orientation. This information is then used to calculate the appropriate vibration sequence (resupply of components, flip to improve distribution, etc.). The configuration is identical to that of the "Model Finder" but only performed on the image with back-lighting.

Step 1	Click on the <i>Feeder information</i> tab
Step 2	See the section entitled "Configuring the tool: "Detection" tab" page 49 and apply steps 1 to 8.
Step 3	For Asycubes 240 and 530, select the hopper that contains the part defined in the model.

NOTES



- *The objective is to estimate the number of parts on the platform irrespective of their front/back orientation. In general, the backlit image should be used for this purpose to aid detection.*
- *If necessary, it is also possible to apply several tools to obtain a better estimate of the number of parts - for example when the geometry of the parts varies significantly depending on their orientation.*
- *Where two models (thus two "teachings") are used for the same part (front and back), it is only necessary to configure the feeding information in one of the models.*

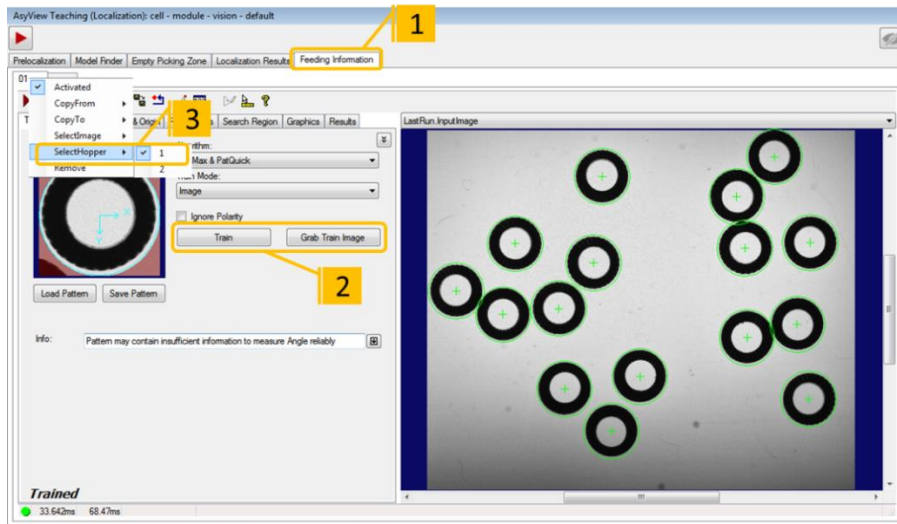



Figure 5-5-32: Feeding Information tool, 01\Train Params

Step 4	Click on the  button to run the tool and obtain the results
Step 5	Select " <i>LastRun.InputImage</i> " in the image selector and check that ALL the parts have been detected

6. End of programming

6.1. Closing the AsyView teaching window

Step 6 Click on the "apply" or "cancel" button

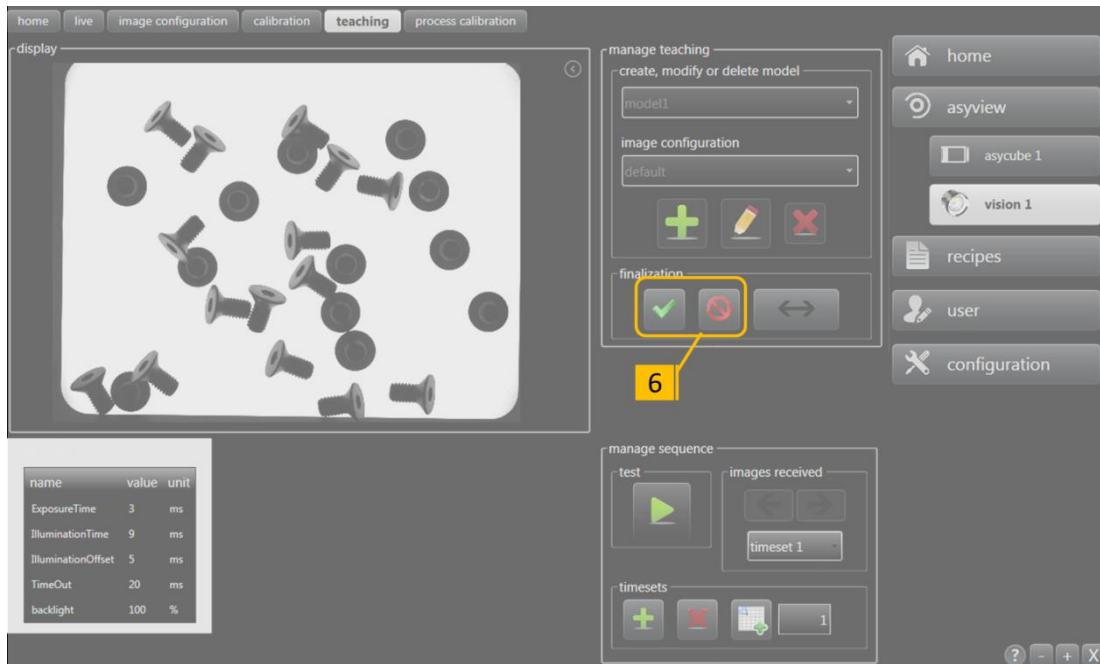


Figure 6-6-1: finalising the configuration of the vision model

IMPORTANT NOTE:



The AsyView status changes to "Configuration - Idle" in the presentation screen (yellow LED). Wait for the change to take effect (LED changes to green again) before proceeding to the next step.

IMPORTANT!



Clicking on the "apply" button does **NOT** save the vision model; you can then test the changes, but they will be lost if the software is deactivated. For more information about permanently saving a recipe, refer to section.6.3

6.2. Testing the vision model

Step 1	Click on the "vision" button
Step 2	Click on the "home" tab
Step 3	Tick the "display results" box
Step 4	Choose the results to display
Step 5	Click on "Acquire" to start the process of analysing all the models.
Step 6	Select the results for a particular model.
Step 7	Check that the correctly oriented parts are accepted and the others are rejected for the selected model.

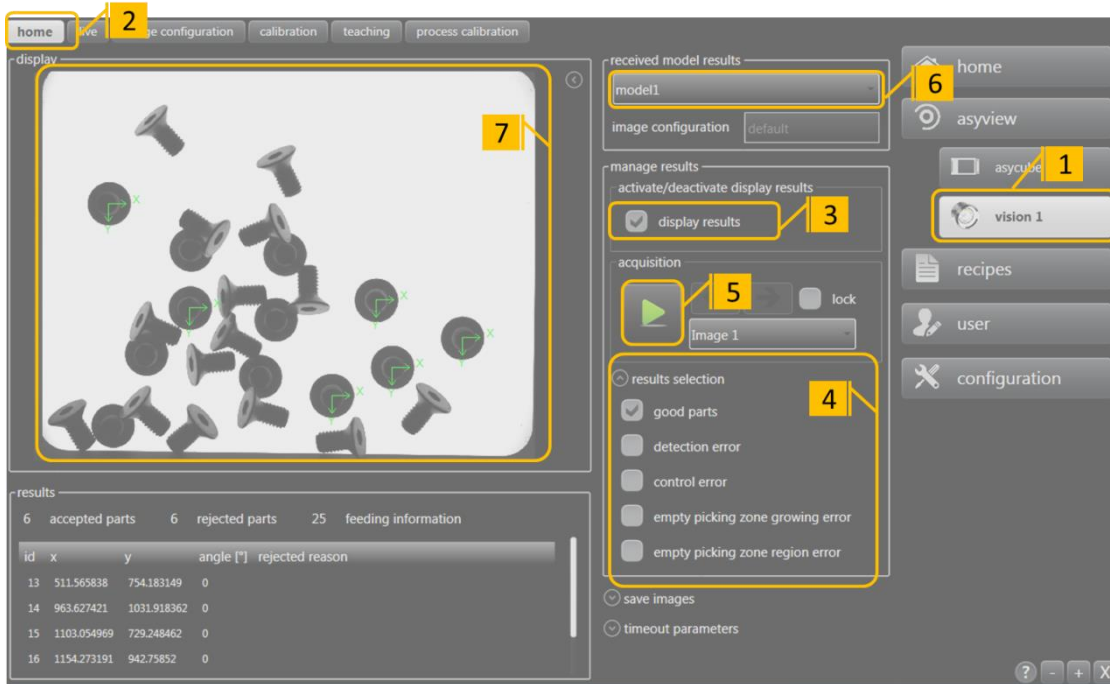


Figure 6-6-2: Vision-Home: Testing the vision model

Step 8	<p>Perform a few vibrations on the Asycube using the shortcut at the top of the HMI and repeat steps 5, 6 and 7.</p> <p>If the results obtained are satisfactory, you can save the recipe as shown in section 6.3. Otherwise, modify your recipe by returning to the teaching tab.</p>
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6.3. Permanently saving the vision model

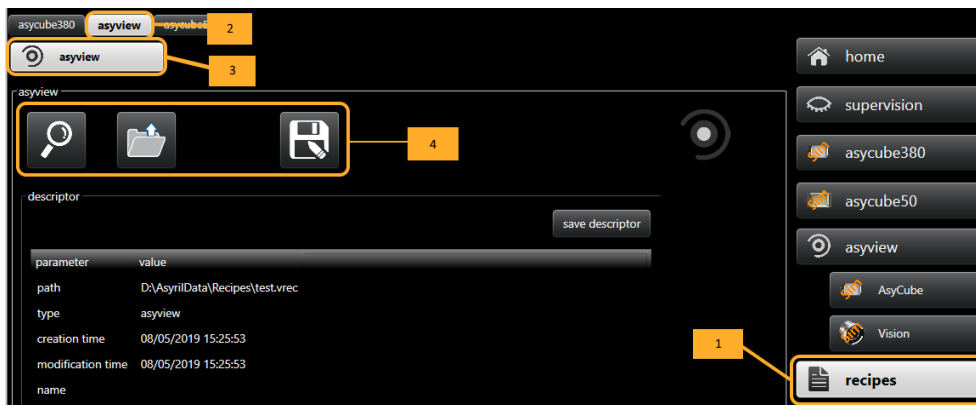


Figure 6-6-3: Permanently saving a recipe

Step 1	Click on the "Recipes" button
Step 2	Click on the "AsyView" tab
(Step 3)	It is possible to select the type of recipe to save. For example: only the feeding parameters or the whole recipe including all the cameras and feeder systems according to the configuration.
(Step 4a)	If the description of the recipe is no longer displayed, click on the "select" button (magnifying glass) to select your recipe, then click on "open" (folder)
Step 4	Click on the "save as" button (floppy disc) to save a new recipe.

To save the vision model only, navigate to the "vision" folder:

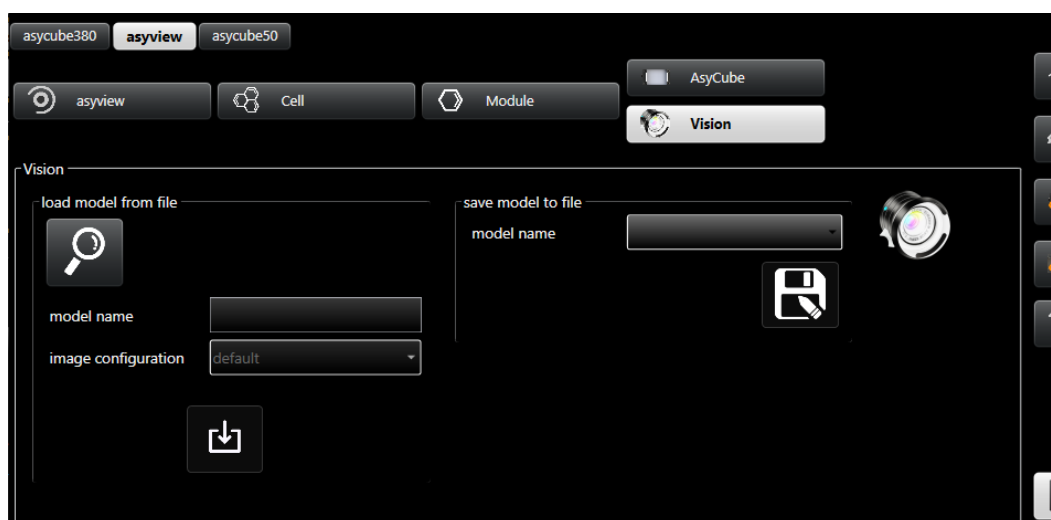


Figure 6-4: Saving a vision recipe only

You can then save the model(s) that have already been created but it is not possible directly change the name (although you are free to choose the name of the folder, the

name of the model it contains does not change); this can be done by loading a vision model (the "model name" box).



NOTE:

Ensure that you give your recipe a detailed name in order to be able to find it easily.



IN CASE OF Asyfeed Pocket CELL or MODULE:

The complete recipe (.rec) should be saved in that case, including the ARL process and its parameters. See Asyri_MODULE_ASYFEED_User_Guide_EN for information on the structure and parameters of the recipe (.rec).

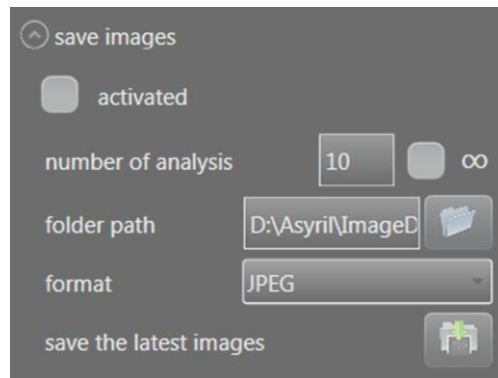
7. Saving images

In the process of adjusting a vision system, it is sometimes useful to be able to view the images that have been analysed in order to understand what the system has done. To do this, AsyView offers two options:

- Save the images used for the last analysis performed
- Save the next X images to be analysed

This can be activated from the HMI (see the HMI documentation) or directly by the customer's system via TCP commands.

The section of the HMI for doing this looks like this:



Images can be saved in two formats:

- Raw images in BMP format to reuse the images for analysis with vision tools.
- Less bulky JPEG images with markers on detected parts to show what has been found or not.

In all cases, the folder for saving can be specified, even if a default folder is automatically selected (D:\Asyri\ImageDataBase).

IMPORTANT!



To avoid filling the SSD disk of the PC, a limit of 1000 JPEG images and 100 BMP images is set. When either of these limits is exceeded, the oldest images are automatically erased to free up space for the image to be saved.

IMPORTANT!



This saving function should not be used on a continuous basis as there is a limit to the amount of data that can be written to SSDs during their lifetime. The limit will be quickly reached with saving enabled permanently, so the disk will need to be replaced out of warranty.

8. Technical Support

8.1. To help us provide the best service...

Before contacting us, please note down the following information concerning your product:

- Serial number and product key for your equipment
- Software version(s) used
- Error message, alarm, or visual signals displayed by the interface.

8.2. Contact

You can find extensive information on our website: www.asyril.com

You can also contact our Customer Service department:

<http://www.asyril.com/en/asyril/support-en.html>

Revision table

Rev.	Date	Author	Comment
A	21.08.2012	DaM	Initial Version based on version 1.4 of the AFEED HMI doc
A1	19.11.2012	BoB	Various modifications made since the initial version
B	21.04.2015	DaM	Updated version for the AsyView V3
B1	22.06.2015	DaM	Structure modified and references added to XFEED/Process doc.
B2	25.08.2016	DaM	Updated product names and documentation
C	21.02.2018	HsJ	Update relating to new version AsyView v4
C1	29.03.2018	HsJ	Update for the new PC model
C2	17.07.2019	CoG	Update for AsyView 4.2.0/HMI rc8.0v2.7.2
C3	09.06.2020	ChL	Addition of sections 3.3.1, 3.3.3 and modification of 3.3.2. Modifications of Figure 3-2 and Figure 4-1.

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