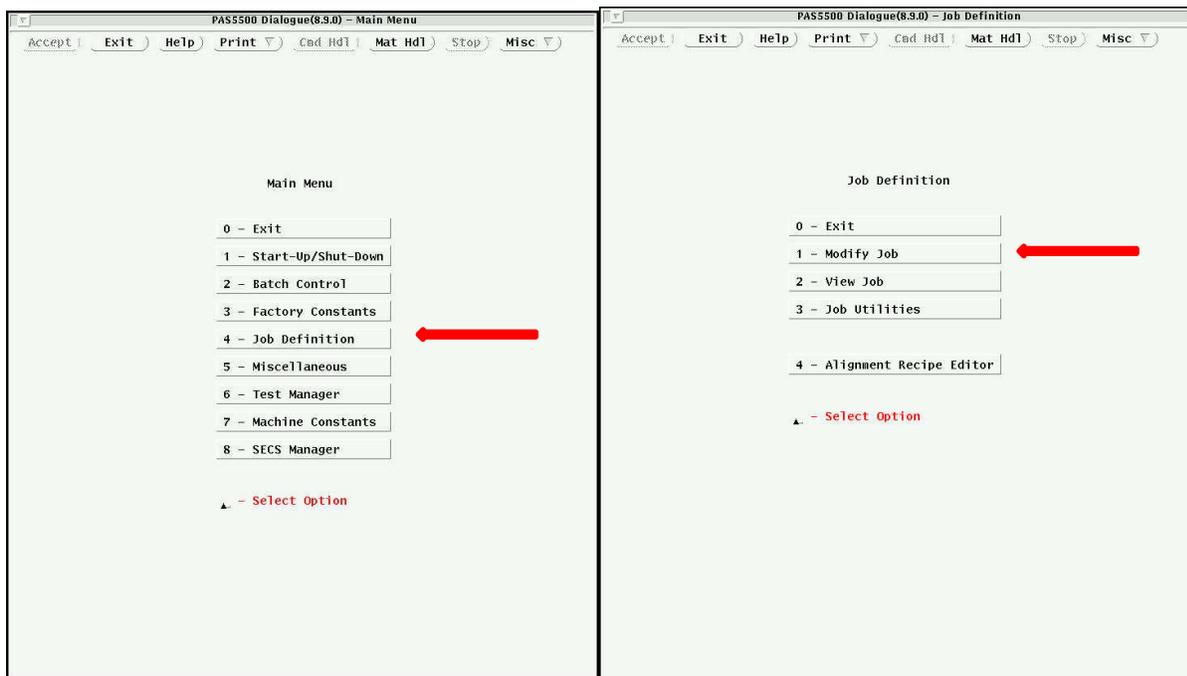


ASML Job Set-up procedure for Standard Jobs – 4” wafers:

The ASML job files are complex and have a significant number of features not available on the GCA steppers. The procedure for setting up jobs is therefore more complex. The following guide will help you to set up programs for full 4” wafers

Jobs contain all cell layout, process, and mask image information to run your full process. All user created jobs will be saved in your user group directory. Layer 0 is set aside for system alignment mark exposure onto your wafer. These marks, called PM marks, are used for pre-alignment of the wafer and possibly for main alignment depending on how the rest of the layers are set up. In general, you do not need to have alignment marks of any kind in your actual die patterns as the system contains a mask with pre-defined marks that can be placed on your sample for alignment. 2 marks are all that is needed for layer to layer alignment. Whenever test or numbers are entered into a job screen, you must hit enter for the change to be made and usually you also need to press an apply button to save the change.



Main System Menu

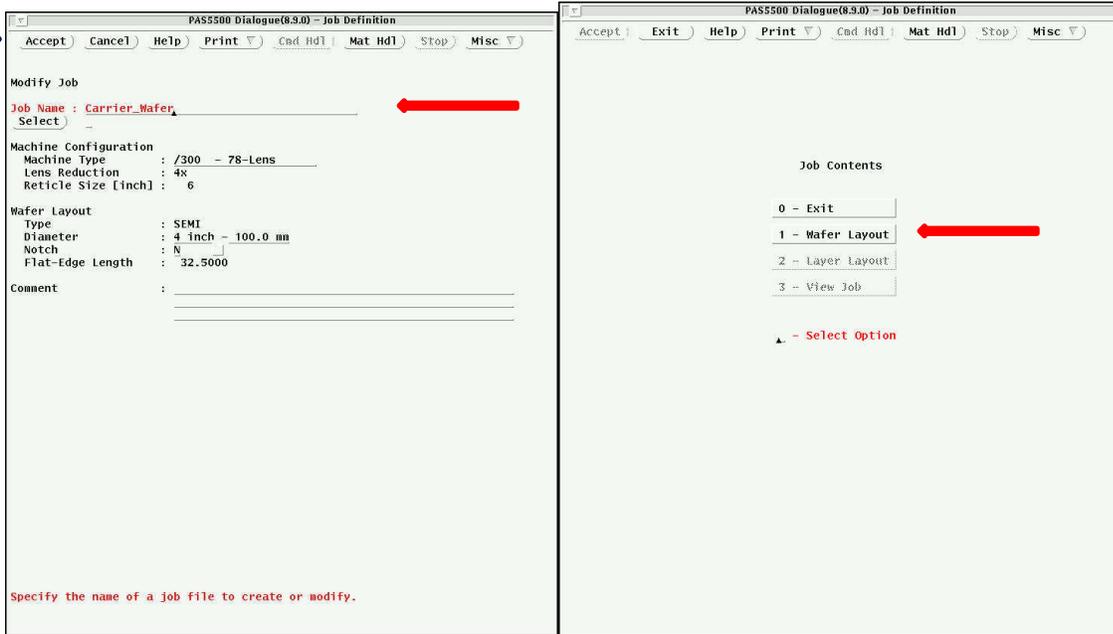
Job Definition Menu

For the job set-up, press the **Job Definition** button in the main menu list.

From the Job definition menu, press the **Modify Job** button.

In the modify job screen, put in the **Job Name** and press enter. (If you are modifying a job, press the select button and find your job in the file system.) Machine configuration and Wafer Layout information will automatically appear. You can add a job comment at the bottom. It is easiest to select an old job, then rename to a new jobname within the same directory path. Your directory path and a template job file will be created during training.

Press **Accept** button at top when done. This takes you to the Job Contents Screen.

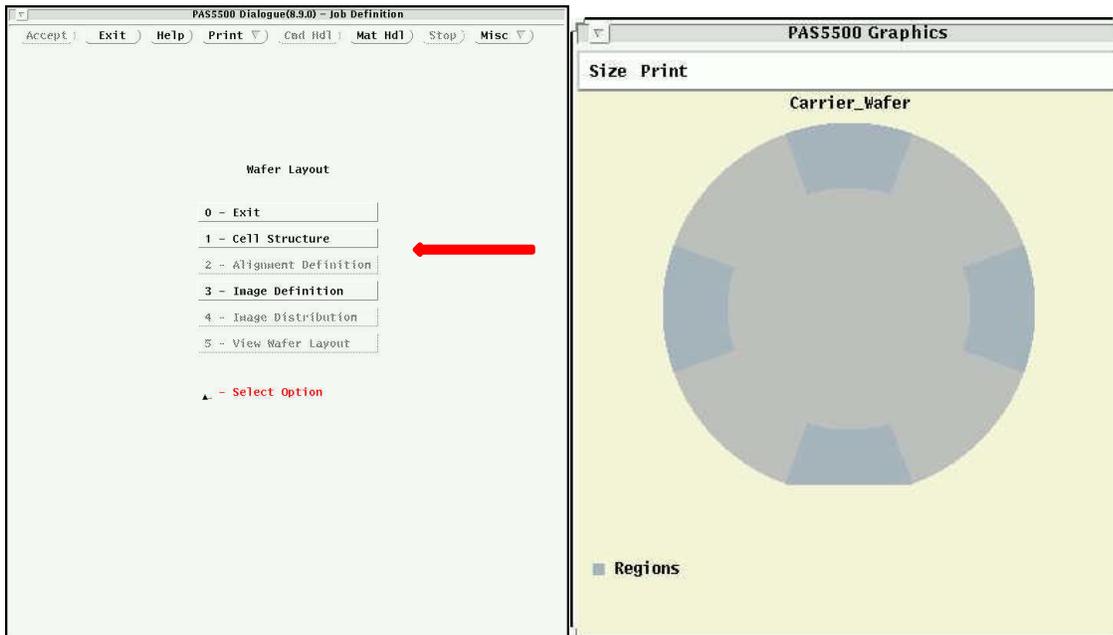


Modify Job Screen

Job Contents Screen

Wafer Layout

Press the **Wafer Layout** button. You will see the wafer layout screen and a carrier graphics window appear.

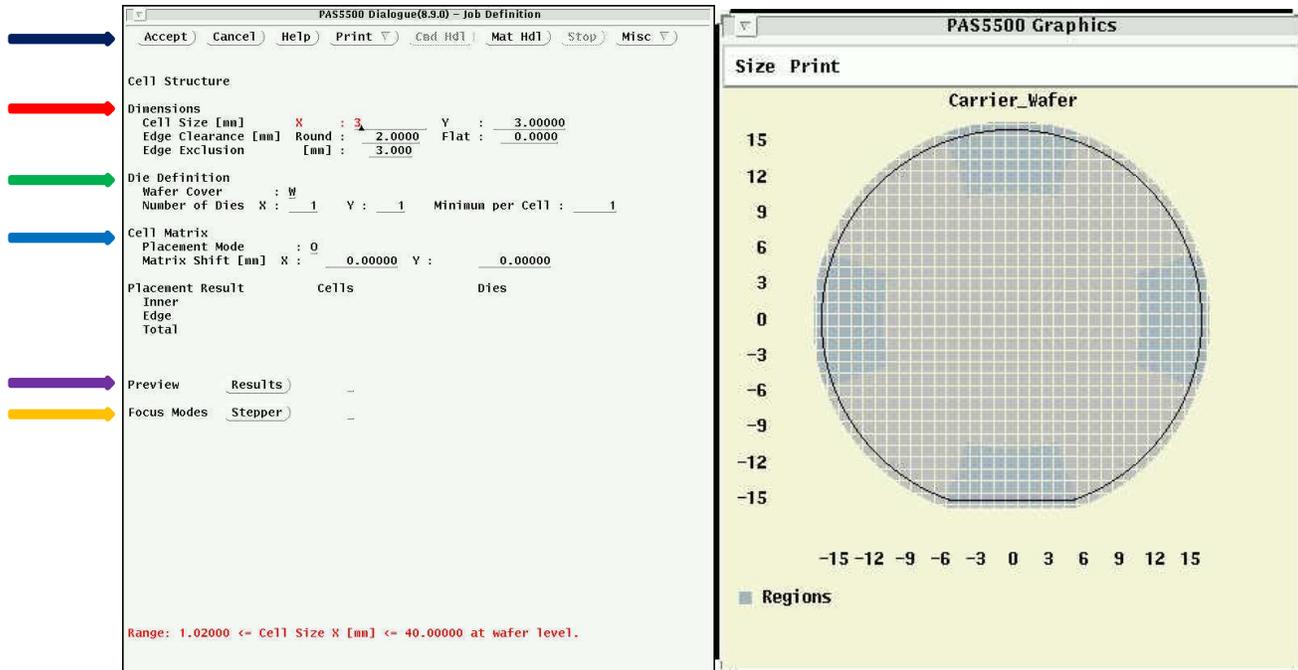


Wafer Layout Screen

Carrier Graphics Window

Cell Structure

Choose **Cell Structure** from the wafer layout menu to get to the cell structure screen. A cell is defined as the step size.



Cell Structure Screen

Carrier Graphics Window showing Cell Matrix

Dimensions: Enter the cell (step) size for x and y, in mm. (3mm x 3mm is selected for this example) Keep edge clearance at default values.

Die Definition: If you want partial shots to be exposed, you can specify more than one die per cell. The system will know to shoot cells where dice (but only partial cells) are present near the edges of the wafer.

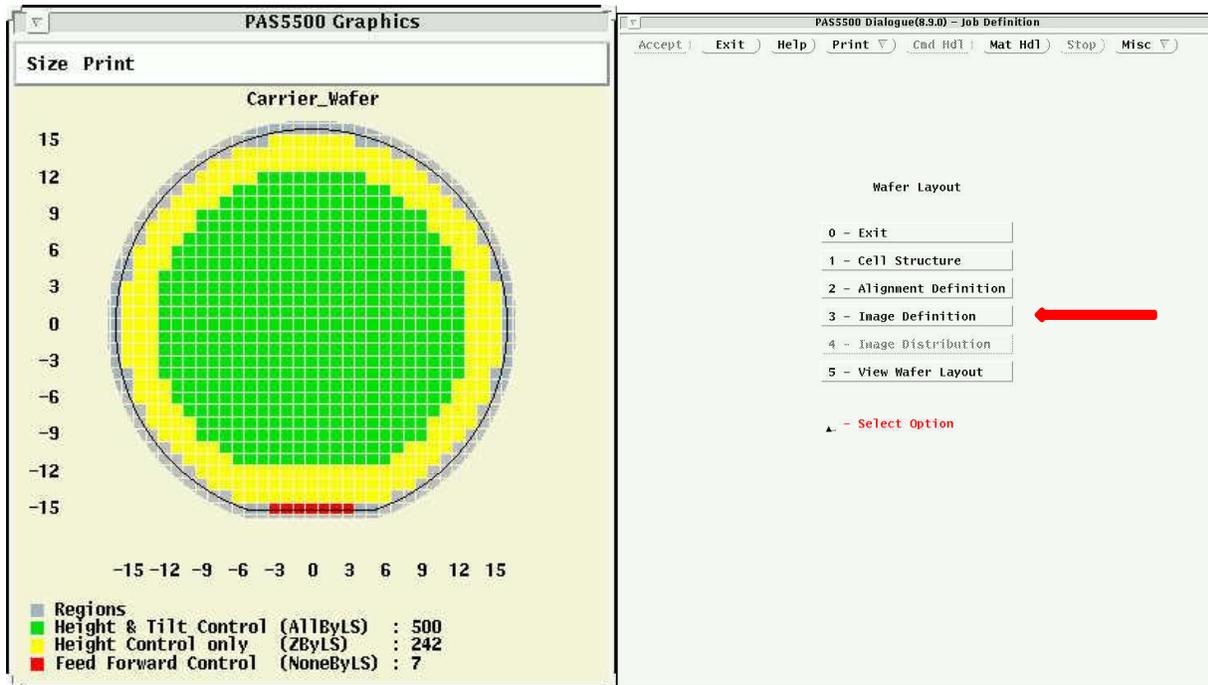
Cell Matrix: Use this to shift the die matrix to do optimum filling. If 0 is selected, the operator enters a matrix shift value in mm. There is an auto function option that tells the computer to do this for you (only for round wafers).

Press **Preview Results** button to update carrier graphics window with the cell matrix

Select **Focus Modes Stepper** button to see the focus height/tilt control modes for all dice. This assumes that the exposure image is in the center of the mask. See focus control modes screenshot below. Green means use of 4-spot die level sensor (die level plus height). Yellow means red level sensor (height only) with die level data used from nearest neighbor die. Red means use data from nearest die for both height and level.

Press **Accept** at top when done to return to wafer layout screen.

Image Definition



Focus Control Modes on wafer

Wafer Layout Screen (2)

Choose **Image Definition** from the menu to get to the image definition screen. In this screen, you will enter information about where and how large the different exposure patterns (images) are on the mask.

First, **name the image ID**. Numbers are fine, Names are fine.

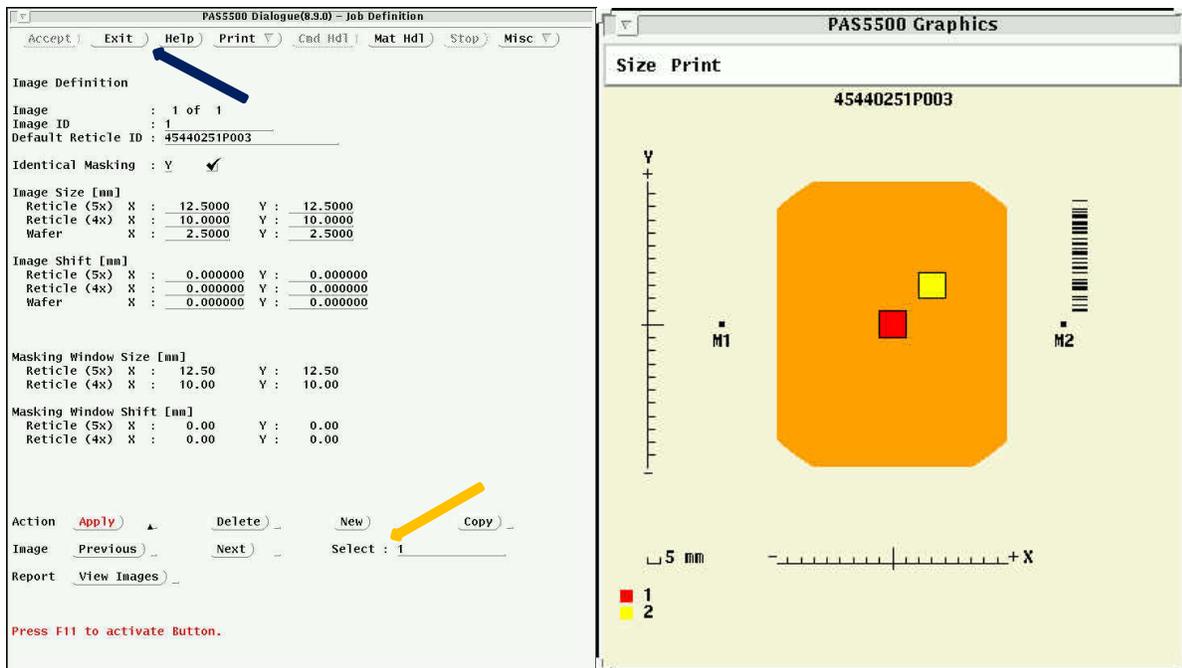


Image Definition Screen

Reticle (Image) Layout

Next, **Input a default reticle ID**. Press enter after typing. This is on the barcode on your mask. The mask maker, Toppan, will put this barcode on the mask. You specify the text string to them.

Next, **specify an image size** (wafer scale or reticle scale). This will set the blade window size for blanking off parts of the mask not desired in the exposure. At wafer scale you need 0.75mm of Cr-border separation on the mask between images to prevent light from bleeding around the shutter blades and exposing a neighboring field.

Next, **specify an image shift** (wafer scale or reticle scale) if the area on the mask is off-center. This is how to have multiple layers on the same mask for different process steps.

Press **Apply** when done, a window showing the reticle layout with color coded Image IDs will appear.

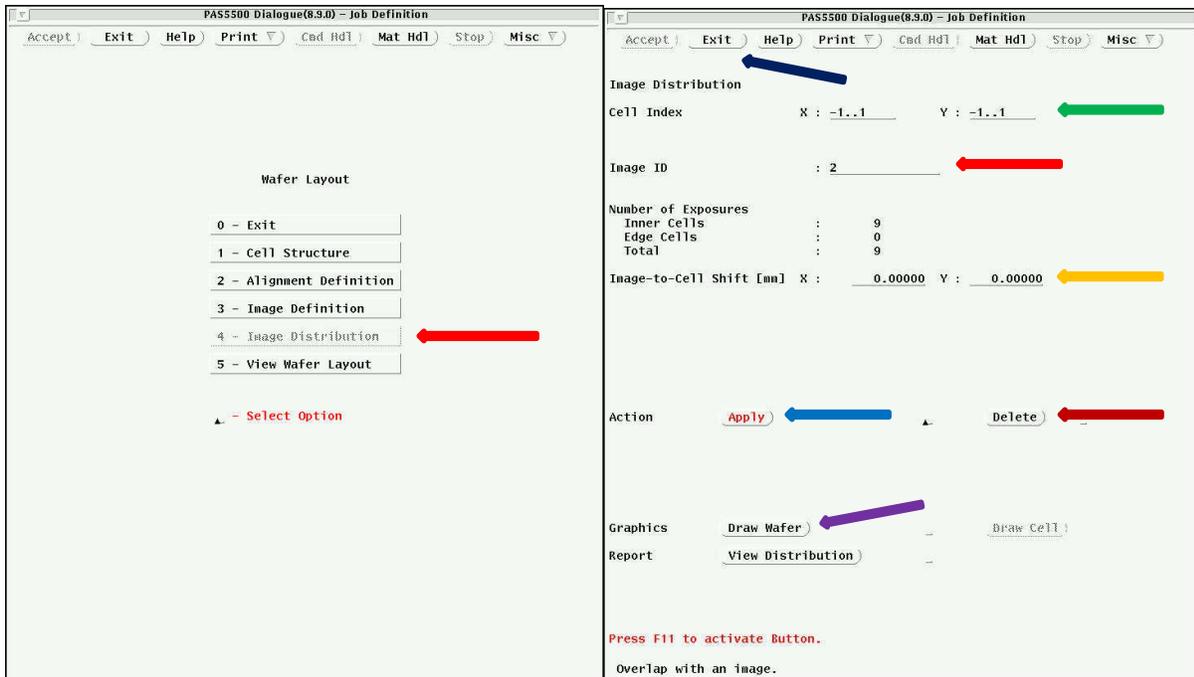
To **add another image**, press **New**, define all parameters for this image, **Apply** again.

The reticle layout window shown above is defined for two, 2.5mm square images (wafer scale) separated by 5mm in x and y (wafer scale)

Select **Exit** on top button row when done. This takes you back to the Wafer Layout Menu.

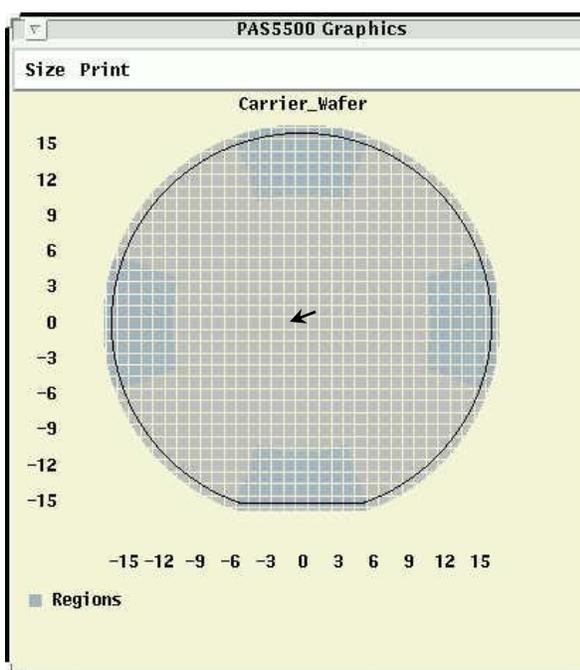
Image Distribution

Select **Image Distribution**. In this section you will choose which cells to expose for each image defined in the image definition section. See Image Distribution Page below

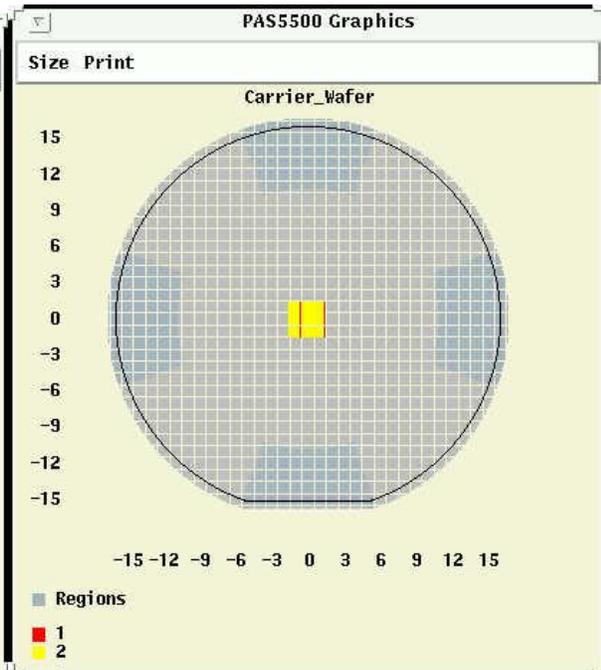


Wafer Layout Screen (2)

Image Distribution



Carrier Graphics - Cursor pointing at 0,0.



Carrier Graphics - Cells to be exposed.

Image ID: Select the image ID you wish to distribute on the wafer. This will be a pulldown menu.

Press the **Draw Wafer** button to display the carrier graphics screen. Row and column numbers are indicated on the axes.

You can select cells to expose in two ways:

1. **Cell Index:** Enter the cell number, where x=0,y=0 is the center cell, press **apply**. Enter a range of cells (with format -3..3), press **apply**.
2. Use mouse to select cells on carrier graphics screen. Pressing same cell again removes the selection. Press **apply** button.

As you apply the cells, they show up on the carrier with the color assigned to the particular image selected.

For each exposed cell, you can also specify an **image shift** relative to the cell outline. If you put in a number, remember to hit apply to make it active. This will usually be zero.

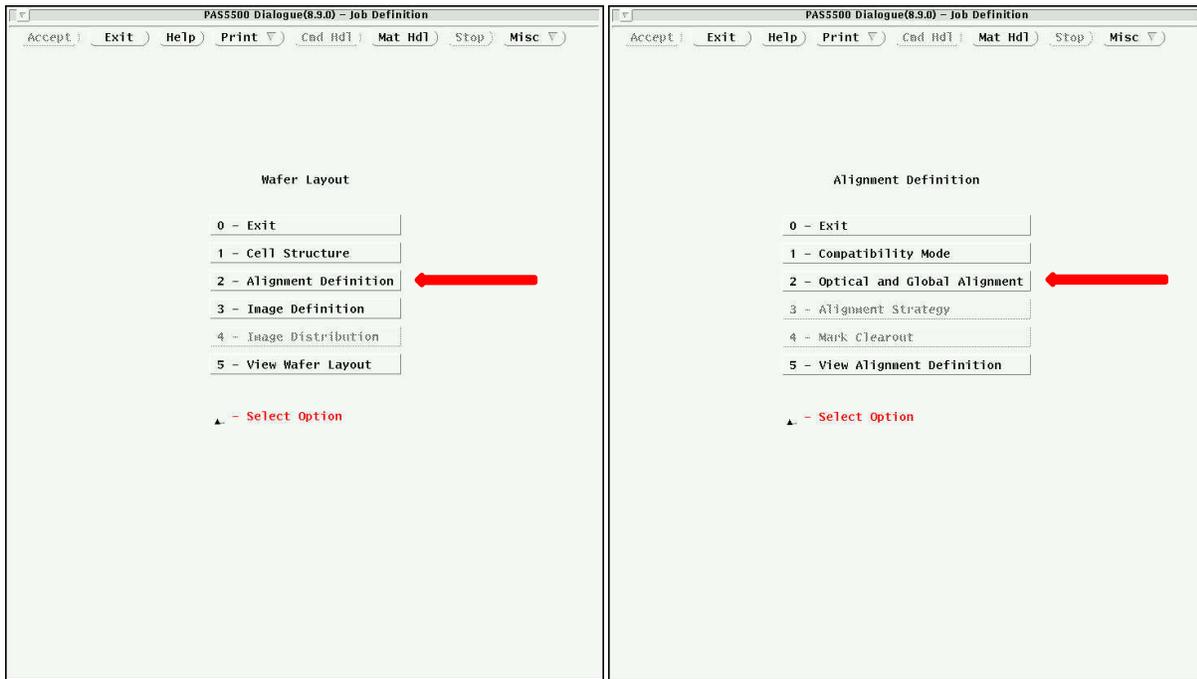
You can also delete an image cell by selecting the cell as shown above and pressing the **delete** button.

The picture above shows a 3 x 3 matrix of cells with two images (1 and 2) set to be exposed in each cell.

Select **Exit** on top button row when done. This takes you back to the Wafer Layout Menu.

Alignment Definition

Select **Alignment Definition** from the menu. This takes you to the Alignment Definition Menu.

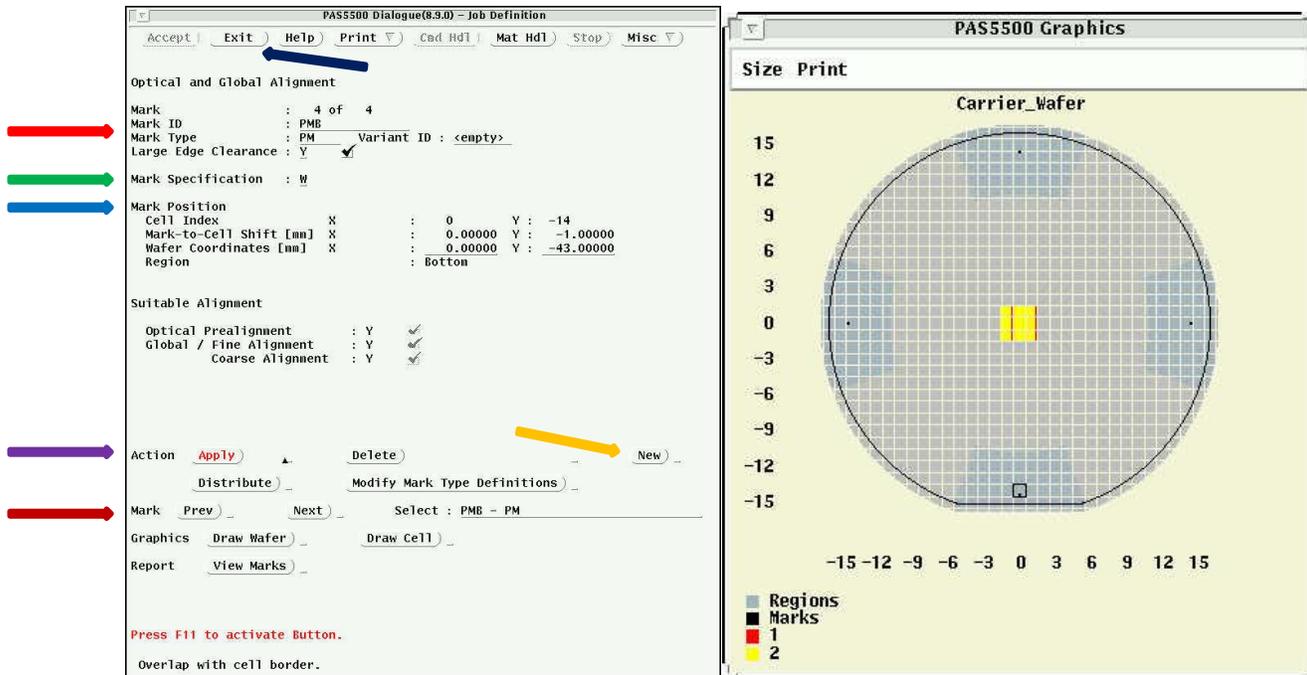


Wafer Layout Screen

Alignment Definition Screen

From the Alignment Definition menu, select **Optical and Global Alignment**. In this section, you will define where alignment marks will be placed on the wafer. The PM marks are on a reticle always installed in the system and the machine knows where they are. You do not need to put alignment marks

on your mask layers. These are exposed and etched into the carrier during a level 0 exposure step or in combination with layer1. These marks will be used for alignment of the wafer to the system. Alignment accuracy is better than 50nm, in general, for this system. Placing marks along both x and y axis is recommended.



Optical Global Align Screen

Wafer Graphics

Defining the wafer marks. The 4 marks must appear in the darker gray areas as shown on the wafer graphics screen. This is where the system accepts marks for optical pre-alignment.

Mark ID and Type: Enter PML for the left mark and select PM for mark type. Use Large Edge Clearance.

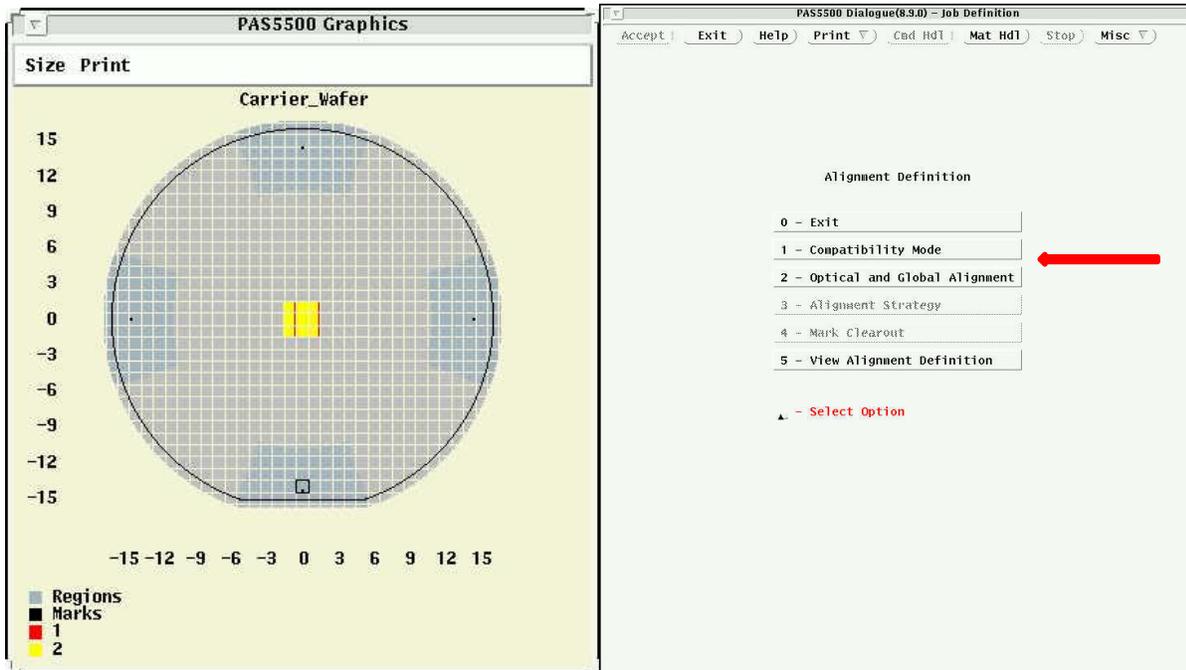
Mark Specification: Choose W to select the mark position in mm from center on the wafer. Choose C to specify the cell index position and offset of the mark relative to cell center. For 4" wafers, you can place the marks right at the cell edge where the dice streets are.

Mark Position: If "W" chosen above, put in the wafer coordinates, relative to center, where you want the left mark.

Select **Apply** button to make the mark appear on the graphics screen.

Press the **New** button to make the next mark. Following the same sequence as above, define PMR, PMT, PMB marks for the Right, Top, and Bottom alignment marks. If you made an error and need to change a mark, use the **Prev and Next** buttons to get to the mark you need to change.

Select **Exit** on top button row when done. This takes you back to the Alignment Definition Menu.



Wafer Graphics

Alignment Definition

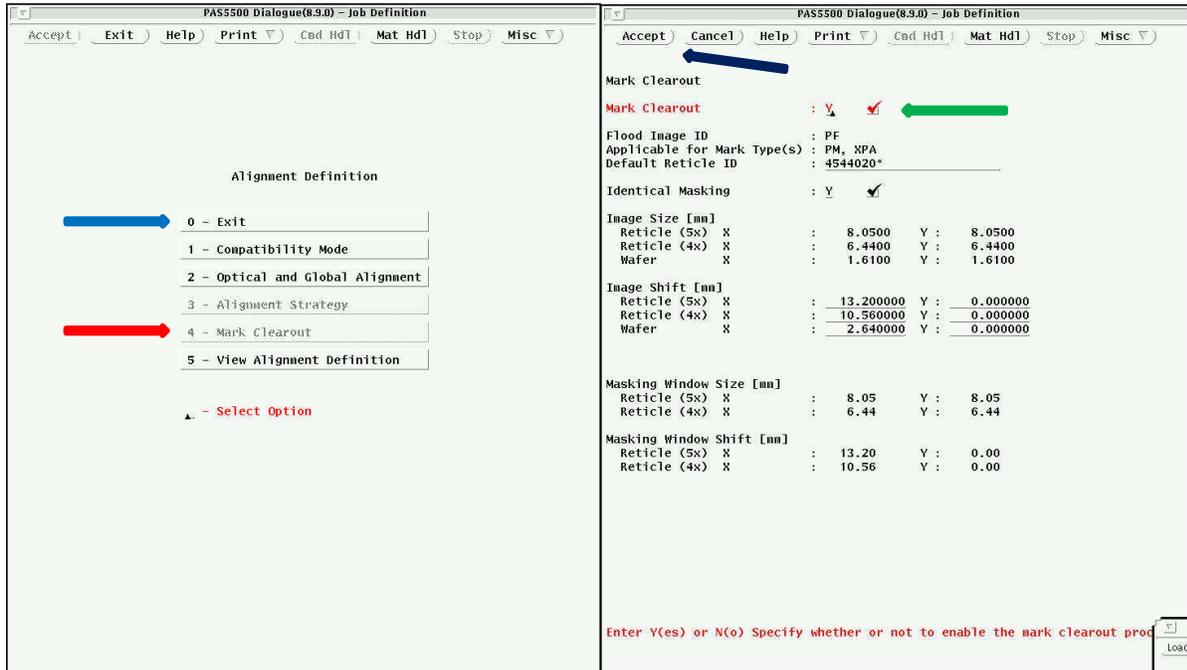
Next, select **Alignment Strategy**. This is where you will tell the system which alignment marks will be used together for aligning layers. Multiple strategies can be defined to use different sets of marks for different layers. For 4" wafers, you will use one strategy.

First, Name the **strategy ID** and press the **Apply** button. Wafer alignment method is always TTL.

Next, press the **Marks Selection** button to open the mark selection and mark alignment graphics screens so that you can select the marks that will be used for this alignment strategy.

Enter the **Mark ID** by name (you can use wildcards, for instance you can type P* to select all mark IDs starting with P) or click on the alignment marks you wish to add to the strategy (in the upper graphics screen). The selected mark will appear as blue in the upper screen.

Select **Exit** on top button row when done. This takes you back to the Alignment Strategy Screen. Press **Exit** again to get back to Alignment Definition Screen.



Alignment Definition

Mark Clearout Screen

Next, select **Mark Clearout**. This will take you to the Mark Clearout Screen.

Mark Clearout Option: **Check the box if desired**. Checking this box will enable the option (to be enabled in a later step on various layers) to expose a window over the alignment marks during a subsequent process step. This is used primarily if you are doing a negative resist process, but want the marks protected from being damaged during the process step.

Press the **Accept** button when done.

Press the **Exit** option until you reach back to the Job Contents Menu.

Layer Layout

Next, go to the **Layer Layout** Menu.

Layer Definition

The first step will be **Layer Definition**.

First enter the **number of layers** for your process (2 for this example; 1, and 2, the 0 layer is always included). Press **Apply**. You can choose more than you need in case you will want to add layers at a later time.

You can enter a **layer ID name** for each layer (or just use the numbers). Use the **Next and Previous Buttons** to edit the layer IDs for each layer. Remember to hit **Apply** after each name change or addition.

When done defining all layers, **Exit** to Layer Layout menu.

Process Data

If you will combine the zero-layer marks with the first layer process then go to the **Process Data** menu first.

Use the **previous/next** buttons to select the layer.

For a 4" wafer, if you want to shoot layer 1 at the same time as you put on the 0-layer alignment marks, check the **combined zero/first layer box**. This saves a process step for full wafers.

For all layers which will use alignment marks, check the **optical prealignment box**. If you chose to combine marks exposure and layer1, you will not have optical pre-alignment.

Select the **outer left and right alignment marks** for use in prealignment.

Press **Apply** when done to make changes active. Make changes to the rest of the layers.

Press **Exit** when done to return to the layer layout menu.



Layer Layout Menu

Process Data

Strategy Selection

With only one alignment strategy, you do not need to look at this menu. All layers requiring alignment will default to that strategy.

Reticle Data

Next, select **Reticle Data** from the layout menu. In this screen, you will tell the system which images to expose on the layers, energy of the exposure for each image on each layer, focus offsets, NA of the lens.

The image displays two screenshots of the 'PASS500 Dialogue(8.3.0) - Job Definition' software interface, specifically the 'Reticle Data' screen. The left screenshot, labeled 'Reticle Data Screen (1)', shows Layer 1 selected. The 'Image' field is set to 'PF'. The 'Expose Image' checkbox is unchecked. The right screenshot, labeled 'Reticle Data Screen(2)', shows Layer 2 selected. The 'Image' field is set to '1'. The 'Expose Image' checkbox is checked. Colored arrows point to specific fields: a blue arrow points to the 'Layer' field in both screens; a green arrow points to the 'Image' field in screen (1); a red arrow points to the 'Layer' field in screen (2); and a yellow arrow points to the 'Reticle Image Size' field in screen (2).

Field	Screen (1) Value	Screen (2) Value
Layer	1 - 1	2 - 2
Combined Mark/Image Exposure	Y	N
Image ID	PF	1
Expose Image	N	Y
Reticle ID	4544020*	45440251P003
Identical Masking	Y	Y
Reticle Image [mm] Size	6.4400	10.0000
Reticle Image [mm] Shift X	10.560000	0.000000
Reticle Image [mm] Shift Y	0.000000	0.000000
Masking Window [mm] Size X	6.44	10.00
Masking Window [mm] Shift X	10.56	0.00
Masking Window [mm] Shift Y	6.44	10.00
Energy [mJ/cm2]	150.00	18.00
Focus Offset [um]	0.00	0.00
Focus Tilt Offset [urad] Rx	0.0	0.0
Focus Tilt Offset [urad] Ry	0.0	0.0
Illumination Mode	Default	Default
Numerical Aperture	0.57	0.57
Sigma Outer	0.750	0.750

Reticle Data Screen (1)

Reticle Data Screen(2)

First, go down to **Layer** and select the first layer to adjust using the Previous/Next buttons

Next, go to **Image** and select which image to adjust parameters for using the previous/next buttons. In the example in screen (1) above, the PF image is selected. The PF image is the Mark Clearout Image. Other Images available will be alignment marks (if allowed you will see the combined mark box checked near the top of the screen) and mask images you defined in the wafer layout menu.

Choose to expose (or not expose) the selected image on the selected layer by checking (unchecking) the **expose image box**. In screen (1) the box is left unchecked and no other options can be changed. Note: you will need to uncheck all images you do not want to expose on a layer. By default, all images (except PF) are set to expose on all layers.

In screen (2) layer 2 with image 1 is selected. Expose Image is also selected.

Now, you can change the **Reticle ID** if it is the wrong one and you can change the **Reticle image size and shift** if they are not correct. These parameters were defined by you in earlier menus in the wafer layout section.

Change the **Energy and focus Offset** values. Best energy and focus should ultimately be determined using a focus exposure matrix, as described in the system operation procedure.

Change the **illumination mode and NA** for the system. Conventional will be used mostly. Annular is available and can extend dense line/space fine feature resolution down to smaller numbers. Max NA is 0.63, lowest NA is 0.4. Higher NA is better resolution, but smaller process focus window.

Finish this procedure for all layers/images, then **Exit** to Layer Layout Menu.

Exit all the way back out to the main menu and say yes to saving job. Your standard job is now done.