

# $\mu$ PG 101 Mask Writer

NTUF Training Notes

v.060910

# μPG Operating Procedures

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# File Transfer

Prepare your pattern according to the Design Rules for  $\mu$ PG. (Appendix A)

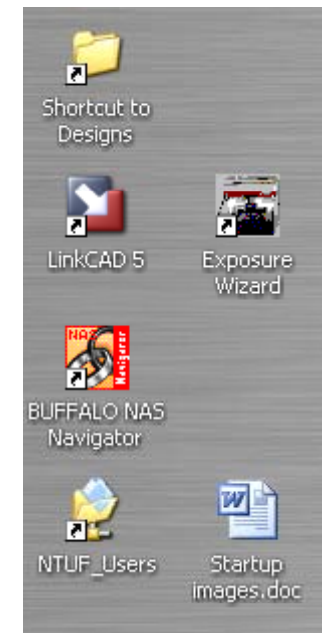
If needed, use LinkCAD to convert your pattern to one of the appropriate formats: CIF, DXF, or BMP.

Transfer your pattern file via USB to the **service PC** in the entryway – do not use USB ports on the  $\mu$ PG computer.

Save pattern to your folder in **NTUF Users**.

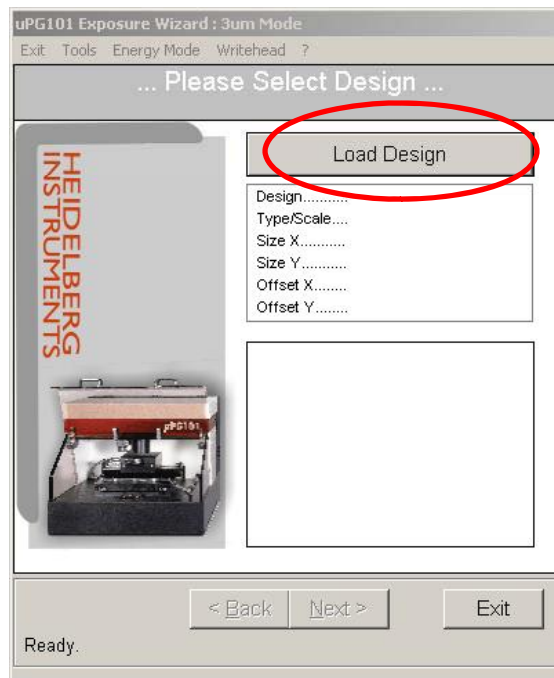
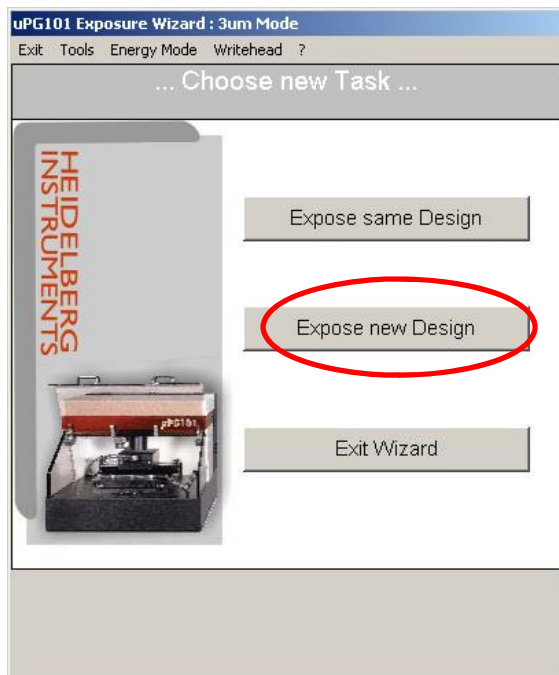
Open NTUF Users folder on the  $\mu$ PG computer and transfer pattern to your folder in **Shortcut to Designs**.

Launch Exposure Wizard if it is not already running.



# Load Pattern File

To write a new pattern select **Expose new Design** and **Load Design** pattern from the Designs folder.



Enter the number of nanometers in one design unit for your pattern.

The Exposure Wizard guides you through the entire process. Read all prompts and follow the directions given.

# Preview Pattern

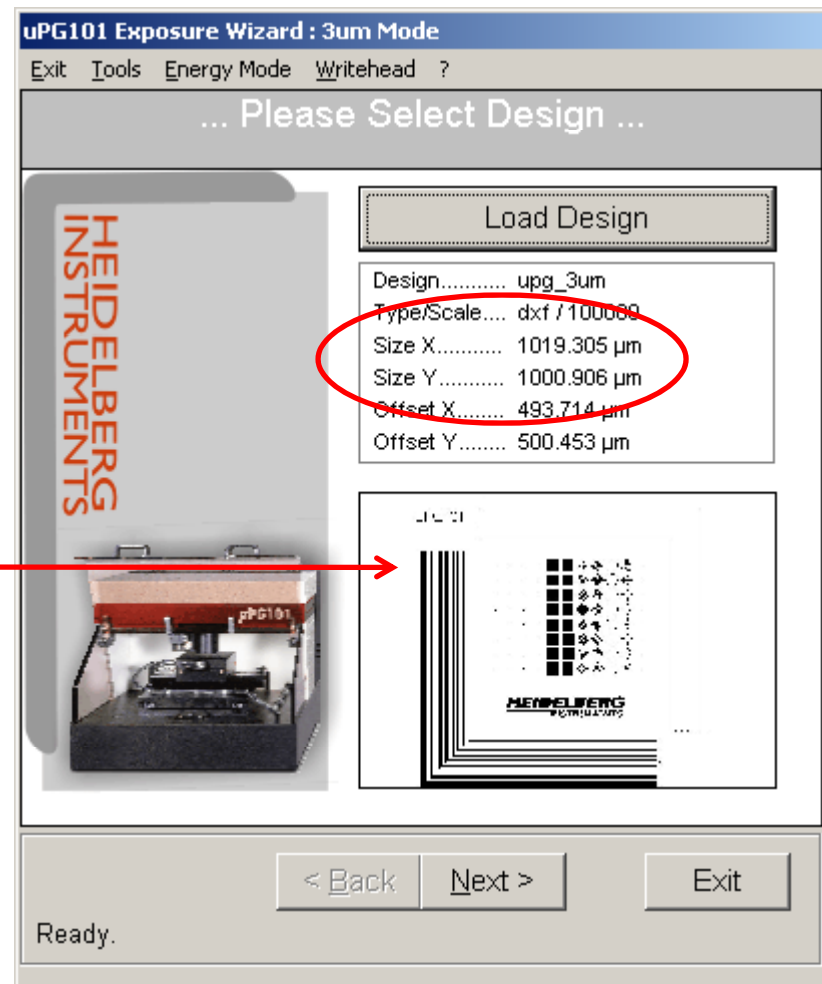
Compare the XY dimensions of the loaded pattern to the expected size.

If the loaded pattern is too large or small then the design unit entered was not correct. **Load Design** again with the correct design unit.

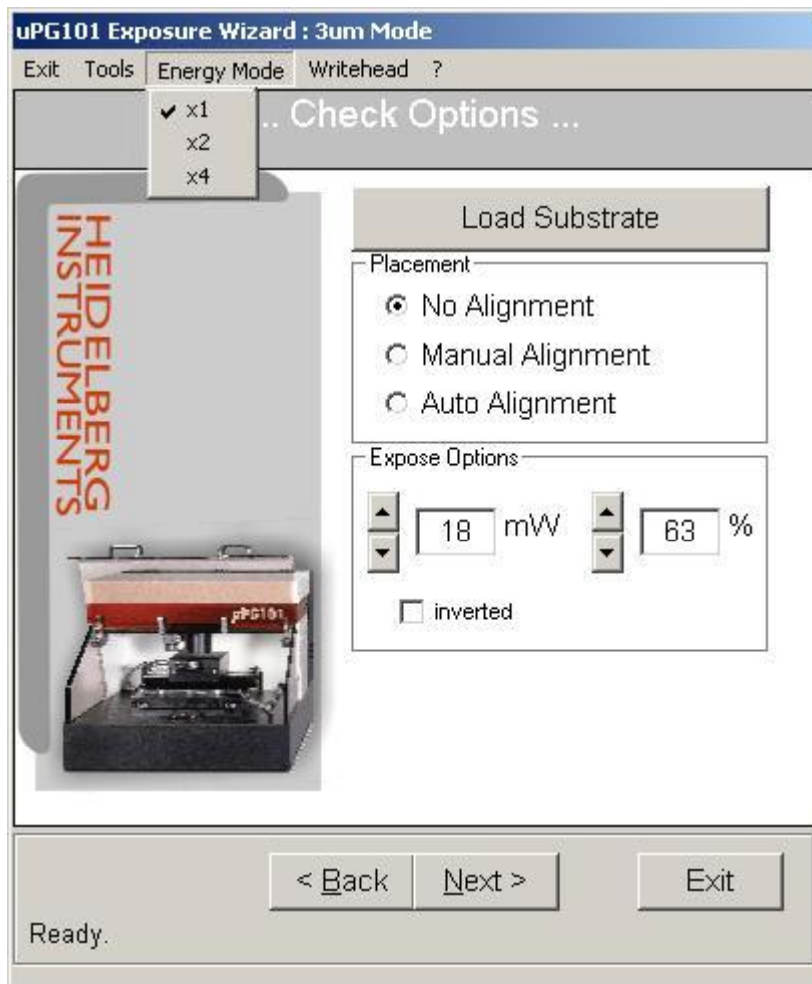
To preview the detailed pattern, double click on the preview window.

*Note: a black box may be seen in the preview. This box is a software bug; it will not print on the writer.*

When the pattern is correct click **Next**.



# Set Exposure Conditions



To write at the center of the stage select **No Alignment**.

Three conditions control the exposure:

- Energy Mode
- Laser Power (mW)
- Pixel Pulse (%)

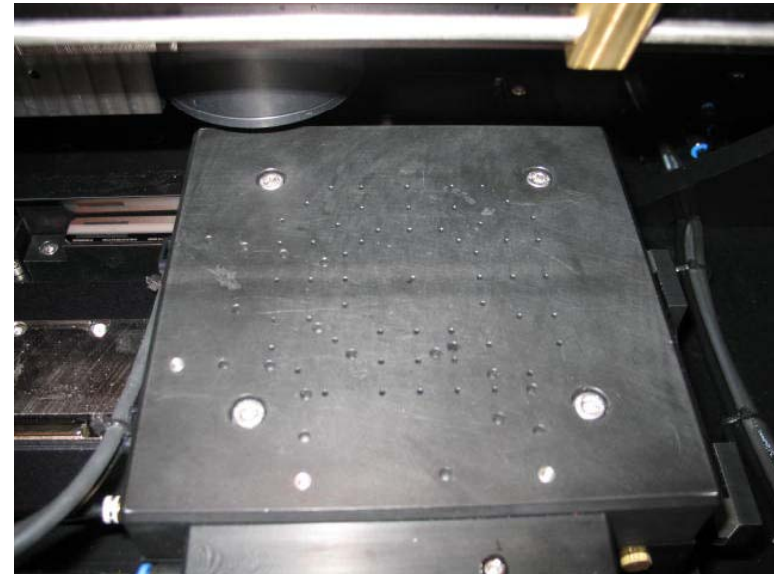
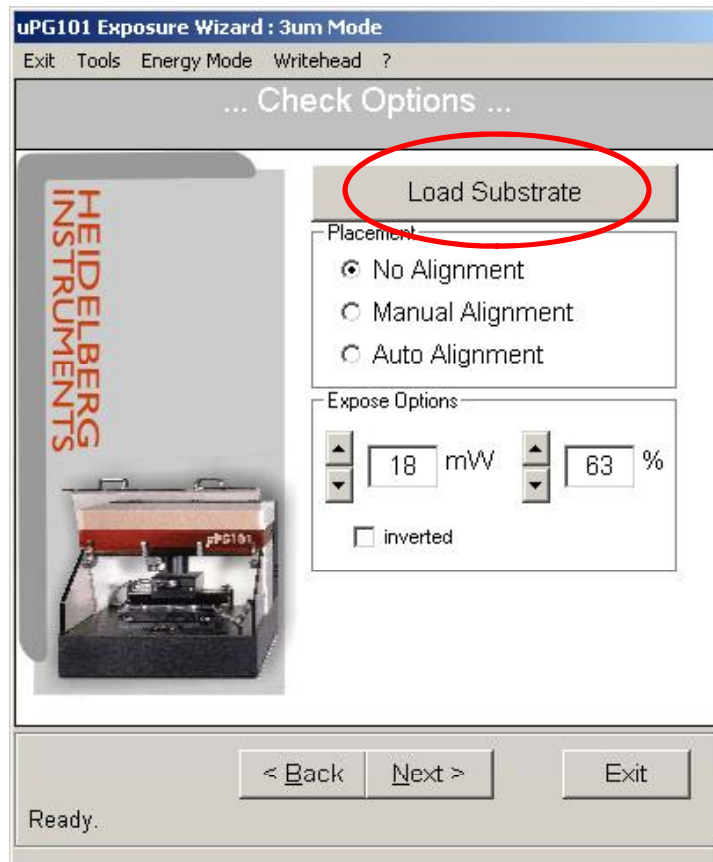
Exposure Guide\*

Resist	Mode	mW	%
AZ 1518	x1	18	63
AZ1512	x2	18	70
S 1805	x1	18	70
Su-8 2100	x4	18	70

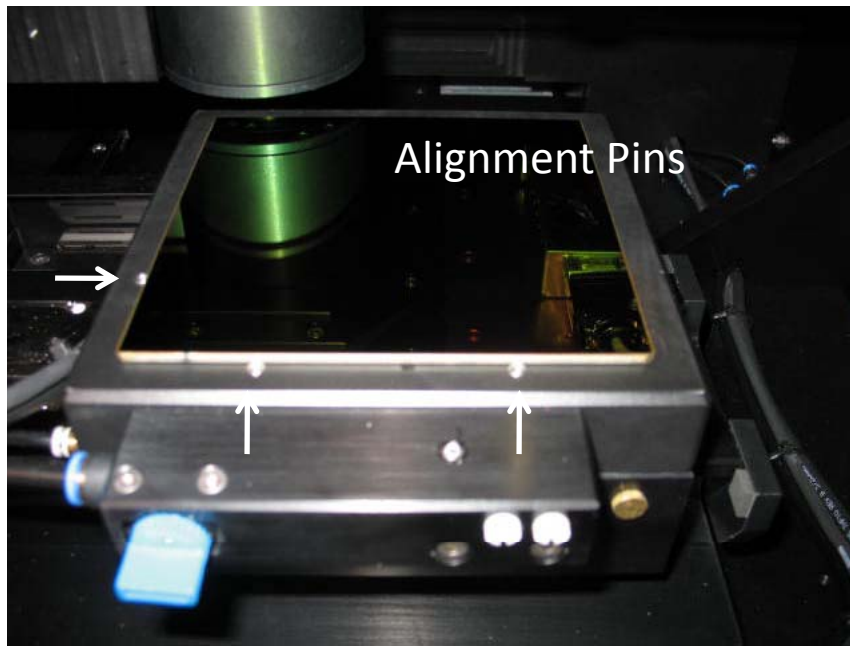
\* To find the correct exposure conditions for any resist, perform the Energy Series described on slide 11.

# Load Substrate

Click **Load Substrate** to access the stage and follow the directions in the dialog box.

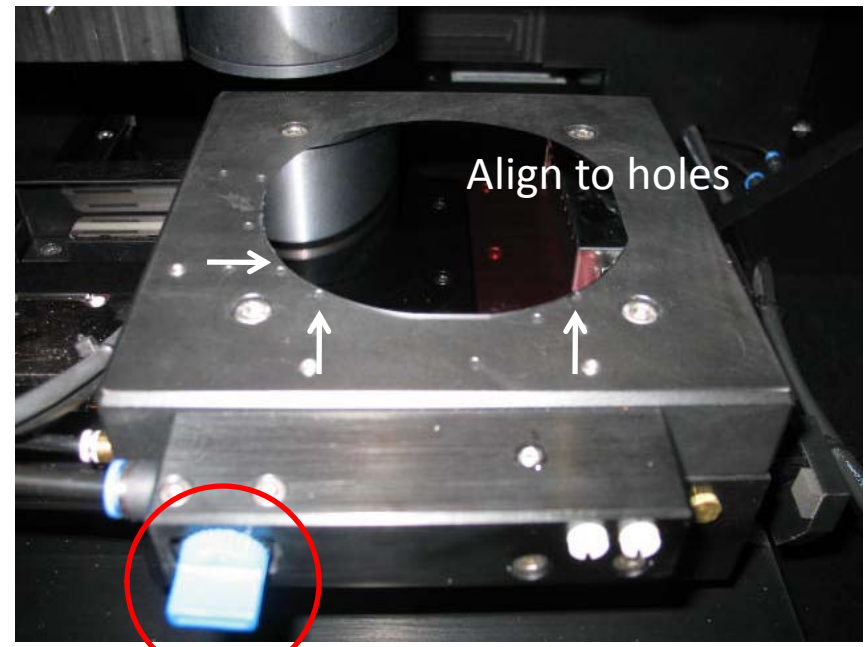


*Note: Your substrate must be flat and at least 2" in diameter. Small substrates and raised features can damage the system! **Never write closer than 5mm to the edge of the substrate.***



Alignment Pins

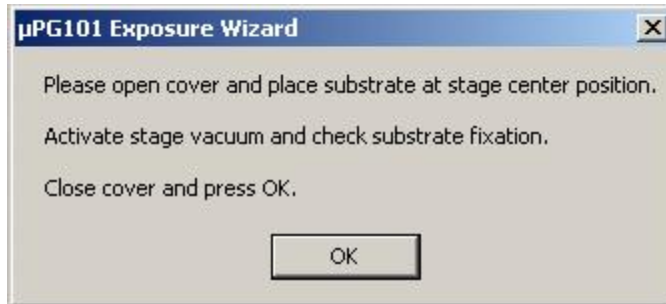
Centered Mask



Align to holes

Centered Wafer

Vacuum Valve ON



Click **OK** to withdraw the stage and focus the write head on the substrate.

*Note: Always use the Load Substrate button or your pattern will not be written in focus.*

In Check Options window click **Next**.

# Expose

## Exposure Options:

- Auto Unload after Exposure – moves stage to unload position after write.  
*Leave this box checked.*
- Expose with fixed Autofocus – write head focuses at the stage center only.  
*Use fixed Autofocus for uneven resists such as thick Su-8.*
- Uni-Directional Mode – writes in a single direction rather than back-and-forth.

After selecting options click **Expose**.



# Finish Writing

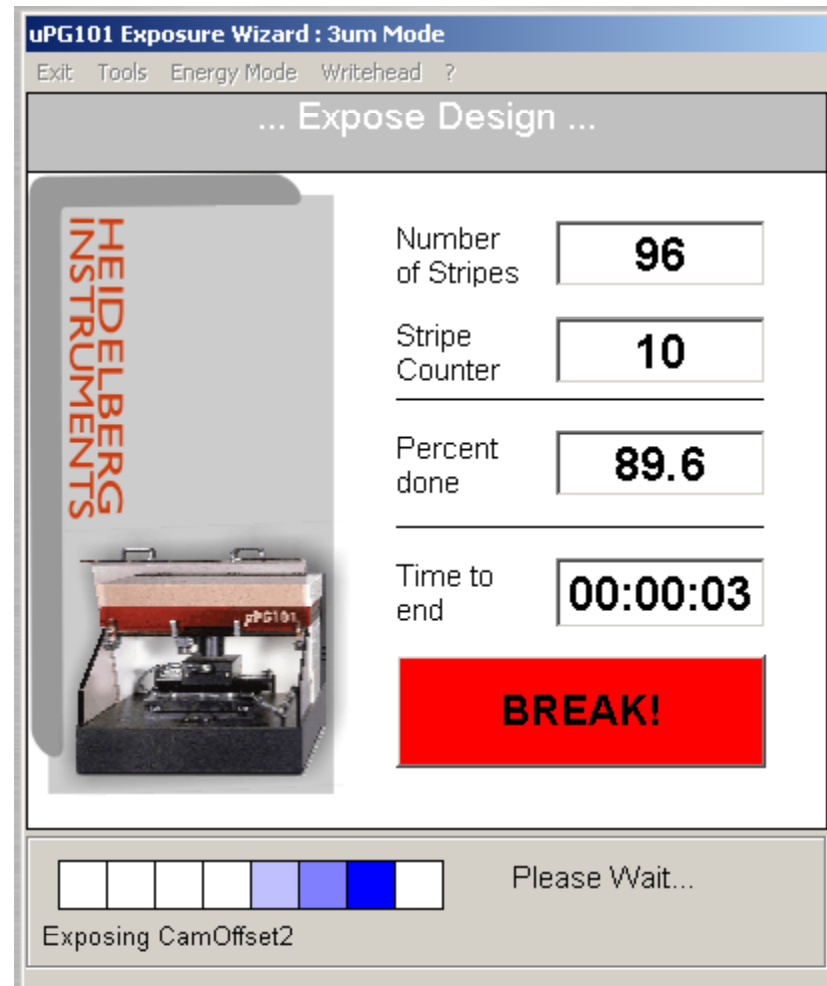
Exposure Wizard will estimate the time to finish – write this time in the  $\mu$ PG logbook.

To stop the write click **BREAK!** The write cannot be resumed, you must start again.

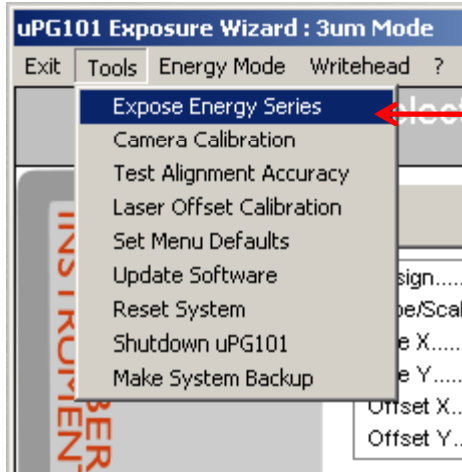
*Note: Do not stop another user's process unless there is an emergency. Contact NTUF staff if you have a question.*

When the write is finished turn off the vacuum valve and remove your substrate.

Do not turn off the instrument or close the software.



# Expose Energy Series



An exposure series is used to find the optimal exposure conditions for a new type or thickness of resist.

The pattern file written is a standard array of features from 1 to 10  $\mu\text{m}$ .

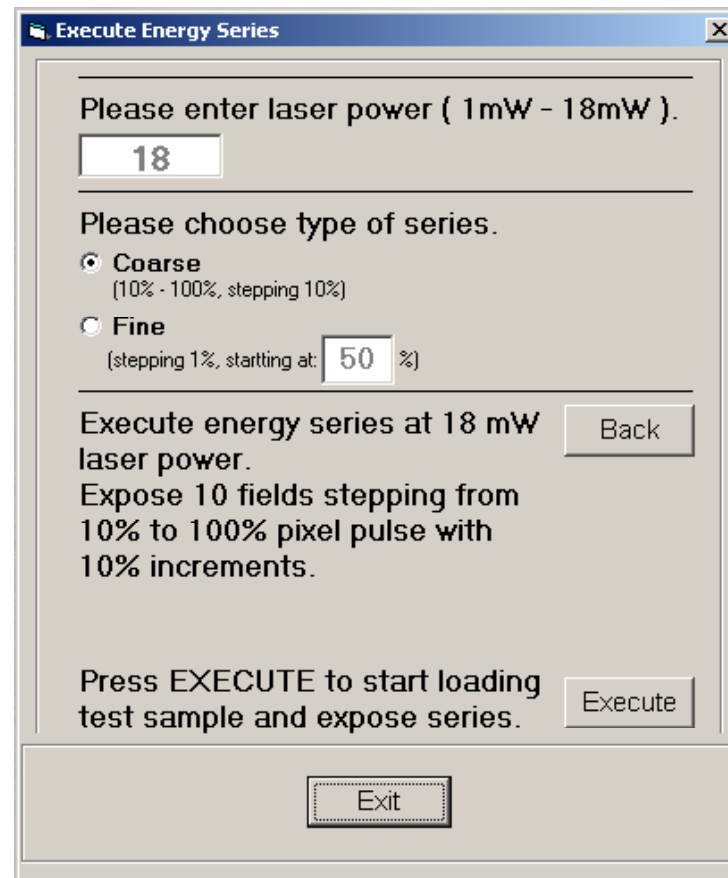
Select **Energy Mode** (x1, x2, or x4)

Use **18mW** laser power.

Select **Coarse** stepping.

**Execute.**

You will be prompted to load the substrate.



# Manual Alignment

Load Substrate

Placement

No Alignment

Manual Alignment

Auto Alignment

Expose Options

18 mW

63 %

inverted

Substrat Size

2

Inch

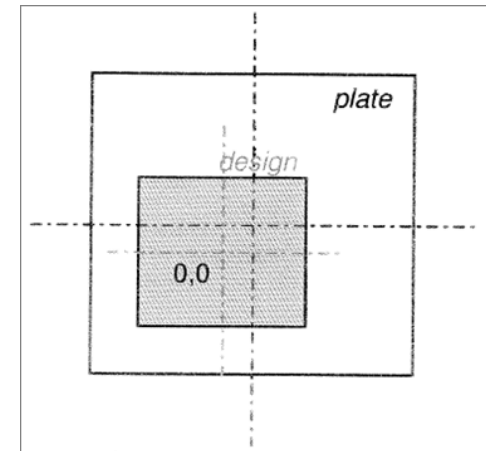
cm

Manual Alignment is used to view the write area and position the pattern at the desired X,Y location.

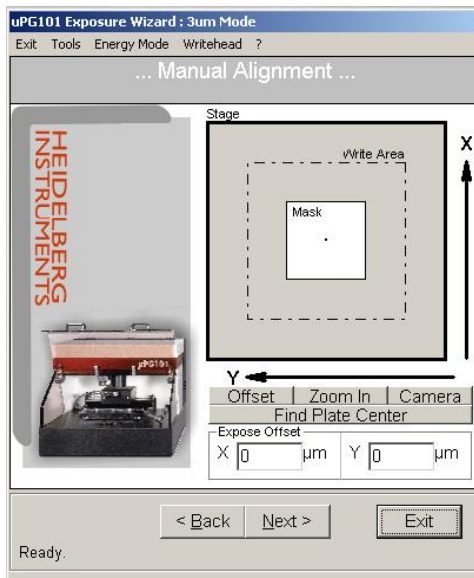
Load substrate at the center of the stage (see slide 8) and select Manual Alignment.

Enter approximate Substrate Size.

Click **Next**.



Example: Design is written below and left of the plate center.

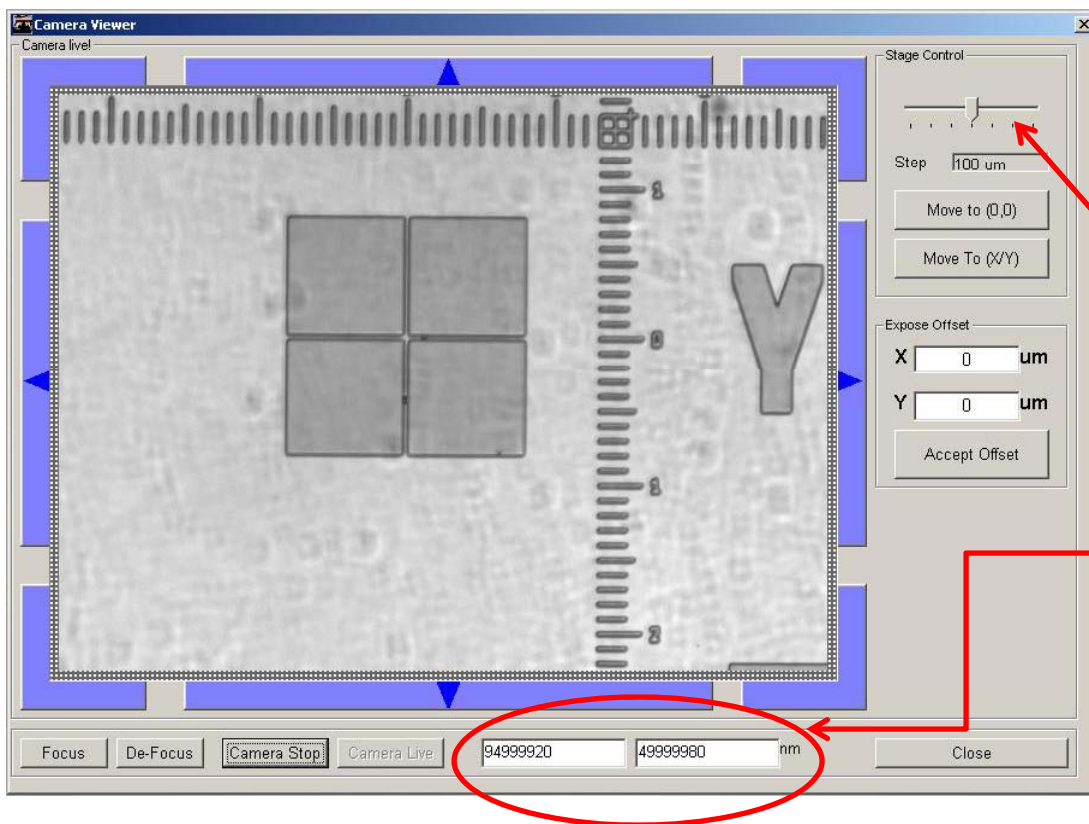


Manual Alignment window shows the pattern area (green), mask area (white), and the writable area (dotted line).

Options:

- Offset – Enter design offset from mask center (X,Y) in  $\mu\text{m}$ .
- Zoom In – Magnify the Manual Alignment window.
- Camera – Use the look-down camera to view the substrate.

# Camera



Locate the desired feature by clicking the purple stage movement buttons.

Adjust the step-size with the slider bar.

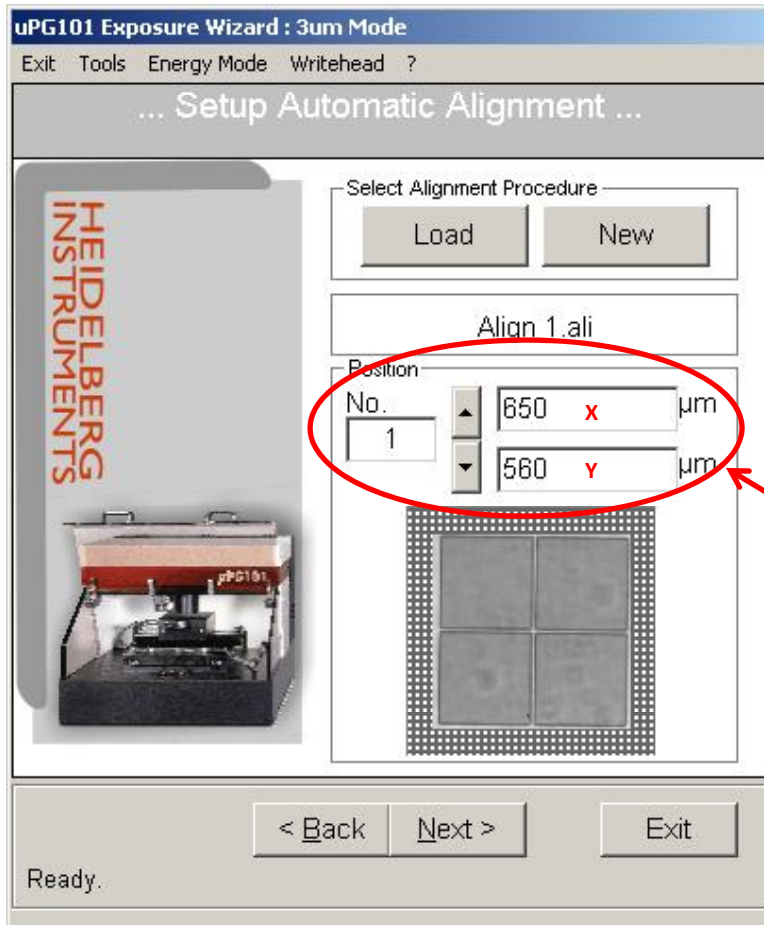
Copy the stage coordinates of your feature from the display (convert nm  $\rightarrow$   $\mu$ m).

Enter exposure offset in  $\mu$ m and **Accept Offset** for Manual Alignment.

*Note: When using an alignment procedure for Automatic Alignment (see slide 14), copy the coordinates of each alignment mark to paper. When creating a new alignment procedure (slide 15) you will be prompted for the position of each alignment feature.*

# Auto Alignment

Automatic Alignment can accurately position multiple layers of lithography.



*Note: The substrate must be loaded in the same orientation on the stage for each layer of writing (see slide 8).*

Select Auto Alignment. Click **Next**.

**Load** an existing alignment procedure or click **New** to create a procedure for your wafer (see slide 15).

Each alignment mark in the procedure is numbered (No.) Scroll through them with the up/down arrows and enter the stage coordinates of each alignment mark in  $\mu\text{m}$ .

*Note: To find the X,Y coordinates you will use the camera (see slide 13).*

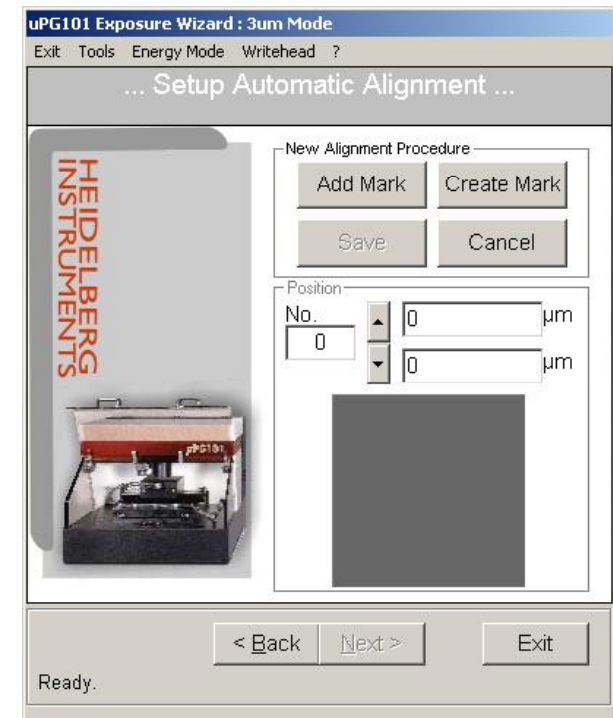
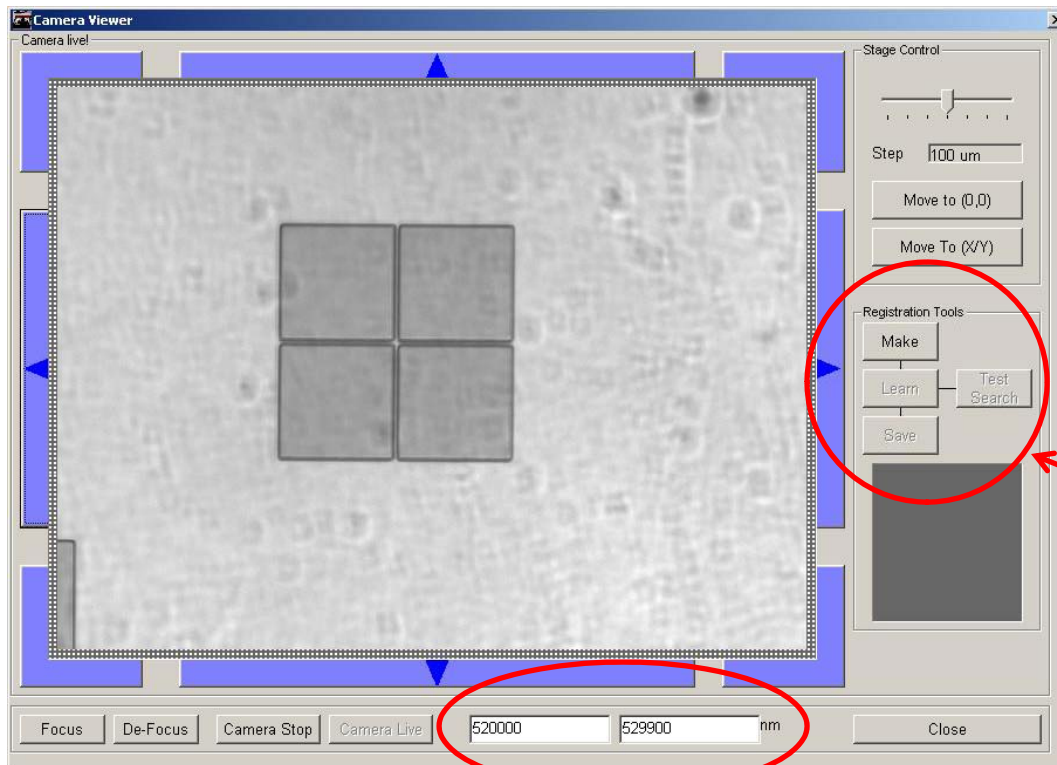
When your alignment procedure is ready click **Next**.

# New Alignment Procedure

Click **Create Mark** to capture an image of the alignment feature.

Move stage to the first feature (see slide 13).

Click **Make** and resize the red box around the feature.

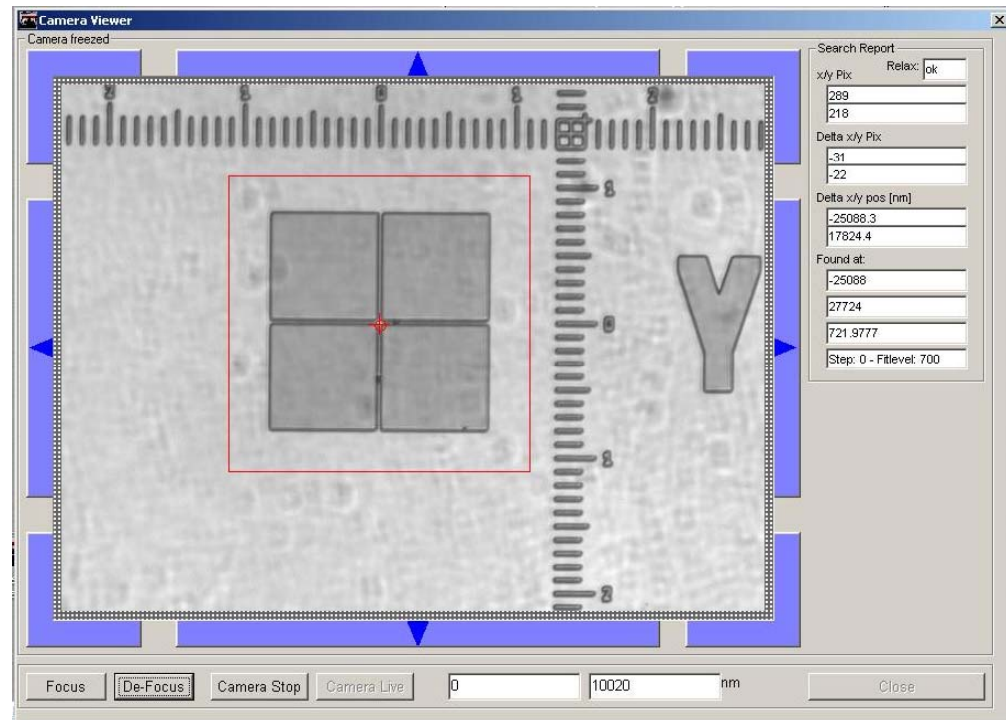


Click **Learn** to capture the image & **Save**.

Copy the stage coordinates for all of the alignment features.

**Close.**

# Test Auto Alignment



Click **Test Alignment** to check your procedure.

The stage will move to the specified coordinates and locate each alignment feature.

Successful alignment shows X/Y-Offset and rotation angle.

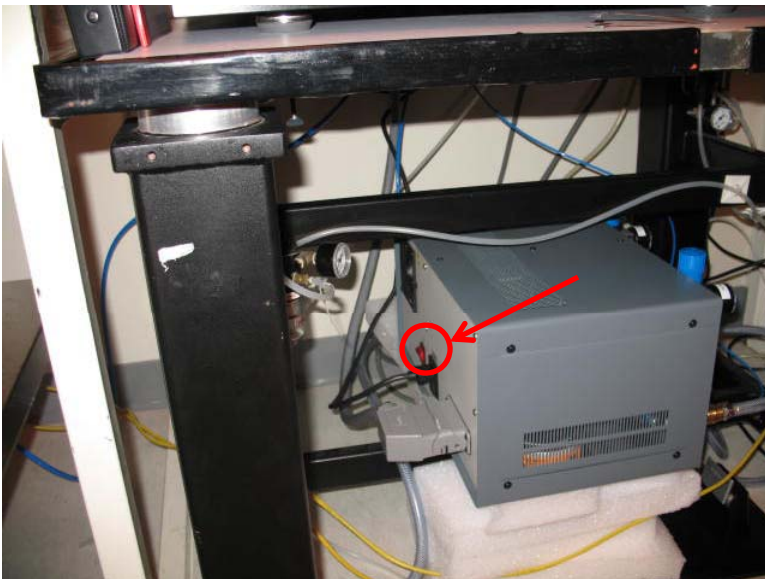
**OK. Expose.**



# Reboot System

If there is a communication problem between the computer and  $\mu$ PG controller, the user can reboot the system.

Be sure to note this in the logbook.



1. Close the Exposure Wizard (Exit).
2. Switch off the system using the On/Off switch at the supply unit under the writer.
3. Wait ~20 seconds.
4. Switch on the system.
5. If needed, reboot the User PC.
6. Wait at least 5 minutes before launching the Exposure Wizard.

*Note: If the supply unit has been powered off you must allow at least 5 minutes for the internal controller to reboot or communication problems will result.*