Standard Operating Procedure (SOP)

Heidelberg DWL66+ Laser Writer, Mask-Writing

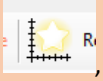
(LW-01)

In case of fire or injury please call 911 (511 from campus phones)

If there is an error on the system/tool please report it in IRIS, the staff will take care of it

Please *DO NOT* run diagnosis without a staff member's approval

Common Errors and What To Do If You See Them:

1) **<u>Error messages</u>**:
   a. "Please unmount current device <WriteHead_XXmm> and mount device: <WriteHead_YYmm>" – the wrong write head was selected in BEAMER when exporting the data. Click "Cancel" in the prompt, go back to the workstation computer, and re-export the data with the correct write head.
   b. When you click "Start Exposure", error message says "Intensity not valid for contained designs" – the tool wasn't set to DWL66PLUS when you exported your data in BEAMER. To fix this, go back to the workstation computer, and re-export your data so that the tool is set to DWL66PLUS (and not, say, DWL2000).
   c. "Stepper <Micro_Stepper> coordinates are NOT initialized! Initialize right now?" – click OK, and switch the camera to Macro mode (click the [icon] button in the Camera window).
   d. "SpiiPlusController >> SpiiPlusError (0x0)" – stage was handled with too much force in one direction, and stage disengaged from the motor. To fix this, initialize the stage by clicking  within the "System Control" tab. This will take about a minute to run (when the icon goes from  to  , that will indicate that the initialization is done).
2) Exposure ends without running any stripes, and shows an error message saying that the job failed and doesn't provide additional information – either the data were exported with too many characters in the title, or the folder with the .lic files is in the wrong location
   a. <u>Too many characters</u>: To fix this, go back to the workstation computer, and re-export your data so that the name of the data has fewer than 45 characters.
   b. <u>Folder in wrong location</u>: To fix this, go to Y:\, find the folder with the .lic files, and move it to Y:\ (it may be in Y:\[your file name] instead of Y:\).

Common Errors and What To Do If You See Them:

2) Password/login info:

a. Windows isn't logged in – Select the user "DWL66plus", and the password is "dwl".
b. Heidelberg software asks you for login info – Username is "DWL66+ User", password is "dwl66".
c. Windows asks you for a password when you open the Y:\ drive – The password is "convert" (it should show that the user is "HI814\convert").

3) Other:

a. Stage seal has popped out – you can try to place it back in yourself. However, if you can't after 1 or 2 tries, call staff for help to put the seal back in properly.
b. Exported data to D:/Users/0_Magic_FolderDWL66+ on the workstation computer, but I don't see the data showing up in the Designs tab after I run the update – The python script may not be running. If you don't see  on the bottom toolbar in Windows, go to the desktop, and double-click 

to start the script running.
c. Fewer than 3 banking pins available for the chuck – check in the small bottle in the "Laser Writer Tools" box. If there are none there, contact staff.
d. Keyboard not working – unplug it from the USB hub, and plug it into a different USB port in the hub.

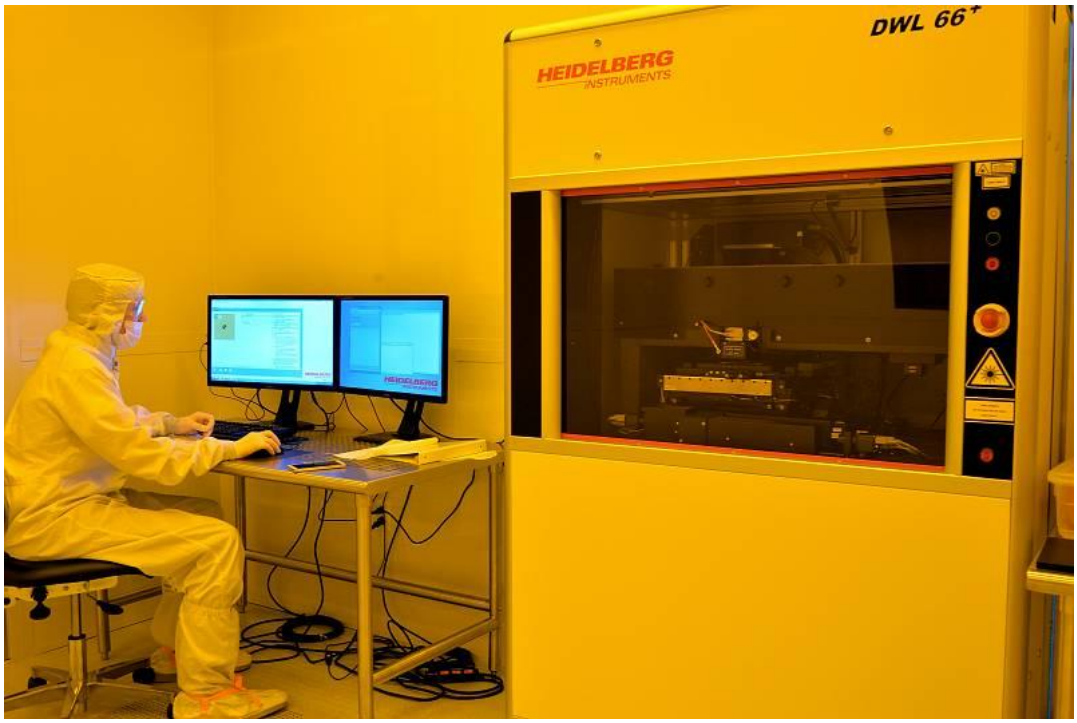
LW-01 Training Videos, QR Code:

In YouTube, search: “qnf Heidelberg dwl66+”

Link:
https://www.youtube.com/watch?v=q_mvEGSCEGI&list=PLiihbHV9HgpWAcmgdpMGBkejcBhEzoKJO

QR code (below):

Heidelberg DWL66+ Laser Writer



- Wiki page for the tool: https://wiki.nano.upenn.edu/wiki/index.php?title=Heidelberg_DWL_66%2B_Laser_Writer
- Primary tool owner: David J. Jones
- For processing questions, contact David Jones at: davijon@seas.upenn.edu
  Problems with the tool ***MUST*** be reported on IRIS. Do not contact primary tool owner with tool issues directly.

Tool Policies:

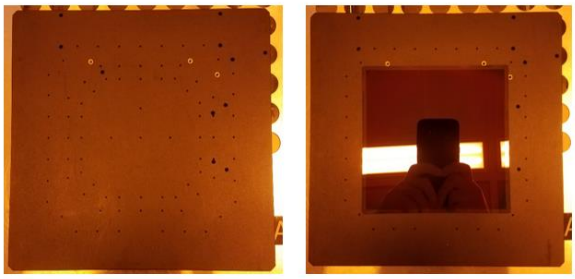
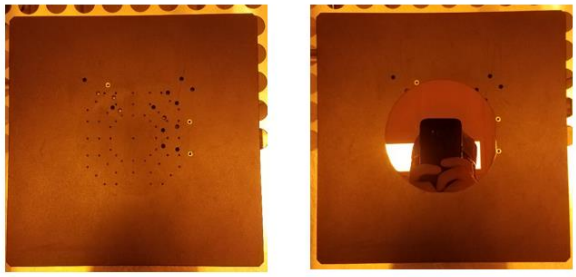
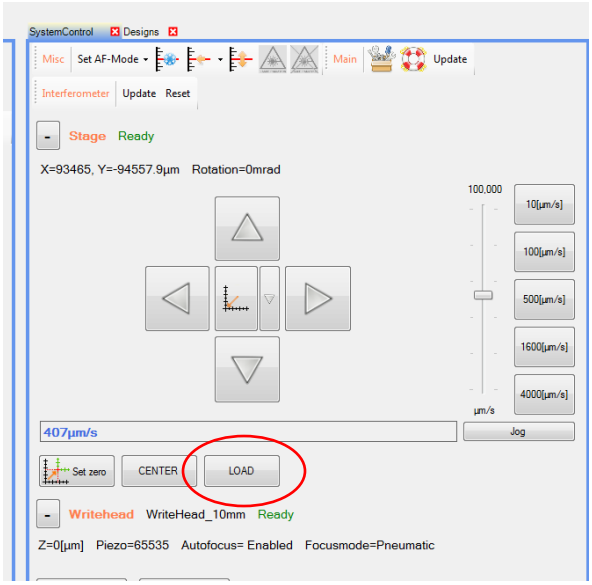
- If you need the write head (WH) changed by staff, you must give **at least 24 hours of notice**. If not enough notice is provided, it is not guaranteed that the write head can be changed in time for your write.
- You may request separate training to change the write head on your own. If you'd like to get this training, please request this training by e-mailing the staff. Note that this training will be provided at the discretion of the staff, based upon your level of experience on the tool. Training to change the write head is not covered during the standard initial tool training.

- If you'd like to expose pieces (samples that are smaller than a whole wafer) using the tool, additional training will be required to ensure that you learn how to operate the tool in a manner that's safe for the write head.
- You do not need to be present at the tool while it's running and exposure. However, it's recommended that you be at the tool while the first ~2-3 stripes are running, just to make sure it the tool doesn't error out before the exposure begins.

Procedure Overview

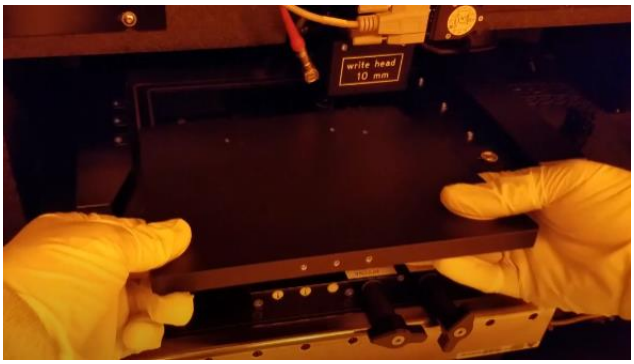
1) Load the chuck (if needed)
2) Load the sample
3) Load the write data (options):
    a. Auto-load method using auto-load script (easiest method)
    b. Load from BEAMER computer method (next easiest method)
    c. Flash drive method (least easy method)
4) Set up exposure job and run exposure
5) Take out the sample

Full procedure:

Log into the tool via IRIS. The Windows password is “dwl”, and the password for the HIMT software is “dwl66”.	
1. Load the chuck (if needed) 1.1. Open the door to the tool. 1.2. If the correct chuck is installed and the pins are in the correct position for what you need, please skip ahead to “2. Load the sample”. 1.3. In the HIMT software, click on the “System Control” tab, and click “LOAD”. This will bring the stage to the load position.	Mask Chuck  Wafer/Piece Chuck  

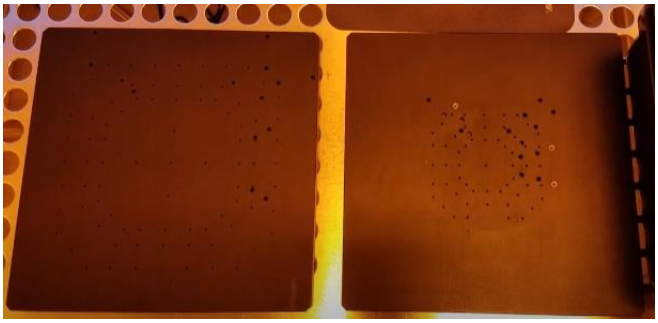
1.4. As stated on the label, set the vacuum knobs to →↑.

1.5. Angle the chuck up and slide your fingers underneath it. Pull the chuck out.

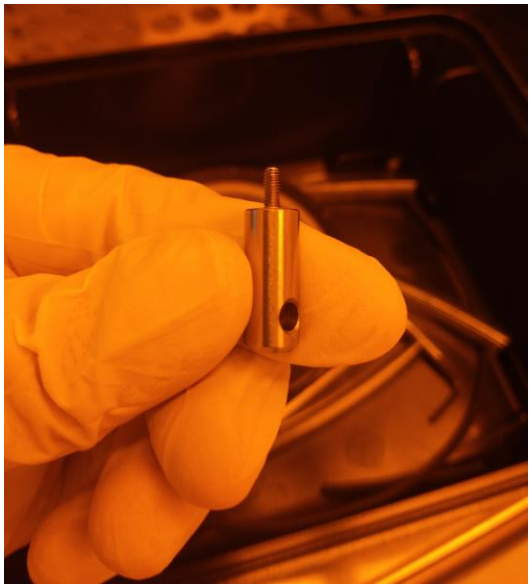


1.6. **Be sure to not flip the chuck over! If you do, you'll drop the pins.**

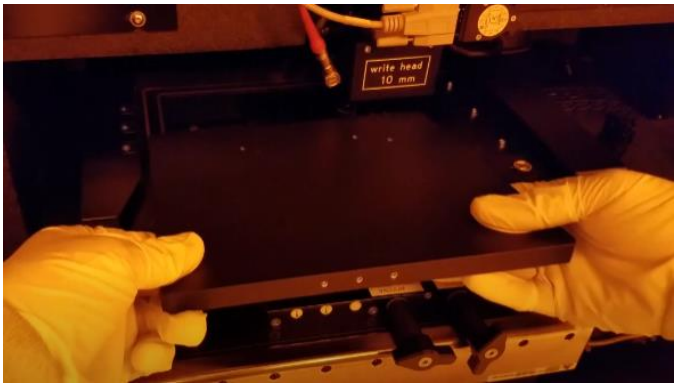
1.7. Set the chuck down on the table next to the tool, along w/ the chuck that you're going to change the pins into. The other chucks can be found in the case next to the tool.



1.8. Find this tool in the toolbox next to the tool, and screw it into the pins. Note that you only need to give it a few good turns (you don't need to screw the tool into the pins all the way).



1.9. Put the chuck back into the tool. Line up the chuck on the stage back and to the left.



2. Load the sample

2.1. Open the door to the tool.

2.2. Use the N2 gun, next to the tool to blow loose particles off of your sample.

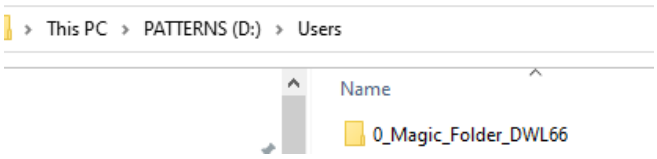
2.3. Put the sample on the stage, and line it up against the pins.

2.4. Turn on the vacuum knobs for the chuck and the sample.

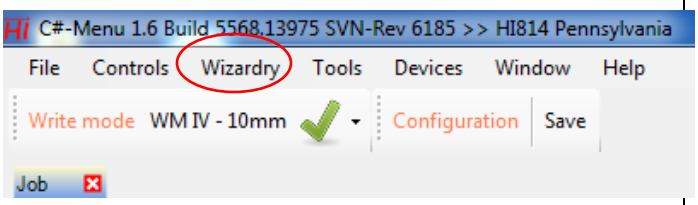
2.5. **Important note**: make sure that you're holding the sample against the pins with your left hand, and <u>then</u> turn the stage vacuum and chuck vacuum on. Otherwise, the sample may slide around, and the tool will print your sample rotated!

3a. Load the data (auto-load method using auto-load script):

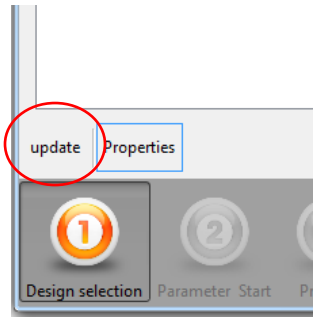
1) For this method to work, either you should have exported your data in BEAMER directly to D:\Users:\0_Magic_Folder_DWL66+, or you can move it there from the E:\ drive on the Heidelberg tool's computer.



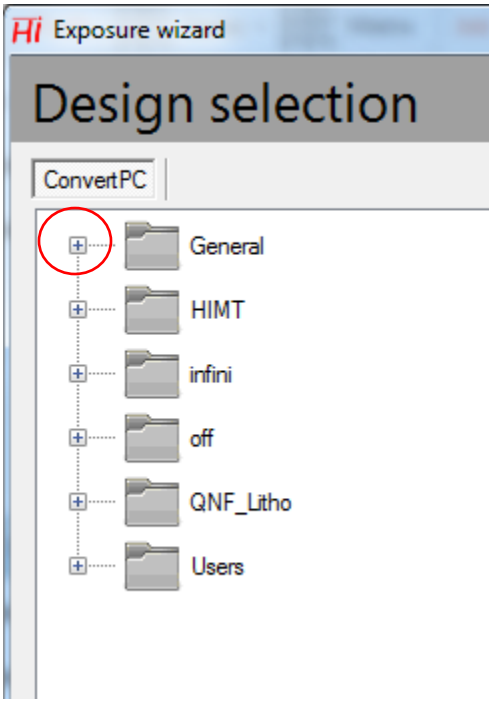
2) Open the Exposure Wizard by going to Wizardry → Exposure Wizard.

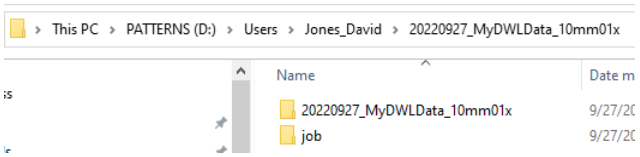
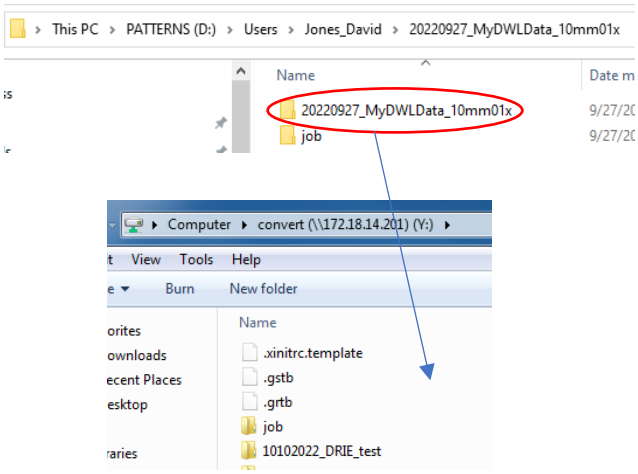


3) Towards the bottom left of the page, click "update".

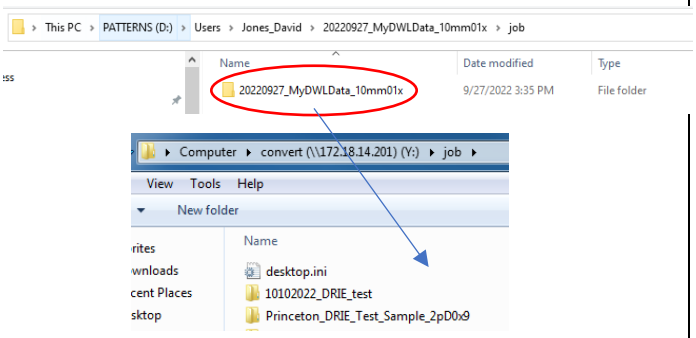


4) Once the update is done, expand the "General" folder, and select your design.



5) If you don't find your design there, check to make sure that the script is running (check item 3b in the "Common Errors" section at the beginning of this SOP).	
3b. Load the data (load from BEAMER computer method) 1) If you can't get the auto-load script to load your data, you can try using this method instead. 2) Go to Windows Explorer, and open the E:\ drive. This drive is set up as a VLAN (virtual local area network) that can read and copy data directly from D:\Users on the BEAMER computer. 3) Find your folder, and find the folder that was exported from BEAMER. In this folder, there should be 2 folders: one with the same title as the data that you exported, and another titled "job". 4) Copy the folder with the same title as the data that you exported (the folder should contain many ".lic" files) to the Y:\ drive on the Heidelberg tool's computer. The Y:\ drive can be found under My Computer in Windows.	  

5) Go inside of the job folder in your BEAMER output folder, and there should be a folder with the same title as the data that you exported. Copy that folder, and paste it into Y:\job on the Heidelberg tool's computer.

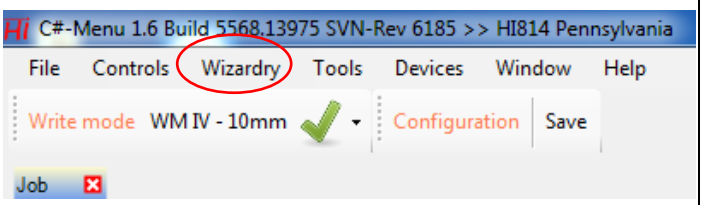


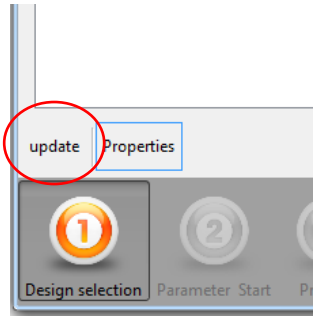
3c. Load the data (load from a flash drive)

1) If the auto-load script isn't working and you can't get the VLAN to connect, you can try loading your data from a USB flash drive.
2) Go back to the BEAMER computer and save your data folder that was exported by BEAMER onto a USB flash drive. Plug that flash drive into the USB hub near the monitors on the tool.
3) Follow steps 3-5 from section 3b above to load your data onto the Heidelberg tool's computer.

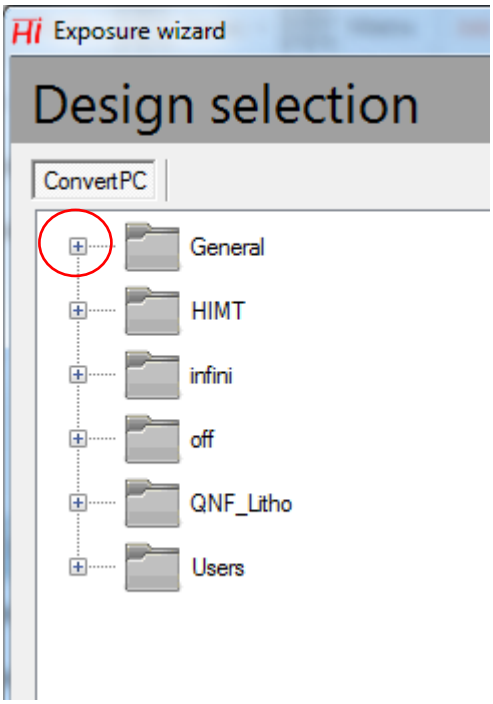
4. Set up and run the exposure job

a) If you haven't done so already, open the Exposure Wizard in the Heidelberg tool's software. To do this, go to Wizardry → Exposure Wizard. Then, click the "update" button near the bottom left of the window.



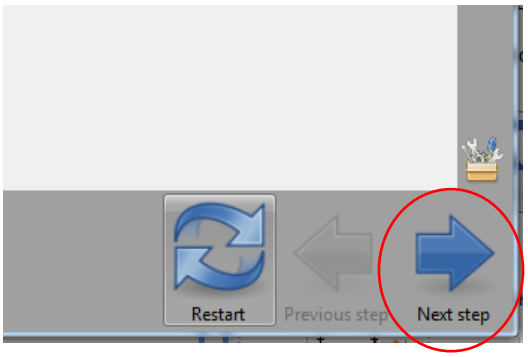


b) Once the update is done, check the “General” folder (click the + box next to the folder) and find your design. The designs are sorted in alphabetical order.

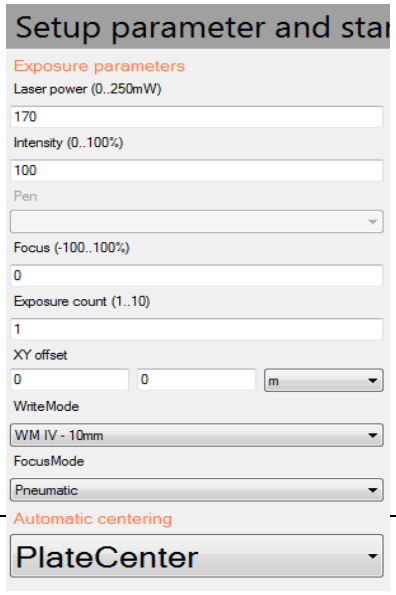


c) Find your design in the General folder and select it (the list will be sorted alphabetically).

d) Click “Next Step” near the bottom right of the window.



e) Set the exposure parameters according to the process you intend to run.

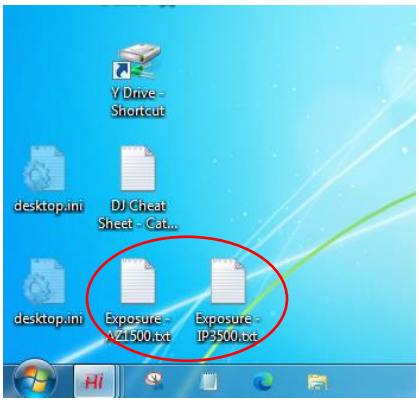


f) **For photomasks**: there's a .txt file on the desktop titled "Exposure – AZ1500.txt" and one titled "Exposure - IP3500.txt". Open the one that corresponds to the type (photoresist) that you're going to expose. Note that you should always use the parameters recommended in the .txt file, and not parameters that you may have used previously. The parameters are updated by staff from time-to-time, so these .txt files will always contain the latest recommended settings. You can ignore the parameters that say "ft0", "FS", etc. – these are just noted by the vendor when they service the tool, and you may safely ignore them. Keep "Exposure Count = 1" and "X, Y offset = 0, 0". Finally, set the Automatic Centering to "PlateCenter".

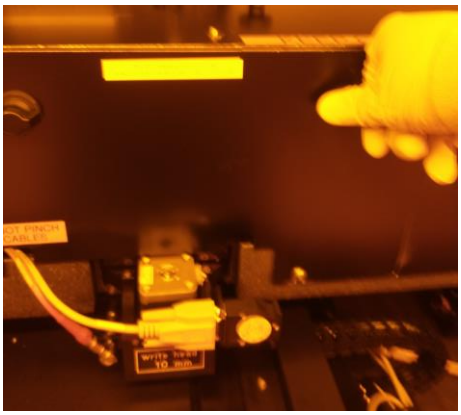
g) **For single die exposure on a wafer**: Recommended exposure parameters for direct writes can be found here on the tool's wiki page. But, you should use "WaferCenter" in the exposure wizard instead of "PlateCenter".

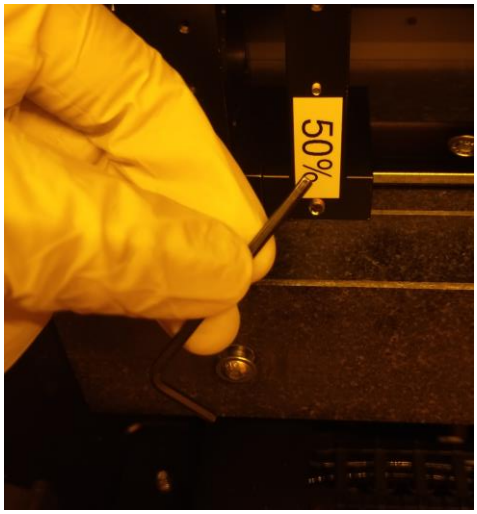
h) **For multiple die exposure on a wafer**: It is recommended to consult staff to help train you on how to set this up.

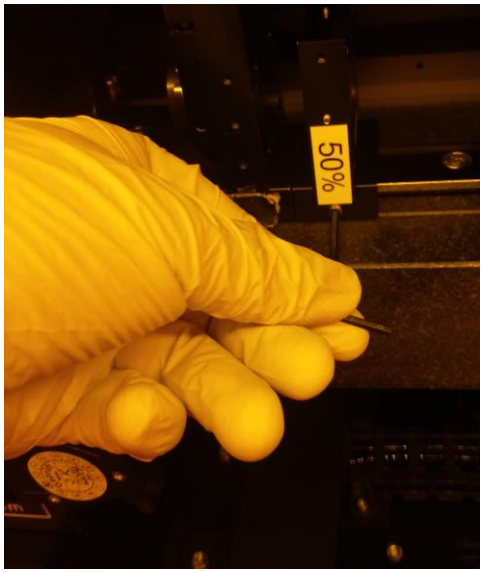
i) **For exposing on a piece**: Please consult staff to arrange for training on how to expose pieces on the tool safely. If the proper procedures aren't followed, it is highly likely that you'll damage the write head! At the time of writing this SOP, an SOP for running exposures on pieces is not available.



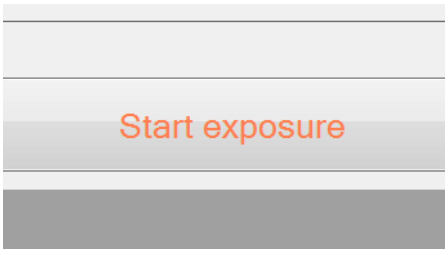
j) Make sure to install any hardware filters that you may need for your exposure. If this isn't done, then the dose may be too high (which would blow out your features) or to low (potentially underexposing the resist). To do this, remove the panel above the write head, and use the black hex wrench (in the tool box next to the tool) to loosen the set screw of the filter. Then, place the desired filter(s) on the rail, and tighten the set screw. As soon as the set screw gives you some resistance, that's tight enough (please don't overtighten the set screw). Then, put the panel back on.







k) Click “Start Exposure”. Click “Yes” through the 2 prompts when they come up.

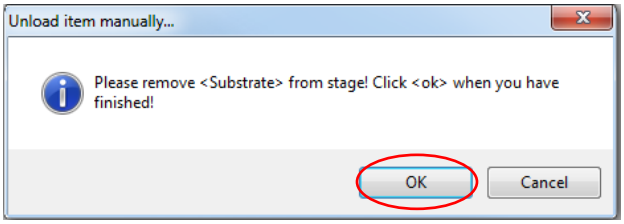


l) The tool will drive the sample under the write head, focus the write head on the sample, and perform the automatic centering (to place the origin (0,0) in the center of the sample).

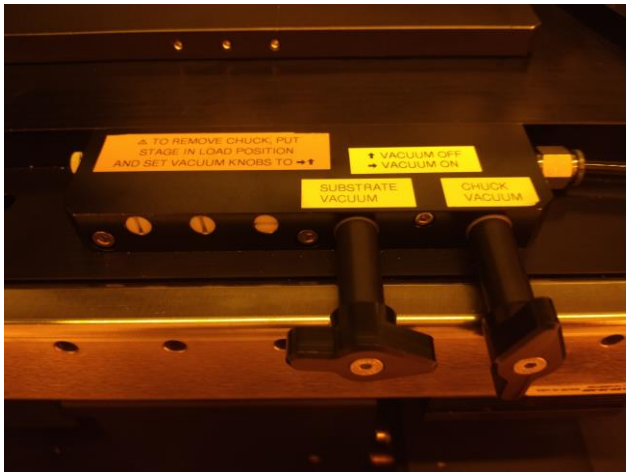
m) Wait for the first 2-3 strips to expose. Once it’s done so, you may leave the tool until it’s done exposing if you wish.

5. Take out sample

a) When the exposure is complete, click “Ok” on this prompt.



b) Turn vacuum knobs off.



c) Take your sample out of the tool.

Log out of the tool via IRIS once the pumping is done	

Feel free to contact the staff members with any questions about your process and the tool.