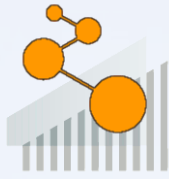




Penn
UNIVERSITY of PENNSYLVANIA



SINGH
Center for Nanotechnology

How to Make Photomasks at QNF

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Steps to Make a Photomask

1. Draft your design in CAD, using LayoutEditor
2. Use BEAMER to convert your design to the laser writer's format
3. Run exposure on Heidelberg DWL66+ laser writer
4. Post-process mask(s) (develop, Cr etch and resist strip)

- Download & install LayoutEditor from [LayoutEditor's website](#)
- Take Penn's [LayoutEditor course](#)
 - QNF staff will provide you with license file folder link
 - The training should take ~2 hours.
- Draft your design.



- You'll need to convert your design to the format that the Heidelberg DWL66+ tool uses. UPenn uses BEAMER to do this.
 - BEAMER will output a folder of data that the tool will use to determine where to run the laser.
- Take [Penn's training in BEAMER for the Heidelberg DWL66+](#).



2 – Data Prep (Taking the Training)

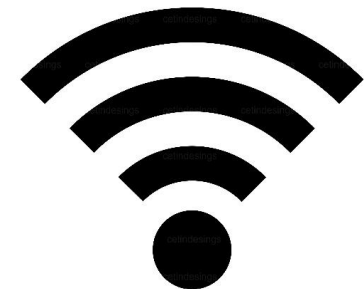
- Bring your .gds design with you!
- The BEAMER training is designed to be taken on your own, on your own schedule, without the need for staff to be present. Just follow along with the lessons in the videos, and do the same things that are being done in the videos.
- BEAMER is very expensive, so we only have one seat for it. That seat resides in the litho workstation computer (tool ID = EBL-02).
- To use the EBL-02 computer, you'll need to reserve it, and log into it through NEMO. You have 2 options:
 - 1) Use the computer directly. The computer itself is inside the QNF, in the hallway in front of bay 5.
 - 2) Access the computer remotely (instructions on next page). To do this, your computer will need to be on the AirPennNet WiFi network, or connected to UPenn's VPN (setup instructions can be found [here](#)).
- The training should take ~2 hours to do.

2 – Data Prep (Remote Access)

- Remote access instructions:

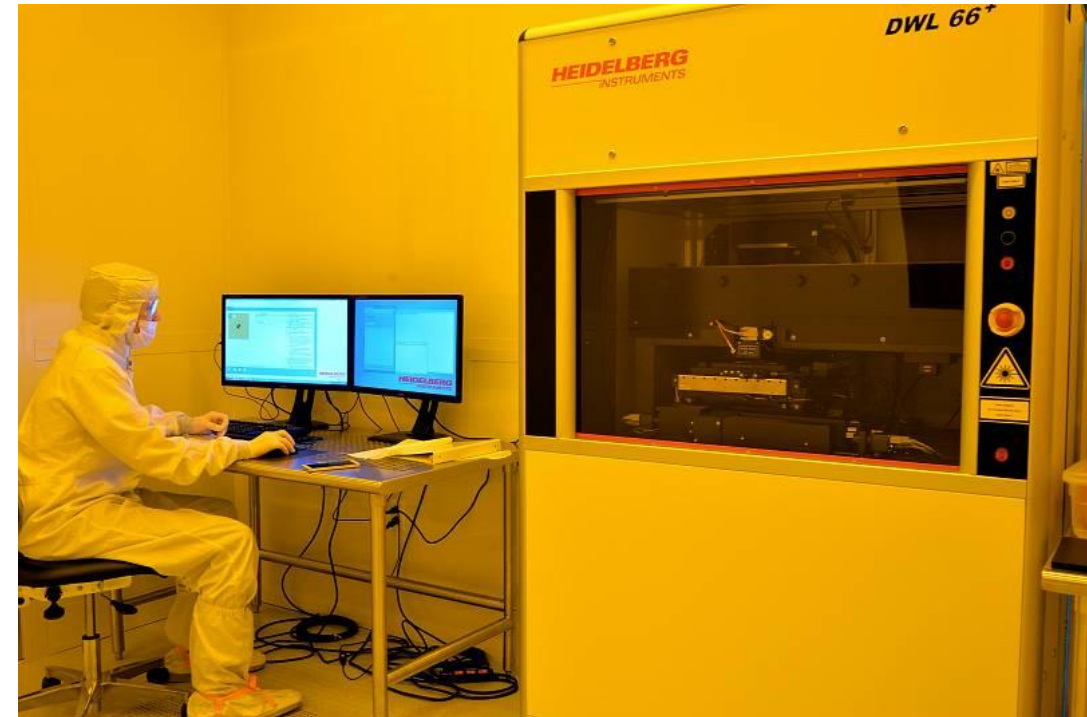
- Connect to AirPennNet, or Penn’s VPN.
- Find your “Remote Desktop Connection” software (in Windows, you can search for it).
- Connect to the following computer: NAN104-3.seas.upenn.edu:6778
- When prompted, enter the following Windows login credentials:
 - User: .\Beamer
 - PW: QNFBeamer
- Files can be transferred by copying and pasting. Keep all files only in your directory in D:\Users
- When finished:
 - Close all software
 - Close remote connection
 - Log out in NEMO

Select "More choices" if your PennKey is autofilled



3 – Heidelberg DWL66+ Training

- Request training for the Heidelberg DWL66+ tool in NEMO (LW-01)
- You should have your design ready and complete the BEAMER training before you take tool training
 - Review the [tool training videos](#) to familiarize yourself with the process.
- Request the photomask blank(s) and orange carriers through the stockroom in NEMO.
- We will exposure your mask as part of the training.



Ordering a Mask Blank @ QNF Stockroom

- In NEMO:

Make sure to order:

- 1) Mask blank
- 2) Mask holder

Stockroom ▾

Search: mask

Stockroom Item: AZ1500 photomask blank (5"x5"), soda lime substrate

Item: **IP3500 photomask blank (5"x5"), soda lime substrate**

Chemicals: IP3500 photomask blank (5"x5"), quartz substrate

1-Propanol (electronics grade) \$22.00

Search: IP3500 photomask blank (5"x5"), soda lime substrate

Add to Order

Add qty

How many?

Add to order

Current order:

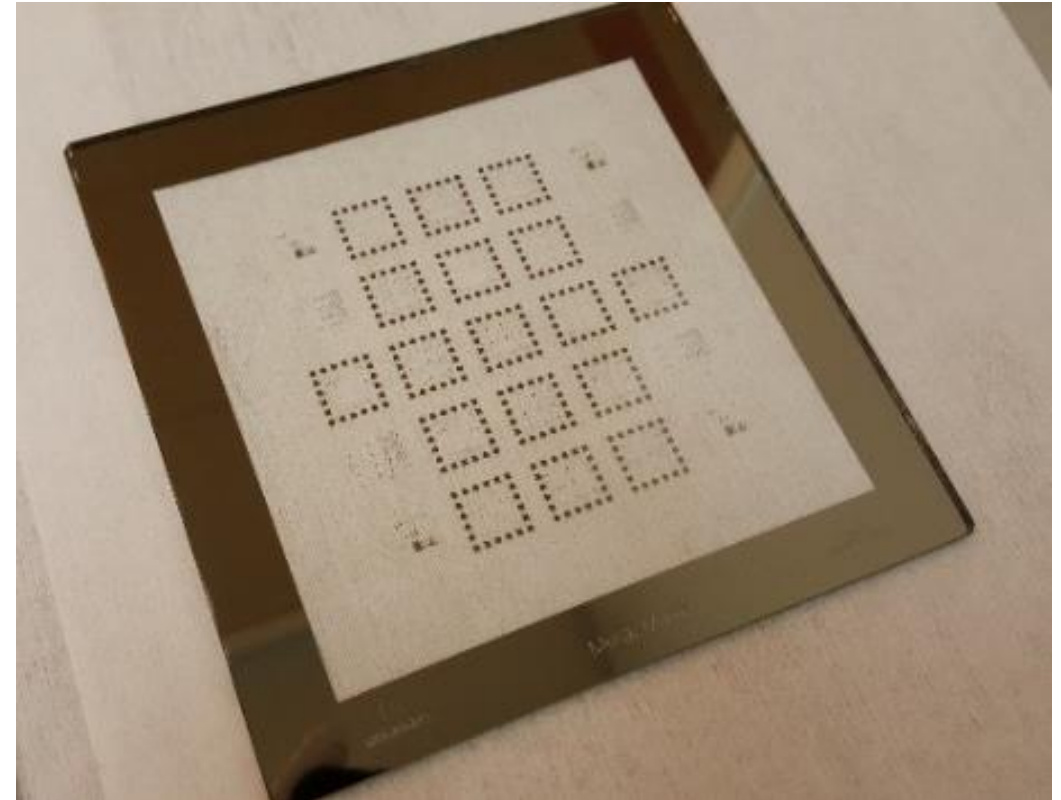
Project	Consumable	Quantity
SINGH STAFF	IP3500 photomask blank (5"x5"), soda lime substrate	1
SINGH STAFF	Orange photomask holder (5"x5"), polypropylene	1

Clear All

Order

Don't forget to check out from cart!

- After the exposure, you'll need to do the following to your mask:
 - Develop the resist
 - Bay 5, Base Developer Bench
 - TMAH 0.26N for 60 sec
 - Wet etch the Cr
 - Bay 3, Acid Bench
 - Cr etch 1020AC, ~3 min or until you can clearly see through!
 - Strip the photoresist
 - Bay 3, Solvent Bench Sonicator
 - NMP (in solvent cabinet), ~6 min at 60C



- [This training video](#) demonstrates the process steps involved