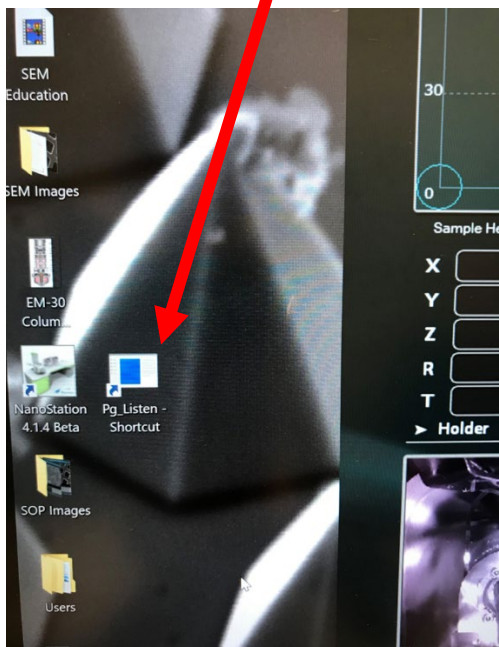


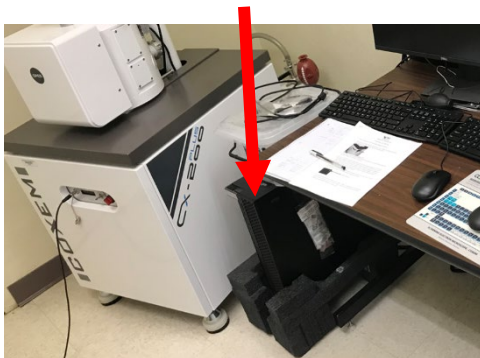
Operation manual for

E-beam Lithography (EBL) – Exposure Section

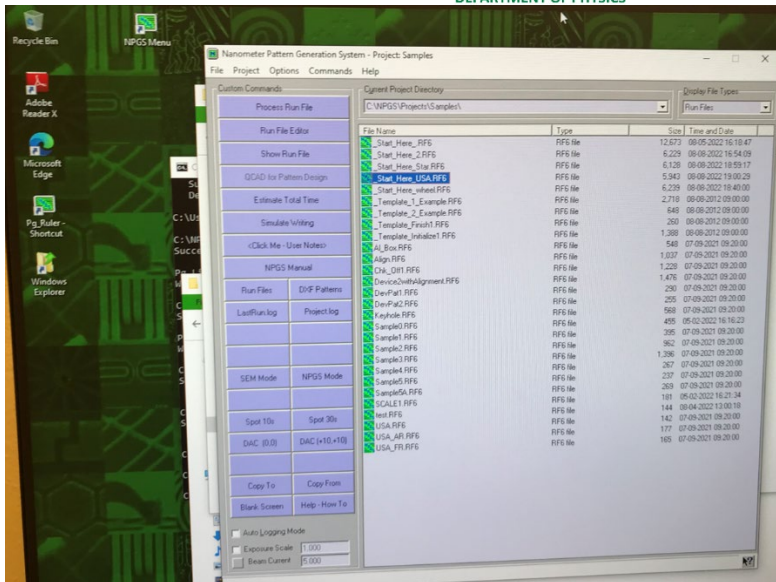
1. Turn on the SEM computer, follow the operation manual of COXEM CX-200Plus and find the area of interest on NanoStation software.
2. Run software **Pg_Listen** on desktop. A confirmation window will pop up, click yes to confirm.



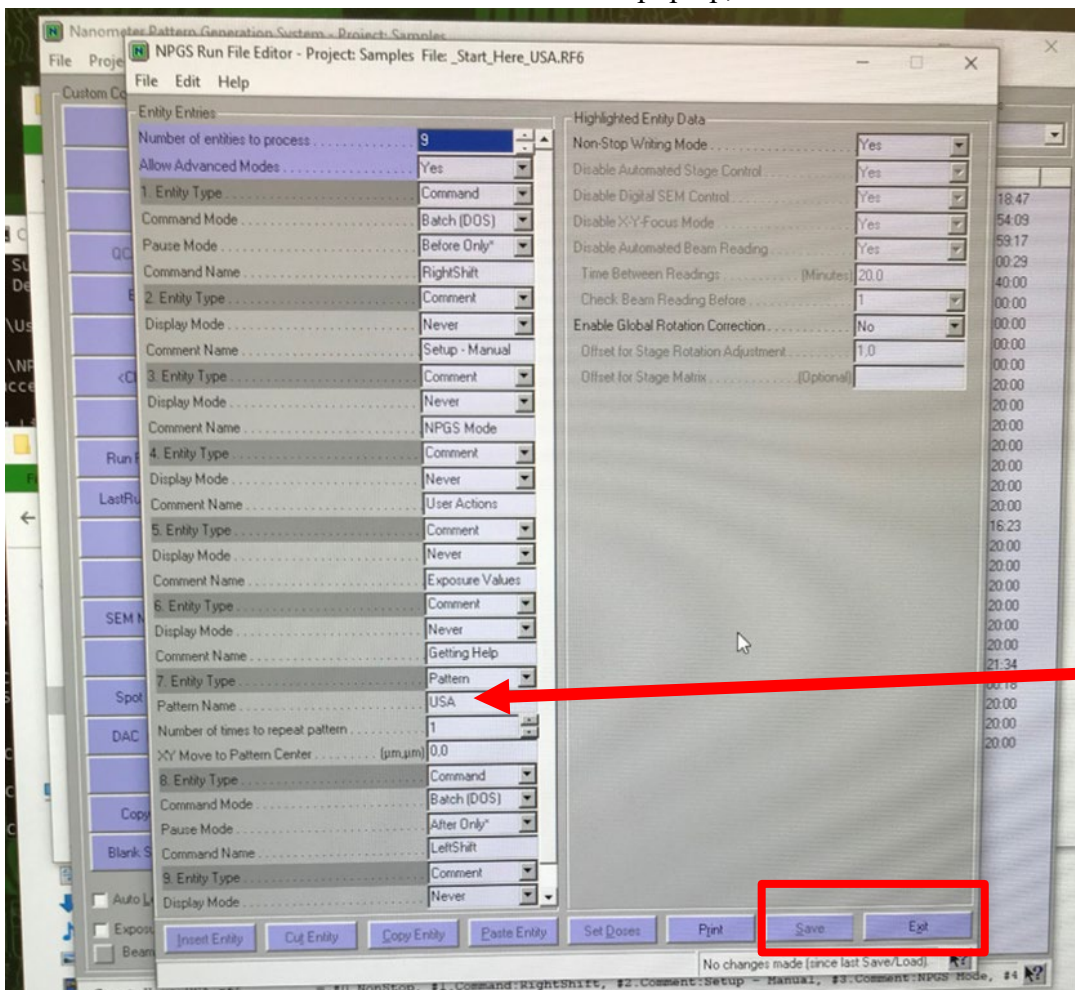
3. Turn on the EBL computer. At this moment, the SEM and SEM computer are both on.



4. Wait for the completion of automatic DACs calibration shown on the command prompt. Two calibrations will be performed, roughly 3 s + 40 s. If any errors show, please stop using and consult with Lab Supervisor.
5. After calibration is done, open the **NPGS Menu**. A tutorial window will pop up, close it and continue, as shown below.



- Select **_Start_Here_USA.RF6** by left click once, click on **Run File Editor**, located at second line from the left column. A window will pop up, shown below.





7. Change the name of the pattern file from “USA” to your file name. Make sure the location is at C:\NPGS\Projects\Samples\.
8. Save and Exit from the bottom panel.
9. Set the Magnification of SEM the same as that in your pattern file (eg. X1000 for 200 μm field size of your pattern).
10. Click on **NPGS Mode** on the left panel of NPGS software.
11. Click on **Process Run File** on the top of the left panel of NPGS software. Confirm on the popped-up window.
12. Wait for the completion of the full-screen mode. The EBL process will be done once exit the full-screen.
13. Click on **SEM Mode** on the left panel of NPGS software. Now the E-beam exposure is done.
14. Follow the procedure of the SEM operation manual. Turn off the E-beam, wait for 5 minutes then vent the chamber, take out your samples, pump down the chamber and turn off the SEM.
15. Turn off the EBL computer. Fill in your name, date, time in, and time out on the EBL logbook. Refer to Development Section or 117 Lab from the Physics Department website for further development and optical microscope check.

E-beam Lithography (EBL) – Development Section

HARP PMMA Resists are developed with Water/IPA Developer using immersion, puddle, and spray techniques. HARP PMMA Developer: Water/IPA 1:10 fast develop in 30 seconds.

Learning materials:

[1] [SEM learning file](#).

[2] EBL patterns support lines of the arbitrary slope, circles, circular arcs, and arbitrary filled polygons. Text, spline curves, and elliptical arcs can also be easily generated and written as a series of short lines with an almost unlimited number of exposure conditions. QCAD natively supports DXF and DWG formats. [Here](#) download the QCAD software.

[3] 1000 HARP PMMA eb 0.1 is supplied as e-beam resist. Spin coat at 1500 rpm for 1-minute results in PMMA film with 100 nm thickness. Followed by soft bake on the hot plate at 180°C for 2 min.