

Nanoscribe PPGT: Getting started Manual

Version of 7.26.2023.

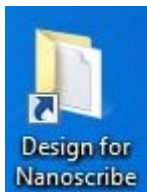
Get the latest one at <https://www.epfl.ch/research/facilities/cmi/wp-content/uploads/2019/12/Nanoscribe.manual.pdf>

1. Introduction

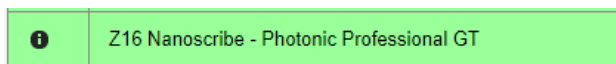
The Nanoscribe Photonic Professional GT+ is a laser exposure equipment using the two-photon absorption mechanism from a 780nm infrared laser to write in 3D into an UV-sensitive photoresist.

2. Log-in and System Initialization

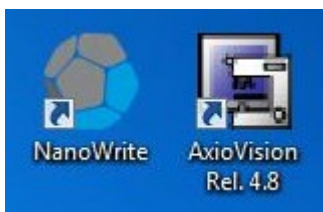
- Make sure to reserve the equipment online in case of long exposure periods.
- Prepare your job files with *DeScribe* and transfer them on the *cmi-transfert* network folder. Place your files in the "Design for Nanoscribe" folder on the UI computer.



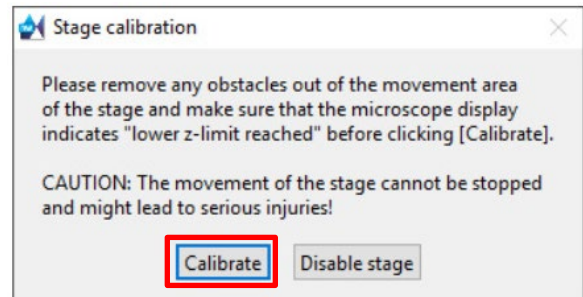
- Log-in on Z16 Nanoscribe – Photonic Professional GT



- Start "AxioVision" and "Nanowrite" by double-clicking on their respective icons



- The system will initialize. The window for stage calibration will pop-up. **Make sure the objectives are down ("lower z-limit reached") and the coarse-stage is free of any obstacles (cables, boxes, etc...) and then press "calibrate".**



- **Wait for the exchange sample holder pop-up window!**



IMPORTANT: Any manipulation on the microscope, i.e. loading/unloading sample holder and mounting/dismounting the objectives, should be done with the "Choose sample holder" window active. Only in this state are the actuators of the piezo-stage deactivated and the stage can move without damage to the equipment! Also, the red LED "BUSY" should be OFF.

3. Inserting the objective

- Objectives are stored into a plastic box and they should never be left unattended outside of their plastic box!

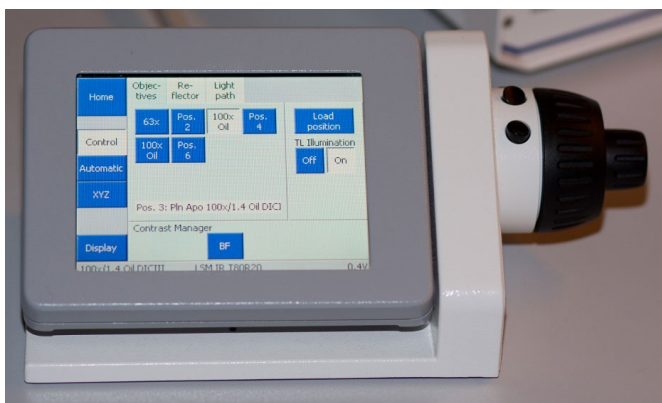


- Unscrew the objective from the plastic box, unscrew the cap.
- Check/Insert the appropriate felt ring (63x & 25x objectives) or plastic resist stop (10x objective) around the lens to prevent resist/oil from spilling on the side of the objective.

felt ring or plastic resist stop



- Use the microscope touchscreen "control" tab, to select the correct turret slot for your objective.



Objectives are inserted in the following slots:

63x objective → SLOT 3

25x objective → SLOT 1

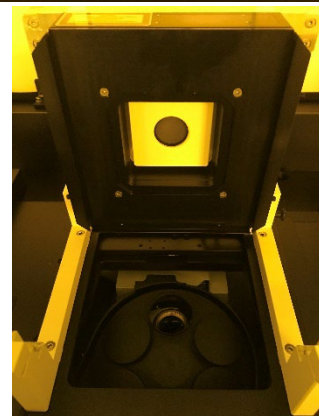
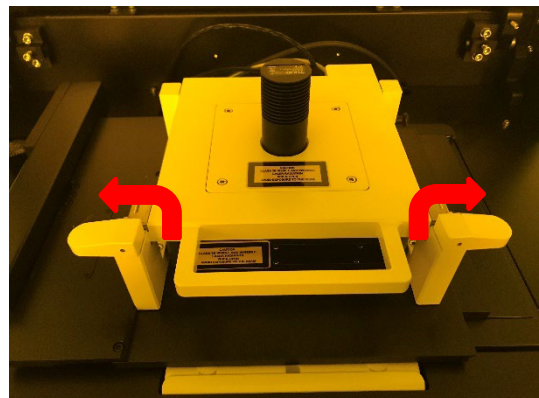
10x objective → SLOT 4

20x objective → SLOT 5

- Release the Nanoscribe frame interlock by pressing the "open" button. Open up the system using the handle.

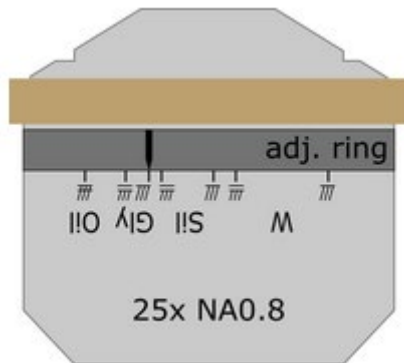


- Unlock the piezo-stage by rotating the two bottom clamping elements, and move the piezo-stage to its vertical position with the handle.



- Objectives are inserted from the top. Remove the cap from the slot, insert the objective and rotate to screw it. **Do not force and immediately inform the CMi staff if the objective is not rotating easily during the mounting.**

- **IMPORTANT:** The 25x objective has an immersion adjustment ring that should be set on 'Gly' as shown here:



- When the objective is mounted, place the stage in tilted position and proceed with the substrate holder preparation and insertion.

4. Preparing the samples

- All items used for the sample preparation of the Nanoscribe can be found in a dedicated cabinet in Zone 13.

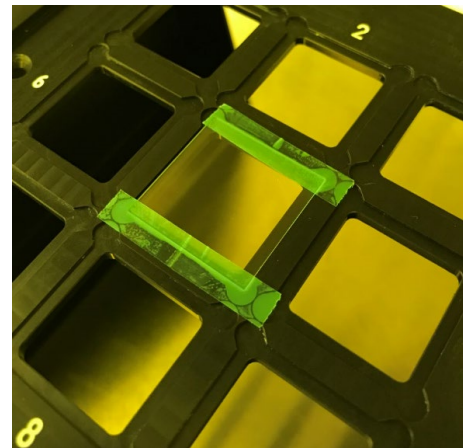


You will need:

- Sample holder mounted on its stand
- Blue tape
- Substrates/samples
- Resist and Oil bottles
- Make sure to select the correct sample holder, correct samples and correct photoresist based on the chosen writing configuration (DILL, immersion, air...). **Check with the staff if you are not sure!**
- Substrate/sample cleaning is done on the "Solvent WET bench" in Zone 13. **Make sure to wear a second pair of protecting gloves!**



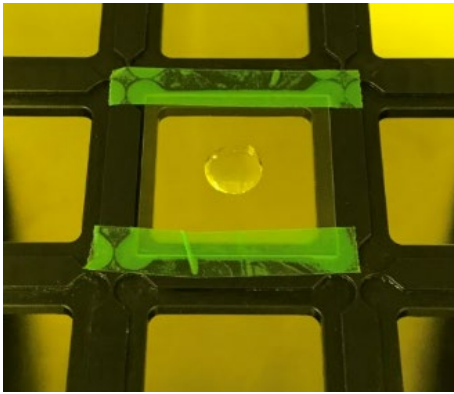
- Cleaning sequence: Rinse with acetone, rinse with IPA, blow dry with N2 gun.
- After cleaning, deposit the sample in the appropriate position in the sample holder and fix it on both sides with some blue tape.



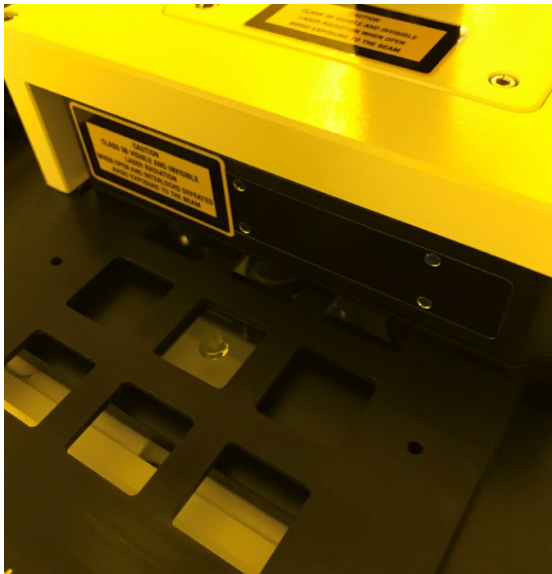
- Take your resist cartridge, remove the cap and screw in a dosing tip



- Dispense one drop at the sample center by gently pushing the cartridge piston. Spread out if necessary. After use, the tips should be cleaned after use by immersing in PGMEA for ~20 minutes and rinsing with IPA.

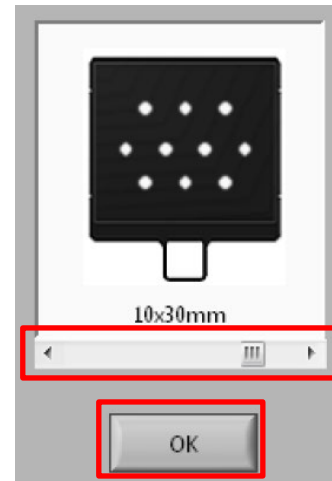


- Note: For the IP-Q/10x configuration, to make sure there is enough resist to print big structures, users are allowed to place resist directly on the objective.
- Push the holder completely inside as seen on the image below.



5. Starting the exposure

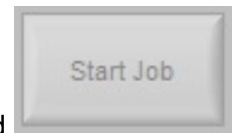
- Once the objective and the sample holder are in place, make sure to select the correct holder from the list and click "OK" in the exchange holder window.



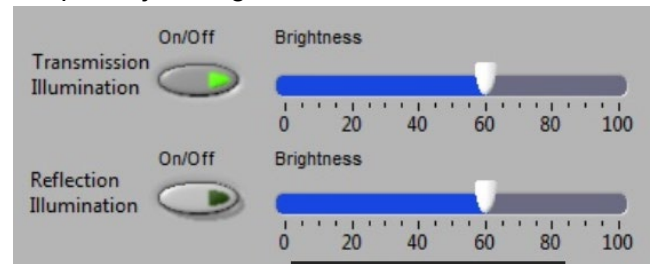
- Verify that you are logged-in on the equipment. If you are not you will see :



and



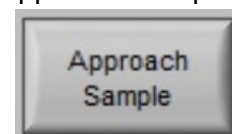
- Turn on transmission or reflection illumination lamps. Adjust brightness to ~60%.



- In the sample holder window (view from the top), make sure the correct sample position is selected, i.e. appears in green. If not double-click on the appropriate position.

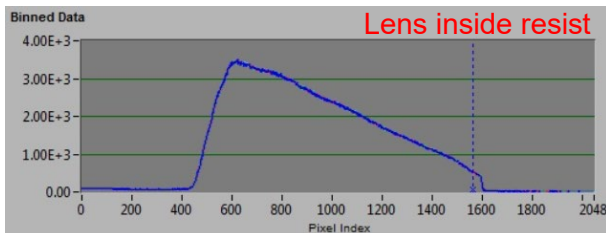
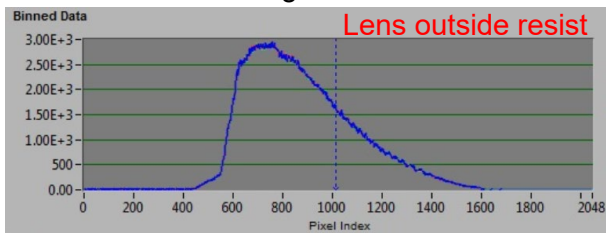


- Press on "Approach Sample".



- The objective will automatically move under the center of the selected sample, coordinates will be set to (0,0). The objective will move up to the "snap-on" position and dip in the resist/oil.

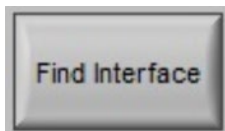
Make sure to detect the change in the shape of the “Find interface” signal:



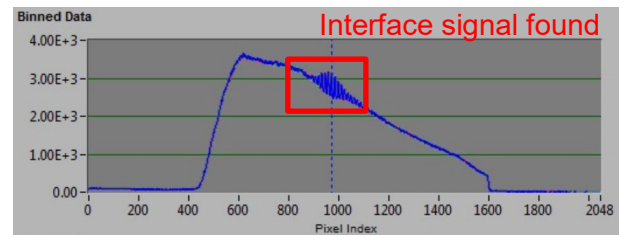
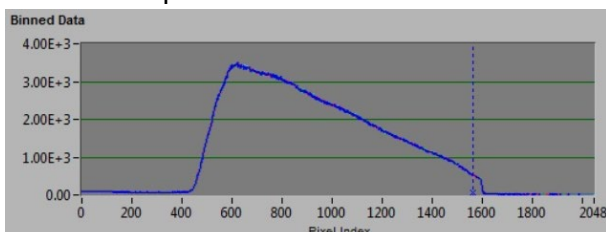
- Move the table to the desired printing position with the joystick or UI arrows.



- When at the correct position, press on “Find Interface”.

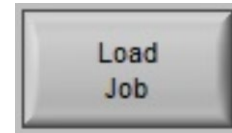


- The microscope z-axis will automatically find the position to maximize the intensity of the « Find Interface » signal which should be around 800 pixels.



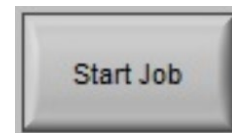
Interface found, strength: 42323 @ 21

- Press on “Load Job” and find your **_job.gwl** file.

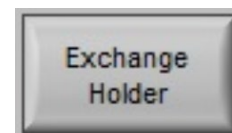


Loading job...
upright_piano_HO_big_job.gwl loaded.

- Press on “Start Job” and watch the process in real-time in the camera window.



- Repeat as many exposure/jobs as you want by moving to different positions on the sample.
- When finished, click on “Exchange Holder”. The objective will go down automatically to “Lower Z-limit reached” position and deactivate piezo-actuators.



- Remove the sample holder, remove the lens (be careful it is now contaminated with resist/oil), replace the cap on the turret opening.
- Close *Nanowrite* and *AxioVision*.
- Log-out of the Nanoscribe – Photonic Professional GT from the Z16 CAE computer.

6. Sample development

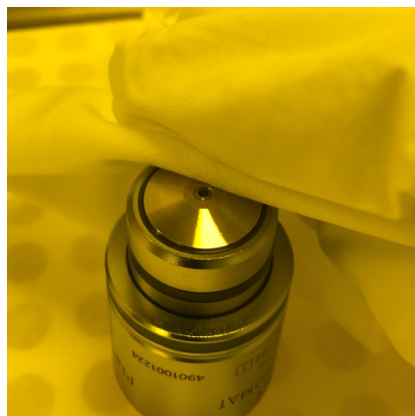
- Development is done on the “Solvent WET bench” in Zone 13. You will need:
 - Beaker 1: PGMEA
 - Beaker 2: IPA
 - Sample holder
 - Timer



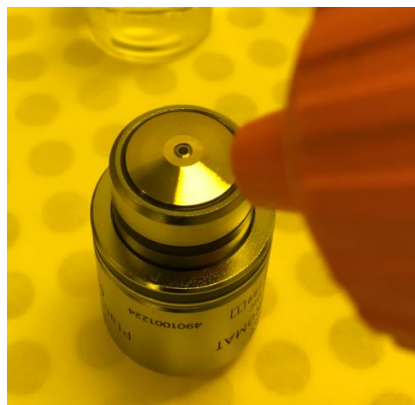
- Development time in PGMEA: typical 14-17 minutes
- Rinsing time in IPA: > 5 minutes
- After development, blow dry with N2 gun with reduced flow, or let the sample dry naturally.

7. Objective cleaning

- **WARNING!!** Cleaning of the objective is absolutely critical to maintain high quality exposure and long lifetime of the equipment. This needs to be done after each exposure sessions!
- Cleaning of the objective is done on the "Solvent WET bench" in Zone 13. You will need:
 - Cleanroom tissue sheets (NOT CLEANROOM PAPER!)
 - Beaker 2: IPA/PGMEA
 - Contaminated objective
 - One pipette
- Remove the protection ring
- **STEP 1:** Wipe with one tissue around the lens to remove the excess resist/oil. You can use two hands: one to maintain the tissue as shown below, second hand to gently rotate the lens. Repeat several times.



- **STEP 2:** Blow the lens with N2 gun to push the resist/oil from the lens. Wipe around the lens same as described above. Repeat several times.



- **STEP 3:** Wrap one tissue around your index, hold the lens firmly and tilt it slightly as shown below.



Using the pipette, deposit one droplet of IPA on the lens. The liquid will flow and be absorbed by the tissue. Blow dry the lens with N2 gun. Repeat two-three times until the lens seems clean. PGMEA can be used if IPA is not effective enough.

- **STEP 4:** To clean around the lens, repeat the operation from step 1 but, this time, wipe with a tissue which is imbibed with IPA.

- When done, do a final check of the cleanliness of the lens. **Make sure to blow the lens with N2 to evaporate the solvents completely!!**
- Screw the objective back in the plastic case and place it back on the microscope table.