µMLA Manual (Pattern Blank)

1. Startup Checklist
   a. Turn on the computer.
   b. <u>Completely</u> open compressed air line by rotating the valve counterclockwise.
   c. Switch on the machine on backside. Wait for a sound "beep" after approximately 5 s (if not, contact Bianca).
   d. Wait another 5 min before starting the software.
   e. Starting software (HIMT MLA) by double click on it (desktop shortcut).
   f. The stage might not be initialized, click "Yes" if you will be asked to. Wait until it is finished < 1 min. Click "OK".

2. Set up Your Job
   a. Job:
      i. Note your "Job Name" in your lab journal. Don't change it.
      ii. Exposure mode: Standard
      (Standard: if you have <u>one</u> structure to expose
      Series: also for dose test).
   b. Substrate:
      i. Substrate Template: by double click on the red field you will be directed to a given list.
      ii. Select the <u>approximate size</u>. Later, it will be measured accurately. Choose (in case of SiO_2 samples): "SiO Wafer 0.5 x 0.5 cm oAF" (optical autofocus), 1 x 1 cm oAF or 2 x 2 cm oAF respectively.
      (If it is not approximately chosen, it will ask you to center the sample under the overview camera.)
      (For mostly used SiO_2 wafer, no matter which layer thickness as long as the wafer thickness is not bigger than 0.6 mm in total).
      iii. Click the bold "Load" button. You will be redirected to the start page. The red field should be green now.
   c. Layer:
      i. For some photoresist it is necessary to go below 70 mJ/cm^2 (which is the lower limit of the machine) for that case you can adjust the LED power to 15% or 25%. You can click on the standard 100% to change in drop down menu.
      ii. Double click on the red field of Design. Again, you will be redirected.
      iii. Select your structure you want to expose. Click the bold "Load" button. (See 2.c.v. for inserting a new exposure structure.)
      iv. Now every field is green, and you can move on to "Load Substrate".

      Optional:
      v. Insert a new exposure structure:
         1. Copy your GDSII file or DXF file in the corresponding "Design" folder on the desktop (in "gdsii" or "dxf"). Assure that you are writing closed polylines! (Check within i.e. Klayout if all structures are dashed indicating closed polylines. <u>Otherwise, the whole file can not be written!</u>)

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2. **Inserting a new structure is only possible when you are in staff mode** in the HIMT MLA software, on the very top of the program click "User", "Change User". In the pop-up window, chance username to "Staff" and tip in the correct password (ask Bianca for excess) and login.

3. In Staff mode, the button "Convert Design" must be bold. Now you can click on it. A new window will be open (GUI HIMT CONVERT).

4. "File" -> "New Job".

5. Name your Job as follow: JJJJMMDD_"your Initials"_"short description" i.e. 20230302_BH_subElyps (maximum of **25** letters, **no space bar allowed**). Click "ok".

6. "Add" your Source File as GDSII or DXF file and select in the popped-up window and "Open".
   (When choosing GDSII files, it might happen that you miss them in the list, then change the File Type to "All(*)" they should be visible now).
   DXF: Change <u>DXF unit to 1000 nm</u> when using um in your .dxf file! Otherwise, your structure can not be depicted correctly. And choose the right layer in selection menu.
   GDSII: choose your right layer.

7. Click "Create default", you will be redirected to previous Window, don't change anything else and click "Complete Tasks".

8. Click "Save" for saving the job file in the pop-up window.

9. Click "Complete Exposure Jobs" and "Finish".

10. Close window GUI HIMT CONVERT.

11. Update your list of Designs in the HIMT MLA software by clicking "Refresh".

12. Don't forget to "Load" your new imported structure.

13. In case you want to "Delete Design" there is a button on the left side of the screen (under Load Design, Characteristics, Edit).

14. Continue with point 2.c.iv.

3. Load Substrate: Optical mode

   a. Place your sample in the middle of the black chuck of the stage system, over the four vacuum holes (Keep time of open shutter as short as possible).

   b. Flip the vacuum switch (to the back), now a constant noise is present (don't get confused when you are still able to move your substrate, it is a slight vacuum but sufficient).

   c. Click "Continue".

   d. Check if your sample moved to the red spot in the front (it is the write head; the spot in the back belongs to the overview camera), <u>if yes</u> then click "Continue", <u>if not</u> it will move to the back camera, here you have to select the middle of the sample with the cross hair on the screen to ensure the write head is placed over the sample while approaching.

Now your sample will be moved to the focus and the size will be scanned. If your sample is a different size than being told the program will ask you to continue with different size. Depending on, if it still fits your needs, click "Yes" to continue or "No" to exchange the sample.

4. First Exposure:
   a. Your overall design structure size (red, not detailed) will be shown on the blue square to indicate the correct area to be exposed.
   b. If parts of the design are not on the substrate:
      i. Make sure that in your *.dxt* or *.gds* file you set the origin of your coordinate system consistently (i.e. in the center of your design).
      ii. You can also manually move your design by the control panel on the right using the corresponding arrows (to move with bigger steps you can change the numbers of driving speed [um/s] or the step size [um], active one is bold; or use the crosshair to select the new spot in the overview image). To see also the change, you have to click "Set Zero" below the arrows.
   c. Select your "Dose".
   d. Set "Defoc" to "-6".
   e. Click "Start Exposure".

5. Unload Substrate:
   a. After exposure you will be asked to unload, click "Yes" otherwise click "Unload Substrate" on the bottom left and "OK" later.
   b. The chuck of the stage system will move to the front, turn off the vacuum switch, remove your sample and close the shutter! (Keep time of open shutter as short as possible).
   c. (If you want to expose multiple times, click "New Job" or "Restart Job" for the same pattern.)

6. Shutting Down:
   a. By closing the software and confirming with "Yes" the µMLA is shutting down (the camera software on the right doesn't have to be closed).
   b. When software is closed, switch off the µMLA on the backside.
   c. Turn off compressed gas by rotating the valve clockwise.
   d. Shut down computer.