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*This guide obtains just brief information. In case you need detailed instructions, read chapter **Software Operation Manual**. Reading this manual is highly recommended for new users working in **Elphy** software!*

TESCAN/RAITH MIRA3 SEM-EBL

Elphy – Before exposure

1. Open Patterning Parameter panel in Elphy, select **Patterning Parameter Calculation** and write there the **Current, Step Size, and Dose** you want to use. Finally, calculate the **Dwell Time** (calculator button), which should be higher than 0.000300 ms. Press the **OK** button.
2. Open **New Position List** in the **File** panel
3. Open **GDSII Database** panel, load your design, drag and move the selected design to the position list, and select patterning layers (layers 61 and 63 are for alignment procedures).
4. If you want to do multi step lithography, be sure that you have global marks (in the design) for the calibration of UVW coordinates and local marks in every writefield, where you need precise stitching.
5. It would be best if you created **working areas** for patterning fields (global mark, full view of sample, smaller fields): right mouse click on your design -> **Edit** and open working areas by button
6. Click with the right mouse button on the design in the position list, select **Properties**, open **Patterning Parameters,** and press the **Times** button to calculate the patterning time. Time should be reasonable (depends on the design). If the time is too long, change the patterning parameters or discuss the patterning with **exp. users** (preferred).
7. Align the beam in the **MiraTC** software with the selected beam intensity, save the beam alignment setting to the **SEM Presets**.
8. Typical doses: PMMA 950k, 30 kV:area - 330µC/cm^2, line - 1000 pC/cm,dot - 0.03 pC.

Elphy – First lithography step

1. Open **New wafermap** in **File** panel – the **Waferlayout** can change the properties of the wafer **layout** in the **File** panel (you can change the size of your virtual sample view – for example, to 10x10 mm)
2. Select your beam setting from SEM presets, and since now **DO NOT USE DEGAUSS**
3. Find the left corner of your sample, focus on the edge, and press **WD&Z** (in MiraTC) button. Go to **Adjust UVW** panel :
   a. Go to **Origin Correction** – Save the position by the **Adjust** button
   b. Go to **Angle Correction**, save the position of the bottom left corner by the **P1** pipette button , find the bottom-right edge of the sample, and save its position by the **P2** pipette button. Save the setting by pressing of **Adjust** button
   c. Check if the function **Enable automatic correction** by Focus is **ON**: Local Focus! should be visible. If you don't see Focus! button, click by the right mouse button on that position, and press Options…, in the Adjust UV Options panel tick Enable automatic correction focus.
   d. Go to **3-Points,** untick P1, P2 and P3. Focus on the top of the resist, use the **WD&Z** function, focus again and save **P1** position by pipette button. Go to the second position on the surface, focus (**don't use WD&Z**) and save the **P2** position by pipette button. Do the same with the **P3** position. **DO NOT CLICK ON Adjust**. Repeat all three steps again

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4. Go to the **Writefield Manager** panel , select your writefield setup, click by the right mouse button on it and select **set** (you can edit it or make a new one)
5. Find some particles on the resist, which you can use for calibration. Go to **Scan Manager** and select **Writefield Alignment Procedures** -> **Manual** and double click on any setting. The **Scan properties** will be open:
    a. In the Main panel, write Scan size 10 µm, 256 No of points, calculate Step size and Scan size
    b. In the Mark procedure panel, select Mark sequences and Placement set as 10 µm in both directions
    c. Run the **alignment** by right mouse click -> **Execute** -> move the cross by **Ctrl + mouse click and move**
    d. During the Writefield alignment, gradually decrease the **Scan size** and increase the **Placement**
6. Go to Faraday cup, select **Patterning Parameter** panel, set the external patterning **PAT** (**IMG** will be off), and measure the current by **Measure** button in the Beam current panel
7. Specify the positions of your designs and working areas in Positionlist, select all patterning items in the position list, and press the **Scan** selection button .
8. You can copy the items in the position list in the matrix in the PLS-Preprocessing panel

Elphy – Second lithography step

1. Open the design of your sample with all global marks and patterns by double click in **GDSII Database** panel. Ideally, the bottom left corner of your virtual sample should have coordinates [0,0] in µm.
2. Open **toolbox** and place **flags** on the positions of global marks. (For easier placing of flags, change the design grid in **Options** -> **Design grid…**)
3. For example, the first Global mark has coordinates [450,450] µm and contains local marks for the writefield 100 µm.
    a. Find the first global mark, focus on them perfectly in the middle, press **WD&Z** and focus again, save the position **P1** by pipette button in **3-Point** panel (Origin could be loaded in Origin corr. panel by **Adjust** button, where U: 0.450000 mm V: 0.450000 mm)
    b. Do the same with the second (**P2**) and third (**P3**) global mark, but use only focusing **without WD&Z**
    c. Press the **Adjust** button to save **UVW coordinates** (It will transform the design to fit with the sample)
    d. Insert the design to the **position list** -> pick layers 61 and 63 -> change the coordinates to 0 0.450000 0.450000 -> right mouse click on the **design** in the position list -> click on **Properties** -> select **working area** with Global mark
    e. The working area with the global mark and four local marks should have 100 x 100 μm^2, and the middle of the global mark should be in the middle of the working area!

No.	Active	Name	Center U	Center V	Size U	Size V
1	✓	Global	450.000	450.000	100.000	100.000

    f. Press the Scan button in the position list, and the manual alignment will start -> move the cross by **Ctrl + mouse click and move** if successful, automatic alignment will start
4. Go to Faraday cup, select **Patterning Parameter** panel, set the external patterning **PAT** (**IMG** will be off), and measure the current by **Measure** button in the Beam current panel
5. Specify the positions of your designs and working areas in Positionlist, select all patterning items in the position list, and press the **Scan** selection button .

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