

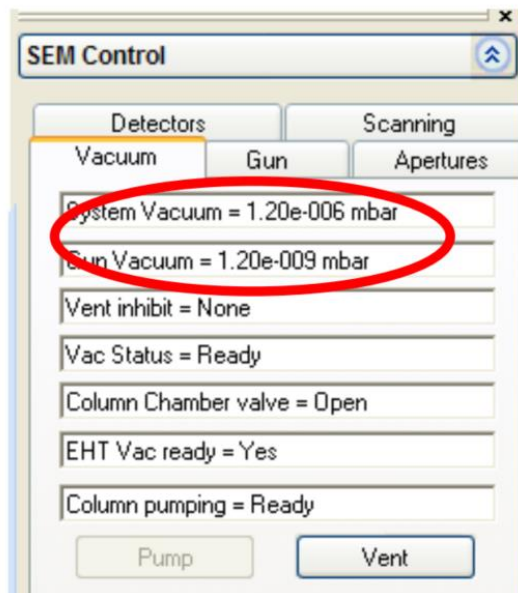
Raith SEM (just imaging) SOP:

Latest update 09.10.2023 Sabrina Eder

Shortest version of SOP Manual:

SEM imaging

- **Reserve time on the e-line calendar**
- **Turn on the Nitrogen:** downstairs in the Snekkerverksted
- **Check in to use the SEM in the logbook and note down vacuum levels:** Fill paper logbook located at SEM. **Make sure no one else is using the e-line!** Otherwise contact the person that is using it.
 - *Also note down the vacuum pressures into the e-Line log-sheet, as shown in the gun and system vacuum indicators in the SmartSEM software under the 'Vacuum' tab:*

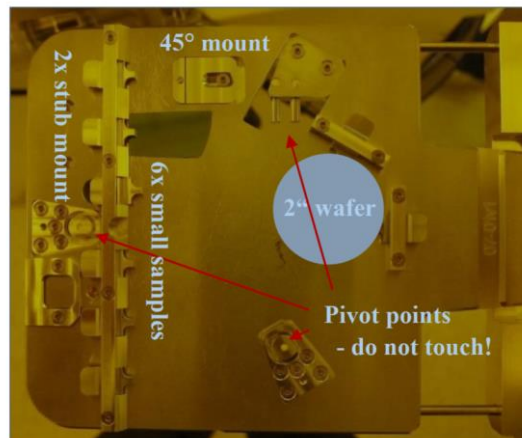


- **Check if the sample holder is loaded:** the sample holder can either be loaded for imaging or be located in the load lock. You can check by turning on the TV-mode of the SEM. If:
 - **Sample holder loaded:** follow the unload procedure to unload the sample holder
 - **Sample holder in load lock:** mount your sample (**Note: please use plastic tweezers and never touch the sample holder without gloves!**)
- **Launch Raith software:** if not told differently the user is q-test and no password
- **Start the loading or unloading procedure:**

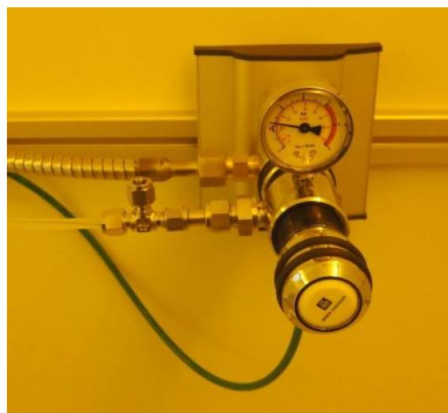
Loading procedure and start up for imaging (via loadlock)

You will load your samples into an Ultra-High-Vacuum System, so please remember:

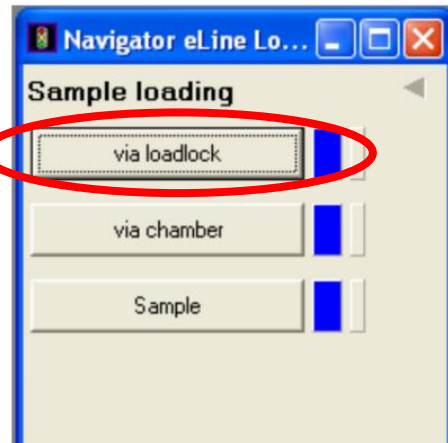
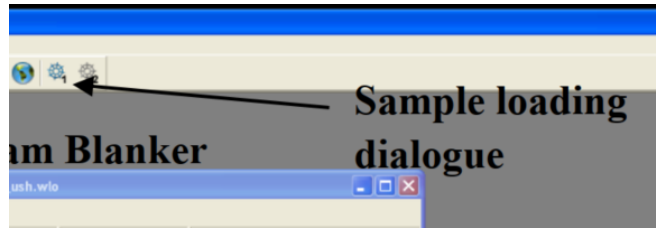
1. **Never touch the sample holder without gloves**, since that leaves behind fingerprints that worsen the vacuum! That means, first of all put on gloves! This also helps to avoid contaminating your sample with particles.
2. **Your sample must be DRY!** Ask before mounting unusual samples. Certain materials can permanently worsen the vacuum inside the chamber or deposit on the mirrors of the interferometer, which may result in very expensive repairs!
3. **Never touch the pivot points of sample holder!** (They are calibrated. see image below for illustration)
4. **Make sure your sample is not too high!** You can severely damage the final lens or the interferometric stage.
5. **Be careful when placing the sample holder on the transfer rod of the load lock.** Make sure it matches on the right with the inset, and also sits horizontally. You can severely damage the final lens or the interferometric stage if the sample falls off inside the chamber due to improper placement on the transfer rod!



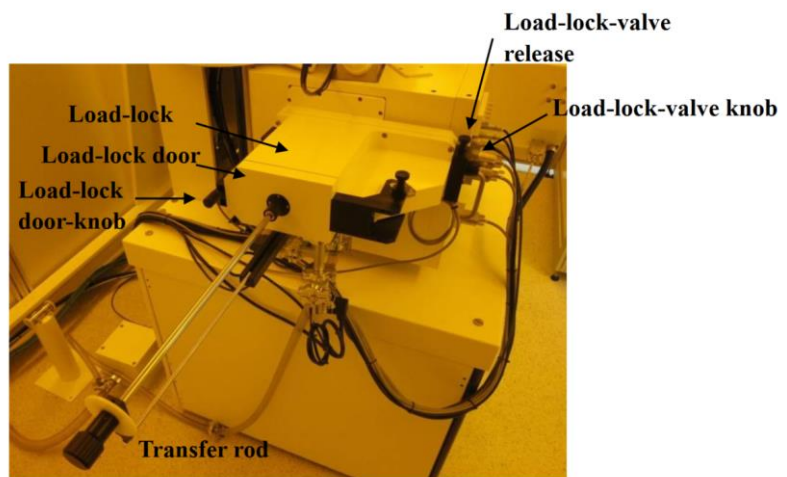
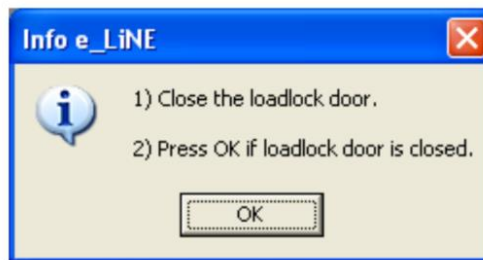
- **Make sure you have securely mounted your sample on the sample holder and placed it on the transfer rod of the opened load-lock.**
- **Before you start the load procedure, check that the nitrogen gas-line is pressurized to 0.3 bar:**



- **To initiate the load procedure, go to the "Sample loading" screen, available via the left-most cog-wheel icon in the menu bar of the Raith e-Line software:**

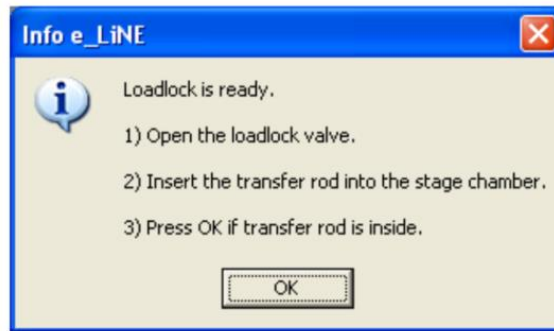


- **Select "via loadlock" and then "Load Sample". Confirm the dialogue asking you if you wish to proceed. After this you will need to follow the instructions carefully:**



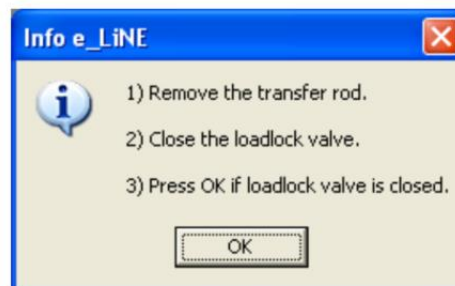
- **Check that the load-lock door-knob is closed (do not over tighten!). Then press ok. After the load-lock was evacuated with the dry-pump you should see the following**

message.

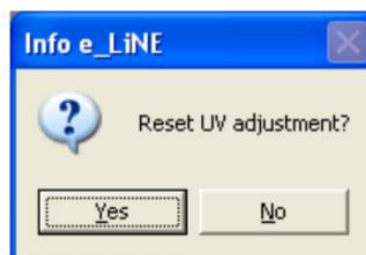


If the load-lock door was not fully closed it will not be able to evacuate the load-lock - so check if this part takes longer than a minute.

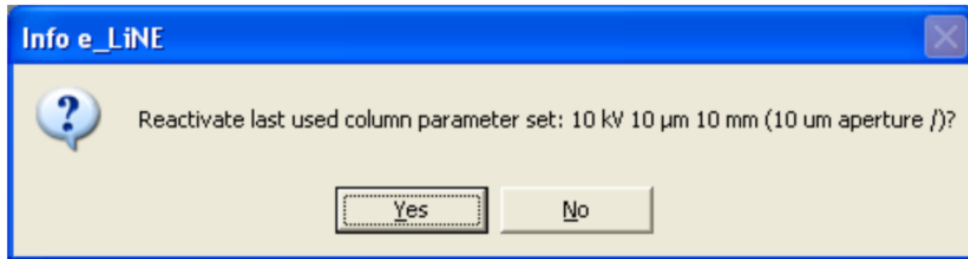
- **Open the loadlock valve:**
 - **lift the load-lock valve release** → **turn the load-lock valve knob counter-clockwise** → **let go of the release and pull out the load-lock-valve knob**. Make sure it's pulled all the way out.
 - **slowly and carefully insert the transfer-rod** (all-the-way!). If you do this with too much speed the sample holder can fall off inside the chamber, which will make a lot of people very unhappy!
- **Once you have pressed OK, the stage will drive up and lift up the sample holder from the transfer rod. Once this has happened (it takes a few minutes) you should see the following dialogue:**



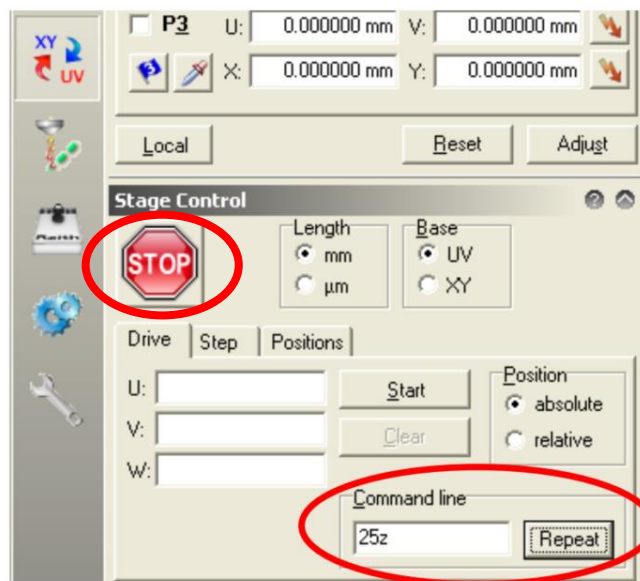
- **Again, carefully!, pull out the transfer rod** → **close the load lock valve (push in load-lock-valve knob, turn it clock-wise until it has snapped into place** → **press OK.**
- **When the loading-process is complete, the program will make two enquiries:**



- **If you wish to keep the alignment from before , then you can keep your UV adjustment. Otherwise, it makes sense to reset it.**



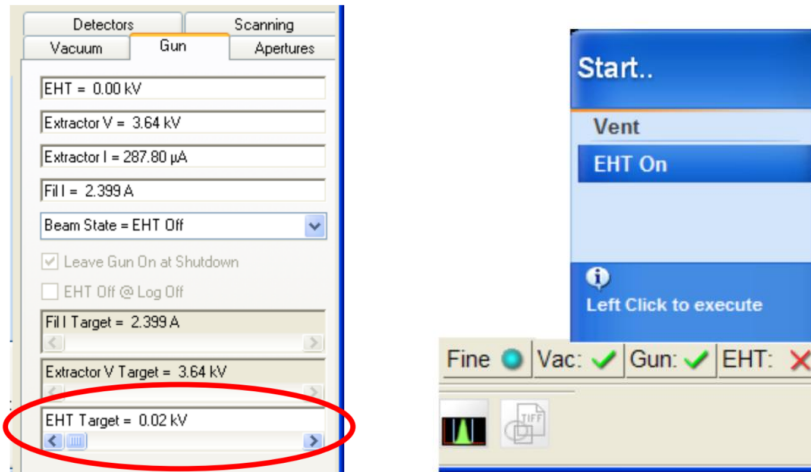
- **If you press yes the parameters will be applied and the gun will automatically turn on, you can press YES if you want. Otherwise press NO and start up the gun manually at a later point. move**
- **Load the wafer map into the Raith software:** Open wafermap -> open the file 100mm_ush.wlo located in c:/eline/user/qttest/wafer)
- **Drive Z-stage to 25z:** After the loading procedure is finished drive the z-stage to the correct imaging position. **NOTE: this will strongly depend on your sample height! If you use samples that are thicker than normal wafers (ca. 0.5mm) you need to reduce this z-value correspondingly! Under any circumstances DO NOT load any sample higher than 15mm!**
 - **Be aware the moment you put in the value and the axis, the stage starts instantly to move! In case of an error on this value immediately press the STOP button to stop any stage movement!**



- **Move to the imaging position on your sample:** CTRL-button and right click on sample location makes the sample move to the imaging position. This movement will always be done with a blocked beam. **Imaging:**
- **Check in the logbook what EHT voltage has been used last. If it was ≥ 20 keV make sure to not restart the EHT with this high voltage!**
- **Set the EHT target to the desired value (for example 5kV).** If the target is larger than 10kV, then set the target to 10kV first, turn the EHT on, before ramping it up further. **To use acceleration voltages above 20kV you need to ramp the filament up**

slowly otherwise it can break! Discuss this with lab-technician if you wish to do this.

- **Turn on the electric high-tension (EHT) by left-clicking on 'EHT' at the lower right of the SmartSEM program and selecting 'EHT On'**

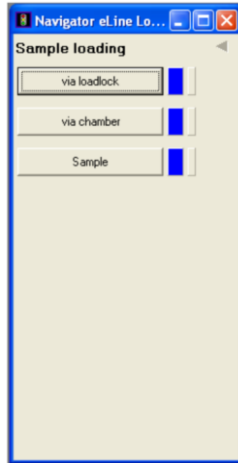


- **Ramp up the EHT to the desired value. 10kV is normally good enough for imaging!**
- **Change the imaging signal to the detector of your choice 'InLens' or 'SE2'**
- **Unblank the beam if necessary**
 - **If you get no signal check brightness and contrast settings**
- **Set your working distance WD**
- **Proceed with focusing and aligning to get optimal image quality**

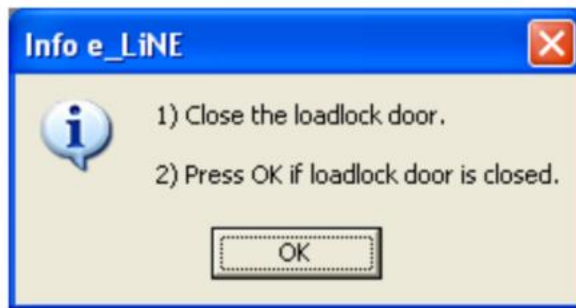
Unloading procedure via loadlock

Once you are finished with imaging follow this procedure:

- **Before you unload the sample, make sure that there is a sample holder inside the imaging chamber. This can be done by checking the infrared camera (TV-detector) inside the e-line.**
- **Initiate the unload procedure, go to the "Sample loading" screen:**



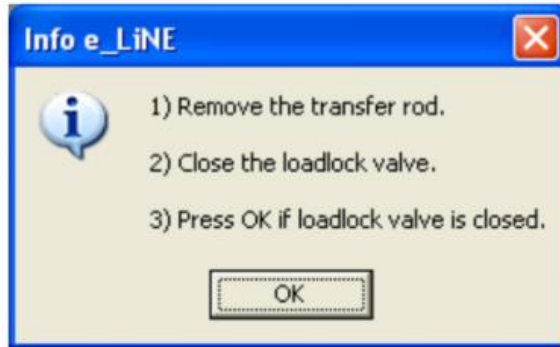
- **Select "via loadlock" and then "Unload Sample". Confirm the dialogue asking you if you wish to proceed. After this you will need to follow the instructions carefully:**



- **Check that the load-lock is fully closed with the load-lock door-knob. Click OK and wait for the next info box to appear.**



- **When you open the loadlock valve, make sure it's pulled all the way out. The transfer rod should be inserted steadily and carefully all the way in. Click OK, and wait for the following info box to appear:**



- *Pull out the transfer rod steadily and make sure that the loadlock valve is shut after.*
- *Loosen the load-lock door-knob, to make sure the load-lock door does not get stuck when it is filled with up to 0.3 bar overpressure.*
- *Click OK and wait for the Load-lock to vent to atmospheric pressure. When the process is complete a confirmation will be displayed.*
- *Remove your sample from the sample holder and put the sample holder back into the load-lock, closing it afterwards.*
- *Log out of the Raith E-Line software, perhaps saving your position list that you used for the exposure first.*
- *Set the detector to 'InLens' mode, to not keep the infrared camera running.*
- *Turn off both screens, and also switch off the stage-joystick (by pressing the X and Y buttons).*