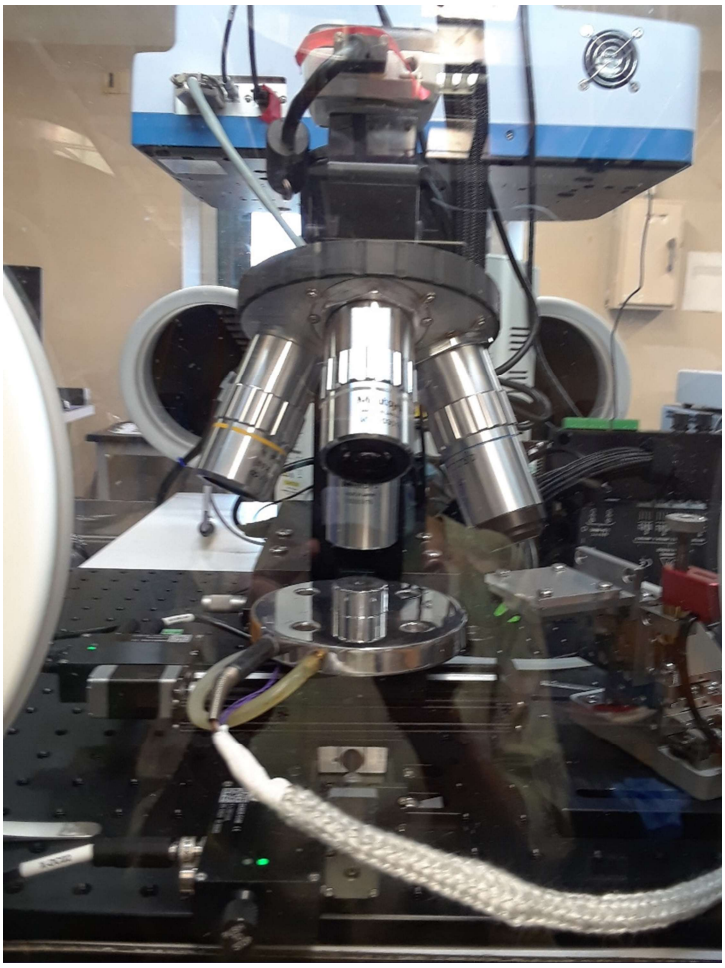
COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK
COLUMBIA NANO INITIATIVE / CENTER FOR INTEGRATED SCIENCE AND ENGINEERING

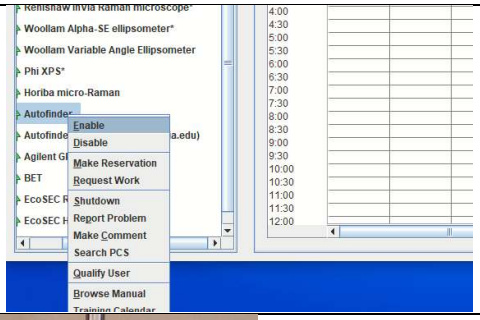
Autofinder (and Glovebox) Standard Operating Procedure



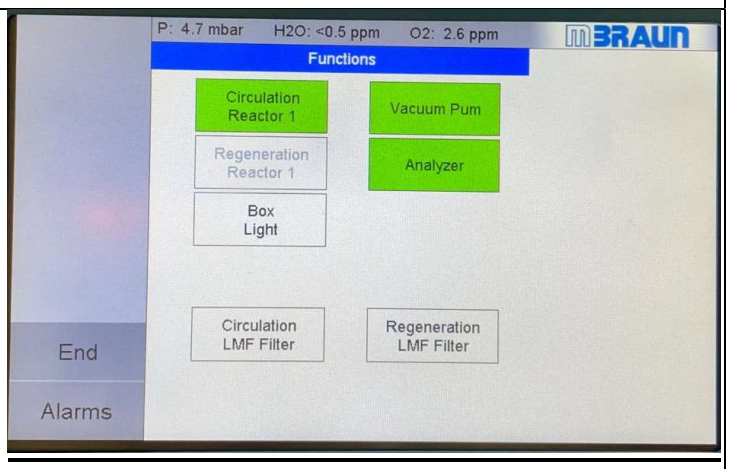
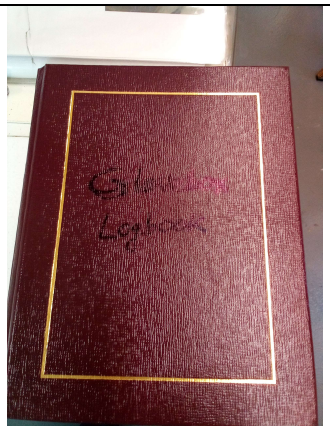
These instructions are intended for reference only, and will *not* replace the thorough training required for proper system operation. Contact a staff member/ superuser with questions or to report a system problem.

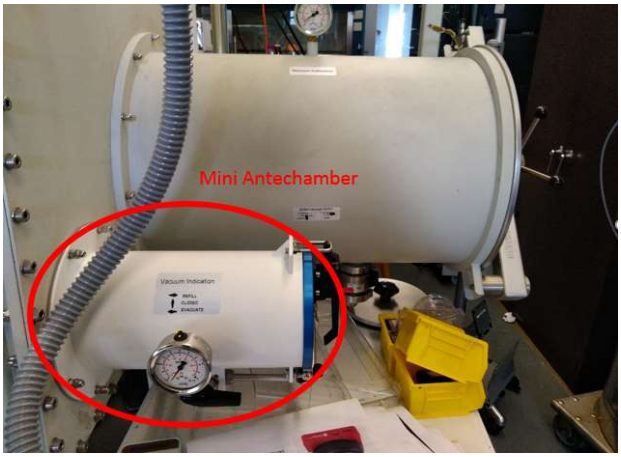
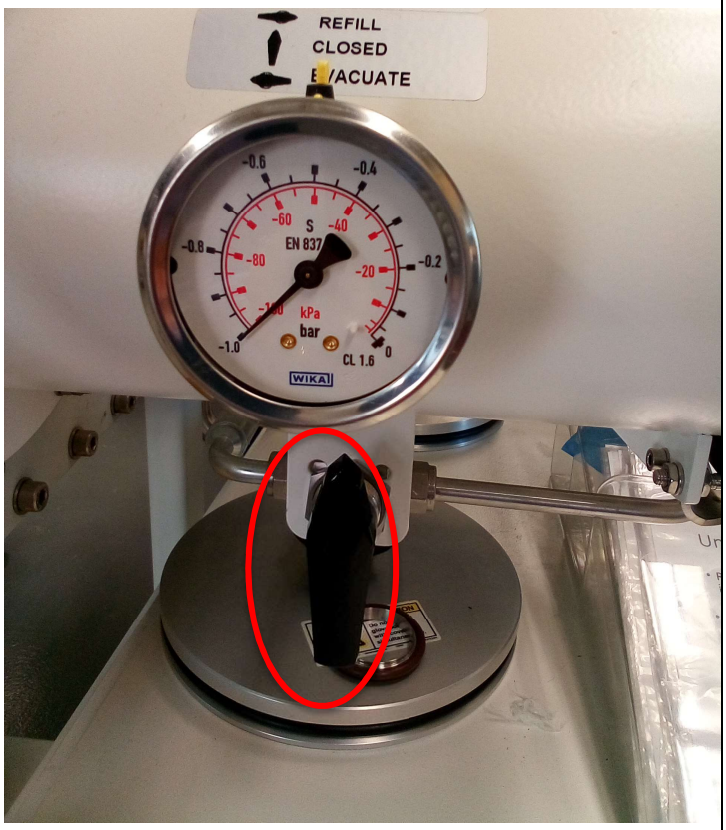
SOP prepared by Dr. Manju Rajeswaran and Anjaly Rajendran Jan., 2022

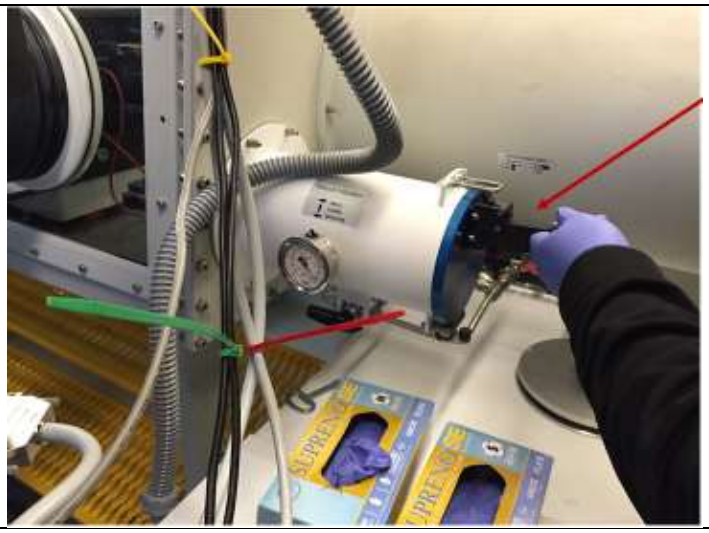
CNI Shared Facilities

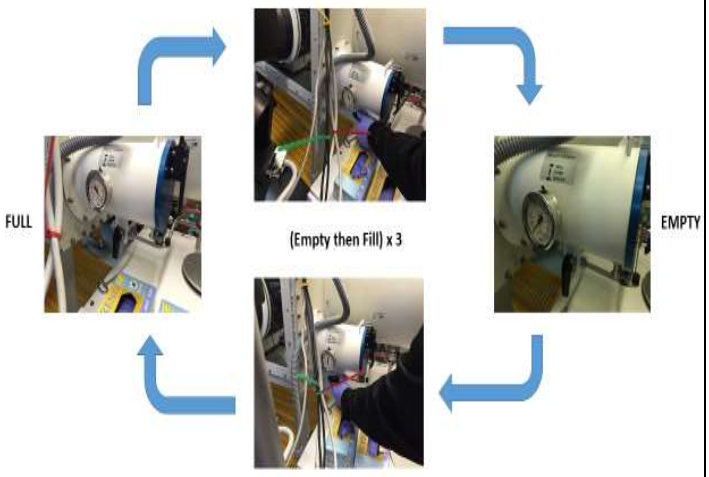
1.	Enable the tool in **BADGER**	
2.	Glovebox N2 Gas supply - Always check N_2 cylinder/Dewar pressure levels before, during, and after using antechamber. If the glovebox gas supply is below 80 psi, DO NOT USE THE GLOVEBOX or if N_2 cylinder/Dewar is empty, please report on badger and if possible, inform staff (SMCL_equipment@columbia.edu) and super-user.	 Glovebox gas supply gauge  N_2 cylinder gauge

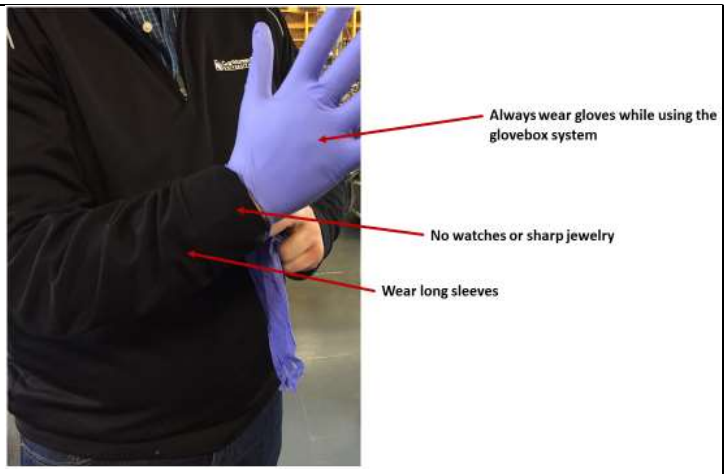
		  Liquid N_2 Dewar gauges
3.	Vibration Isolator N_2 Supply for the transfer stages - If the vibration isolator gas supply cylinder is empty, please report on badger and if possible, inform staff and super-user. The nitrogen supply to the vibration isolation table ensures the surrounding	

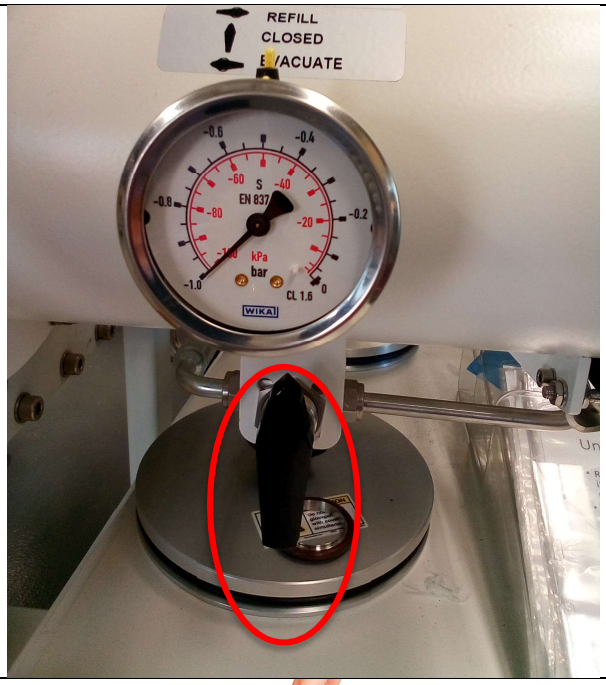
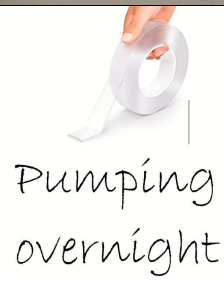
	vibrations do not damage your stack or device.	
4.	Glovebox Control Panel - Always check O_2 and H_2O levels before using antechamber, if O_2 level is above 2 ppm or moisture level is above 0.5 ppm, please report problem on badger and if possible, inform staff (SMCL_equipment@columbia.edu) and super-user.	
5.	Please fill out the logbook, located near the glovebox whenever antechamber is used. Please include Name, UNI, Date, Start Time, End Time, O_2 and H_2O levels before and after, what was put in the box etc.	

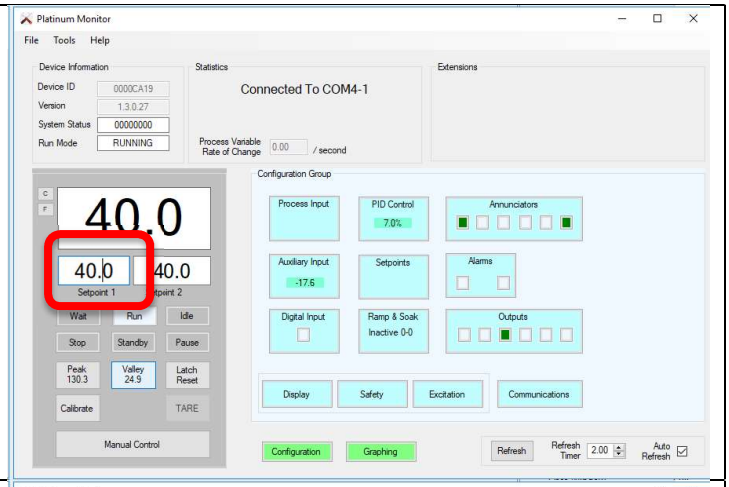
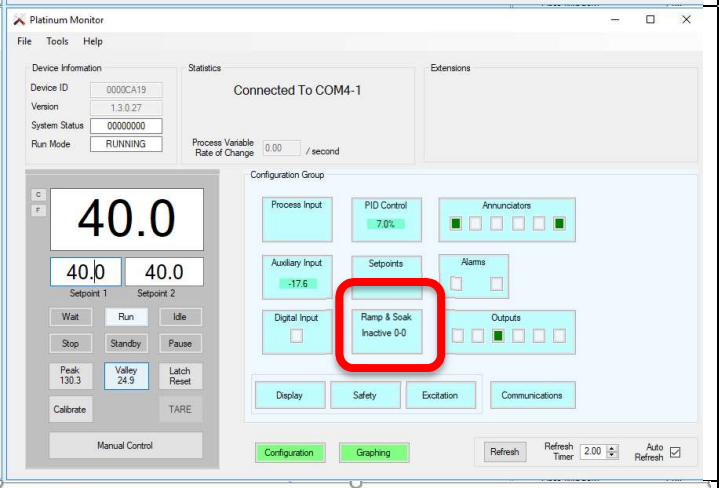
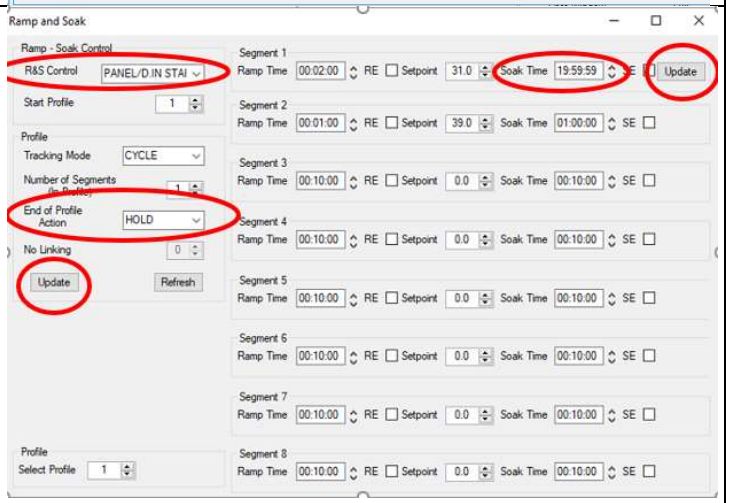
6.	To transfer materials into the glovebox please use the mini antechamber located on the right side of the glovebox	
7.	Open the valve fully counterclockwise to pump the antechamber. Purge antechamber by turning the valve to the "refill" position, gauge indicator will rotate to its extreme clockwise position. Whenever moving something from ambient conditions into the glovebox, the antechamber must be pumped and purged 3 times with a total pumping time of at least 20 minutes.	

	When moving in layered plastic objects like tapes, PDMS and many glass objects like crystal vials and more than 3 glass slides, the antechamber should be pumped overnight. Please ensure that containers transported in the box are open and can be evacuated.	
8.	Make sure the interior door of antechamber is closed. Unlatch exterior door of antechamber and open antechamber.	

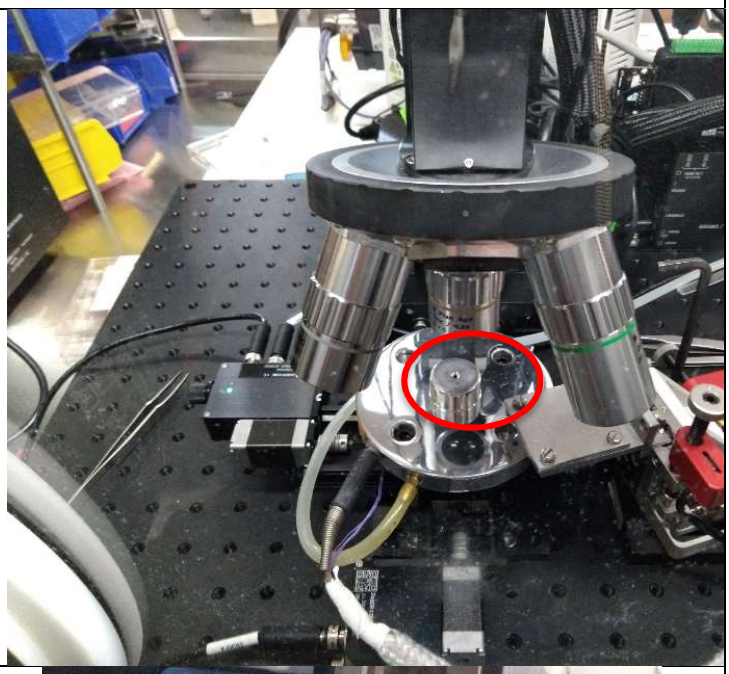
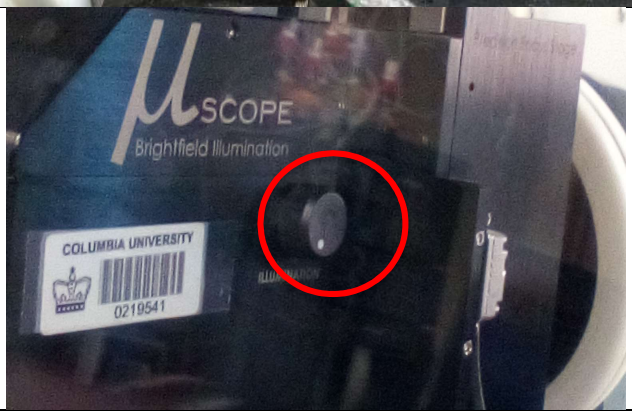
9.	Slide stainless steel tray out, please be careful and do not pull it out all the way. Load your material of interest on the tray and Close the antechamber lid	
10.	Next, pump and purge (vacuum and refill) the antechamber 3 times to make sure the antechamber is approximately at the same pressure as the inside of the glovebox. Then leave the antechamber under pump down (active vacuum) for minimum 20 minutes to remove all oxygen and moisture.	

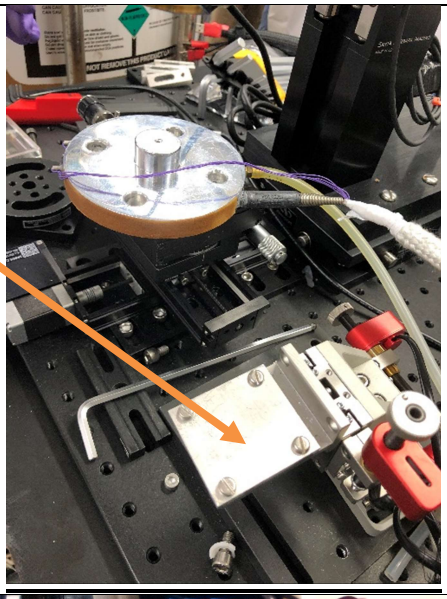
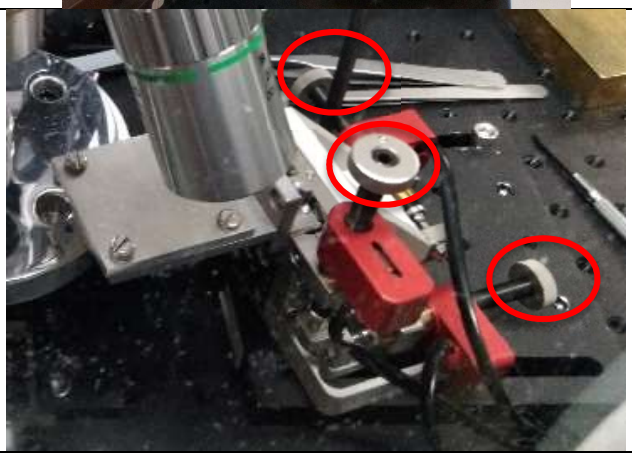
11.	Always wear long sleeves and gloves while using the glovebox system. Please make sure you are not wearing a watch or any sharp jewelry, so you don't puncture the gloves.	
12.	Insert gloved hand and sleeved arm into glove closest to internal antechamber port carefully. In general, aim to miss all obstacles while inserting your arms into gloves.	
13.	Open latch on interior antechamber port and slide out the stainless-steel tray to remove your material. Close interior small antechamber port and close the latch.	

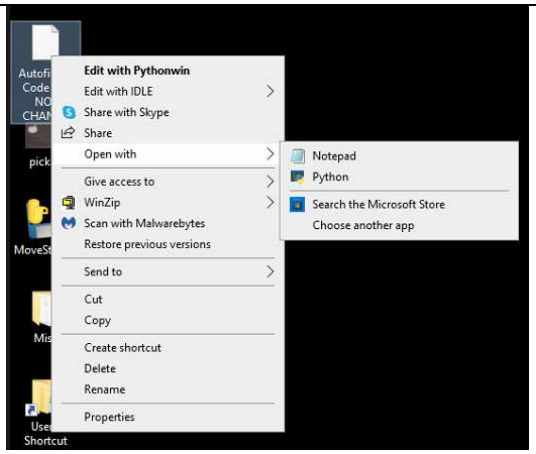
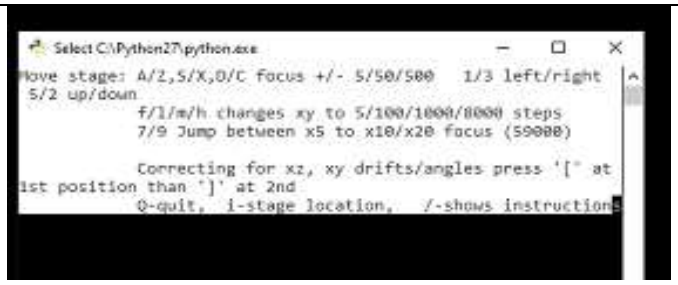
14.	Evacuate the antechamber until it is completely empty, then turn valve to “closed” position. Antechambers should always be left under vacuum with their respective valves in closed positions when not in use.	
15.	If you are leaving samples for overnight pumping in the antechamber, please remember to leave a note on antechamber.	
16.	Turn on Heating stage - Heating Stage takes a few min for the PID to stabilize, so turn the stage on and preset the temperature before you setup the transfer. Use the Platinum software for setting the temperature.	

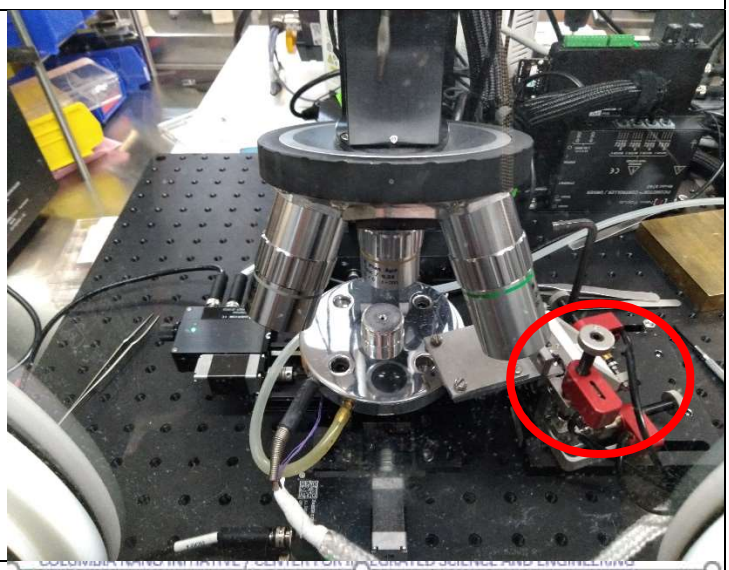
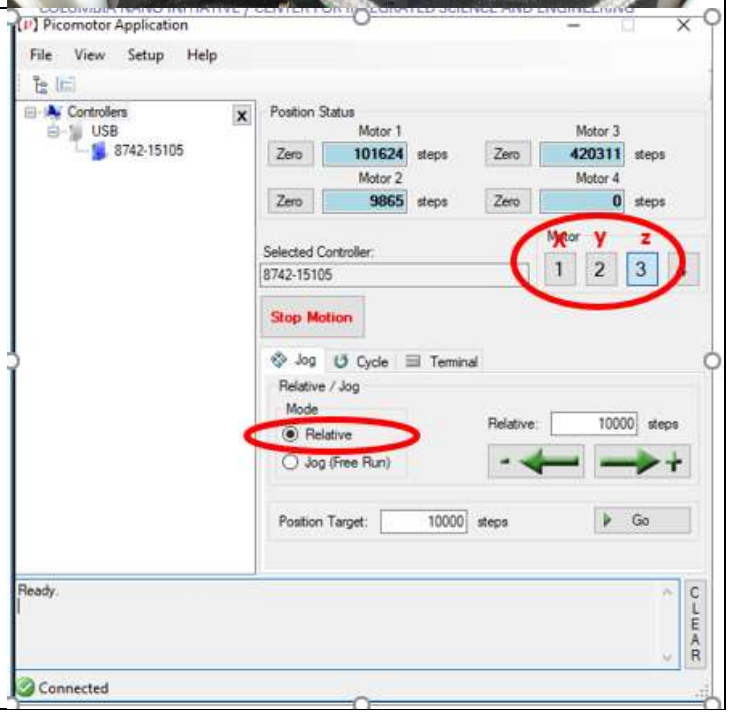
17. Platinum software, Manual mode – change Setpoint 1, press RUN	
18. Platinum software, Ramp & Soak mode – to avoid overshooting please turn it off after finishing your session,	
19. Select R&S control - PANEL/D IN START', End of profile Action "HOLD' soak time is set to a large value like 20:00:00 so that the temperature remains at the desired value throughout the stacking process. Specify target temperature in 'Setpoint', time to ramp	

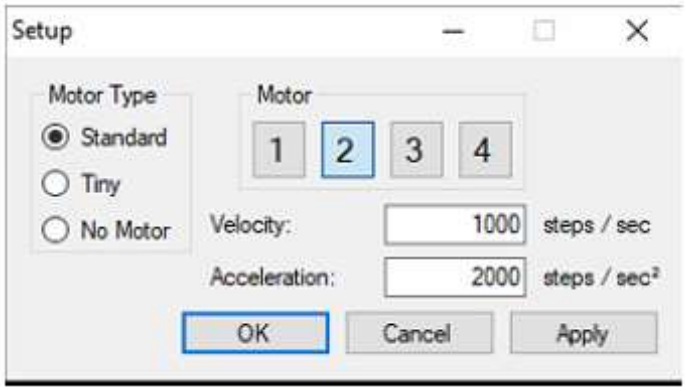
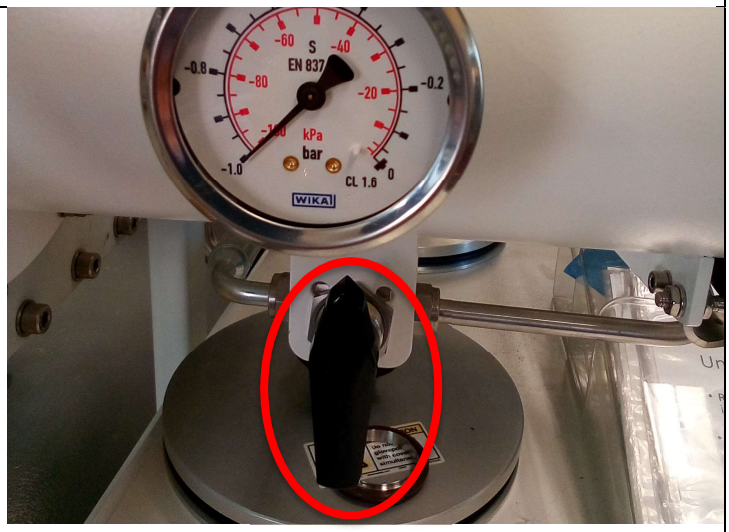
	up in 'Ramp Time'. Press 'Update' to register new settings.	
20.	Turn on Vacuum Chuck Supply - Turn on the vacuum chuck supply to the stage which holds the chip. Press the red button to turn on/off vacuum to the stage	
21.	Turn on N_2 supply for floating table - Double Check the nitrogen supply for the active vibration isolation. There are two switches which control the nitrogen supply to the	Switch 1  Closed  Open

	vibration isolation table. Make sure both are on.	Switch 2 
22.	Place your sample chip on the heating stage.	
23.	Turn on the microscope light.	

24.	Placement of transfer slide - Fasten the transfer slide on to the slide holder using the small screw driver and tighten the base of the slide holder to the base using the larger screw driver.	
25.	All tools can be found in a yellow plastic bin near the stage.	
26.	You can use the X, Y and Z knobs to adjust the position of the transfer slide above the chip roughly. Finer adjustments can be done using software.	

27.	Open the Autofinder code in python - Python script can be used to move the stage in X and Y directions. The microscope objective can be moved in Z direction to adjust the focus.	
28.	Stage left/right -> 1/3 Stage up/down -> 2/5 Fine movements -> f Medium movements -> m Fast movements-> h Focus control – Objective movement A -> down by 5 steps Z -> up by 5 steps S -> down by 50 steps X -> up by 50 steps D -> down by 500 steps C -> up by 500 steps W-> down by 2000 steps E -> up by 2000 steps	

29.	You can view the live camera window by using the Motic software, located on the taskbar	
30.	Stacking in the glovebox can be done by utilizing the robotic picomotor micromanipulator (the red one to the right of the Autofinder stage).	
31.	Open 'PicomotorApp' . Manipulator can move in the X, Y, and Z directions, labeled as 1, 2, and 3. Select 'Relative' mode. Move using the relative area for the number of steps (+, or -) to go "up/down, left/right, or +-z" depending on your motor selection.	

32.	Setup -> Controller to control velocity and acceleration. Do not use values higher than default velocity 1000 steps/sec & acceleration 2000 steps/sec^{2}.	
33.	When done - close the Nitrogen valve. Switch off the microscope light and vacuum. Ramp down heater temperature to 35°, clean exfoliation bench, antechamber is in vacuum and the knob is in 'closed' position.	
34.	Disable tool in badger