

SU8220 Cold FE-SEM **User Manual(Eng.)**

울산과학기술원 연구지원본부 기기분석실 **UNIST Central Research Facilities UNIST Materials Characterization Lab**

CONTACT

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UCRF

Bldg.102 209 **Tel.** +82 52 217 4028



Lab Safety

Compliance with lab safety rules

If you do not follow the lab safety rules, access and use of the lab will be restricted, so we ask for your cooperation.



No Food or Drink

Wear Protective Clothes

Wear Foot Protection No Open-Toe Shoes

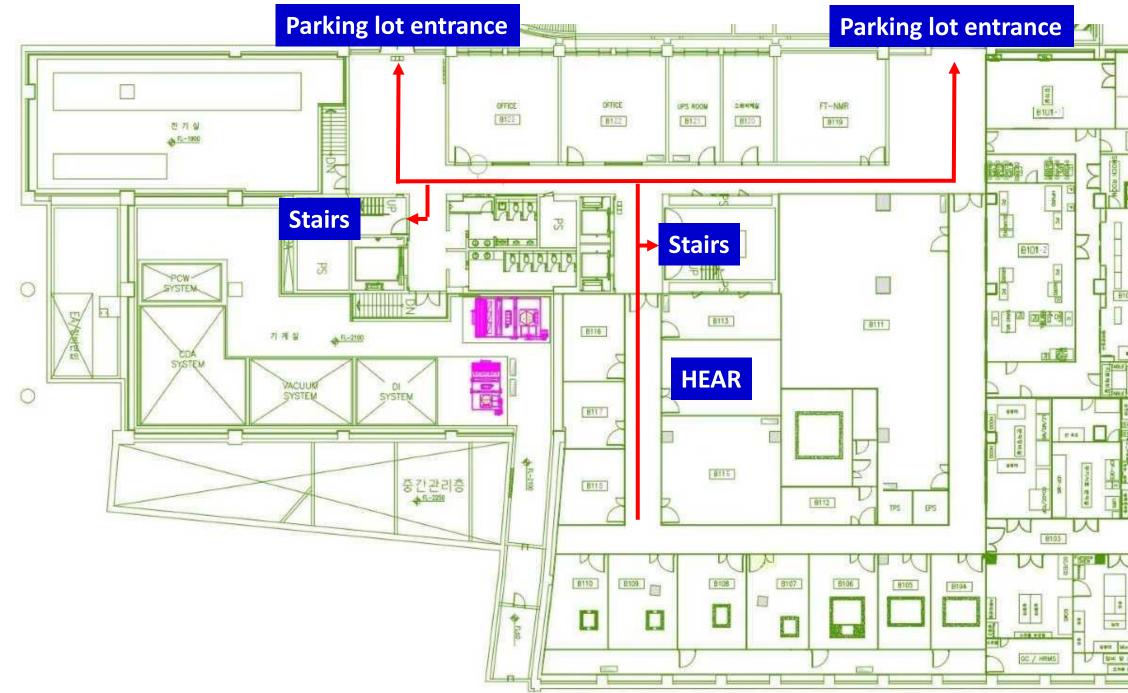
If you didn't bring your lab coat, please wear a shared lab coat entrance side of the room 101-2 on the first basement floor of 102 building.

Make sure to wear a lab coat and enter the lab of UCRF.

Make sure to keep the lab clothes you wore in their original place.



Lab emergency evacuation

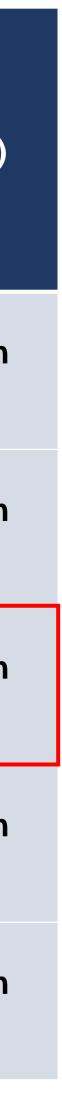




UCRF SEM Feature

	High resolution imaging	EDS analysis	Specimen damage & charge-up	BSE detector	E-SEM	Reservation status	Introduction year	Fee(100%)
SU8220 cold FE-SEM	Õ	Ο	Slight	X	X	Busy	2013	40,710won /30min
SU7000 FE-SEM	Ο	Õ	Serious	X	X	Busy	2021	40,710won /30min
Cold FE-SEM	Ο	Ο	Slight	X	X	Not busy	2011	31,320won /30min
Nano230 FE-SEM	\bigtriangleup	Δ	Slight	X	X	Not busy	2009	26,100won /30min
Quanta200 FE-SEM	X	Δ	Slight	Ο	0	Not busy	2009	26,100won /30min





SEM stubs

Туре	Α	В	C	D
Equipment	SU7000	old FE-SEM FE-SEM E-SEM	Nano FE-SEM Quanta FE-SEM	
Usage	General	Cross section	General	Cross section
Picture (Front)				
Picture (Back)				

- If you need a special stub other than the stub above, please discuss with the SEM manager and UDMC.
- 4176)



- 🕿 SEM stub Production: UDMC Cha Jae-hoon(cjh614@unist.ac.kr, 4069), Jeong Woo-hyun(print102@unist.ac.kr,





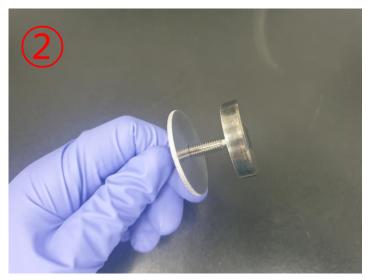


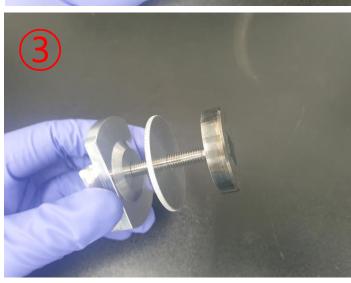
Specimen Preparation







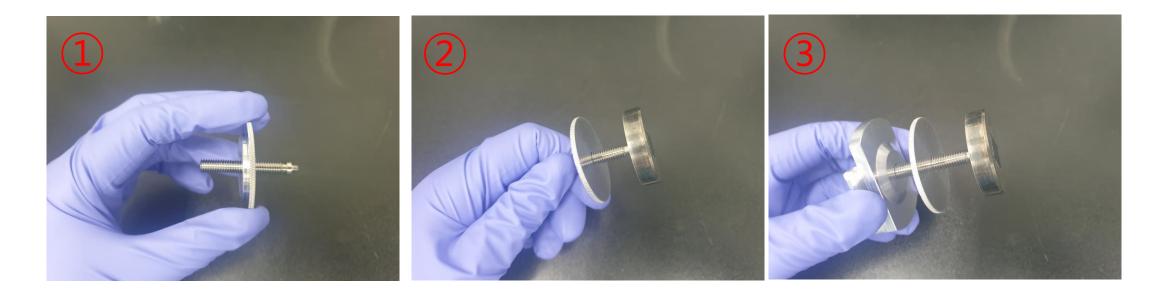






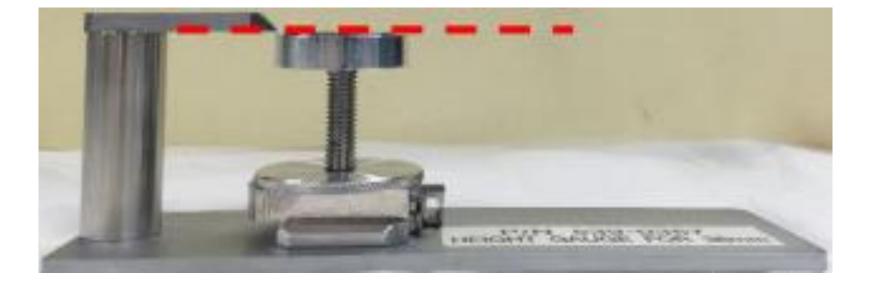
- 1. Wear appropriate safety gear. (goggles, gloves, etc.) **★**
- 2. Prepare completely dried specimens.
- 3. Prepare 4 items needed to assemble the specimen holder.(If the screw does not come off from the holder, wrap tissue paper around the screw and loosen it with a long nose.)
- 4. Fix a very small amount of specimen using tape to individual stubs.(Use carbon tape for powder) *
- Press the power of hume and blow to remove 5. dust from the specimen. \star

Specimen Preparation











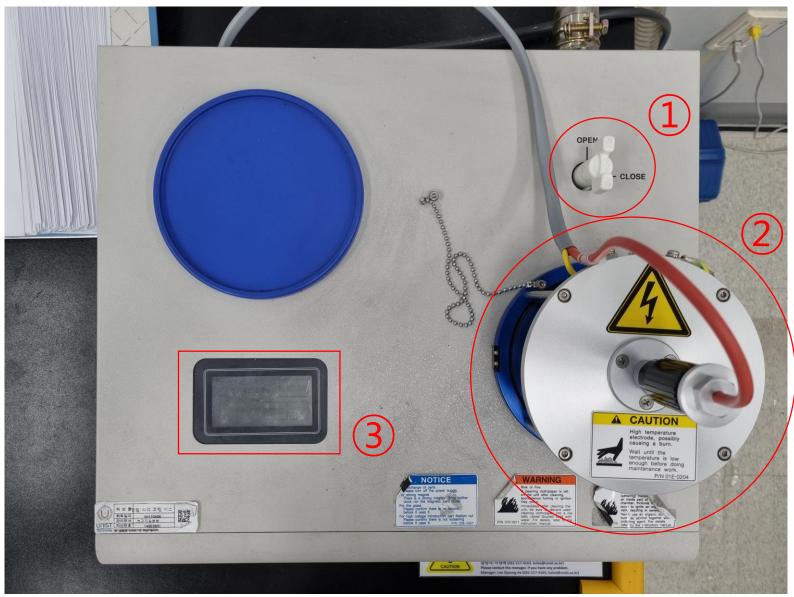
- Coat it if necessary. 1.
- 2. When the coating is complete, assemble the holder in the order of the picture next to it.
- 3. Check if the top and bottom direction of the specimen holder is correct.
- 4. Check if the screw protrudes from the bottom. (If it protrudes, you need to change it to a smaller screw.)
- 5. Adjust the specimen height so that the highest part of the specimen touches the height checker. \star





Coating

Hitachi Sputter



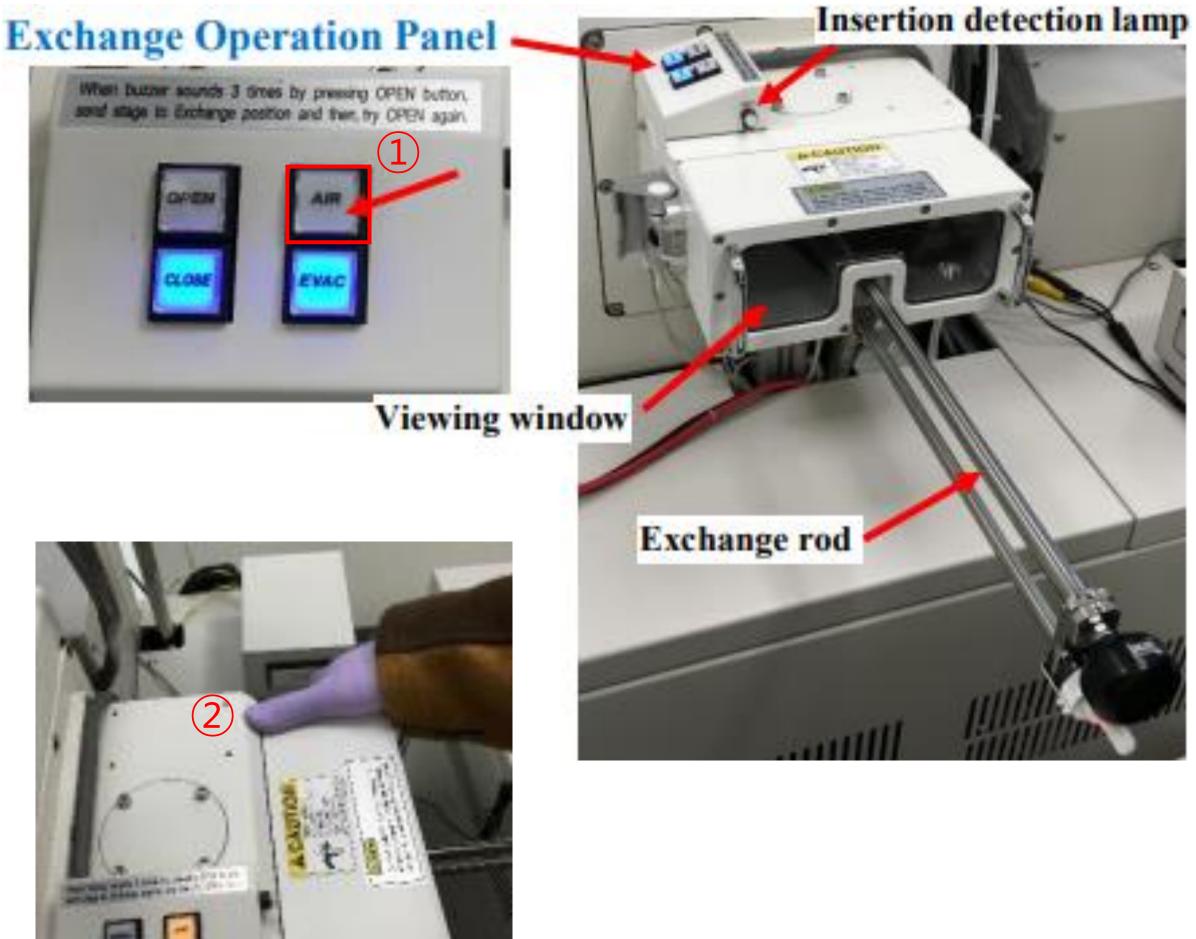
- Material: Pt
- Sputter current: 20mA
- Time: 15 ~ 240s

- Turn the valve open.
- 2. Open the column part and place the specimen in the center.



- Make sure the specimen touches the Pt source. 3.
- Press the touchscreen to view the coating 4. parameters.
- If you want to change a parameter, press 5. [Change].
- 6. Tap each parameter and enter the desired value.
- Press [Enter] [Back] [Start]. 7.
- 8. When Processing finished appears on the screen, open the column and remove the specimen.
- Press [Restart], then press [Stop] after 20 9. seconds.
- 10. Turn the valve to [CLOSE].

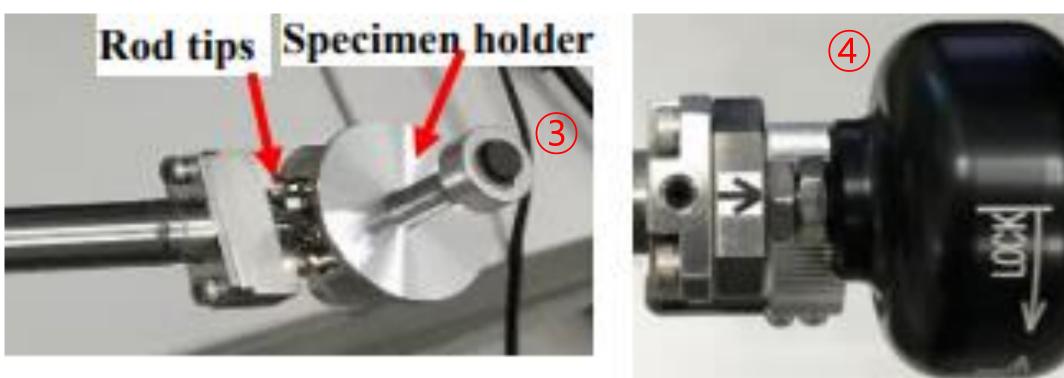
Loading the Specimen





- ----





- Press [AIR], wait until the buzzer sounds. 1.
- 2. Open the exchange chamber door. (Do not hold the exchange rod to open the door.)
- Insert the specimen stage onto exchange rod. 3.
- Turn the knob counterclockwise to 4. lock.(LOCK←)★



Loading the Specimen







- Close the specimen chamber door. (Do not hold the exchange rod.) 5.
- Press [EVAC], wait until buzzer sounds. 6.
- 7. Press [OPEN], wait until buzzer sounds.
- 8. Turn the exchange rod locking knob.
- 9. Push the rod into the chamber until the insertion detection lamp.

(Do not forcibly insert the exchange rod. \bigstar)



Loading the Specimen





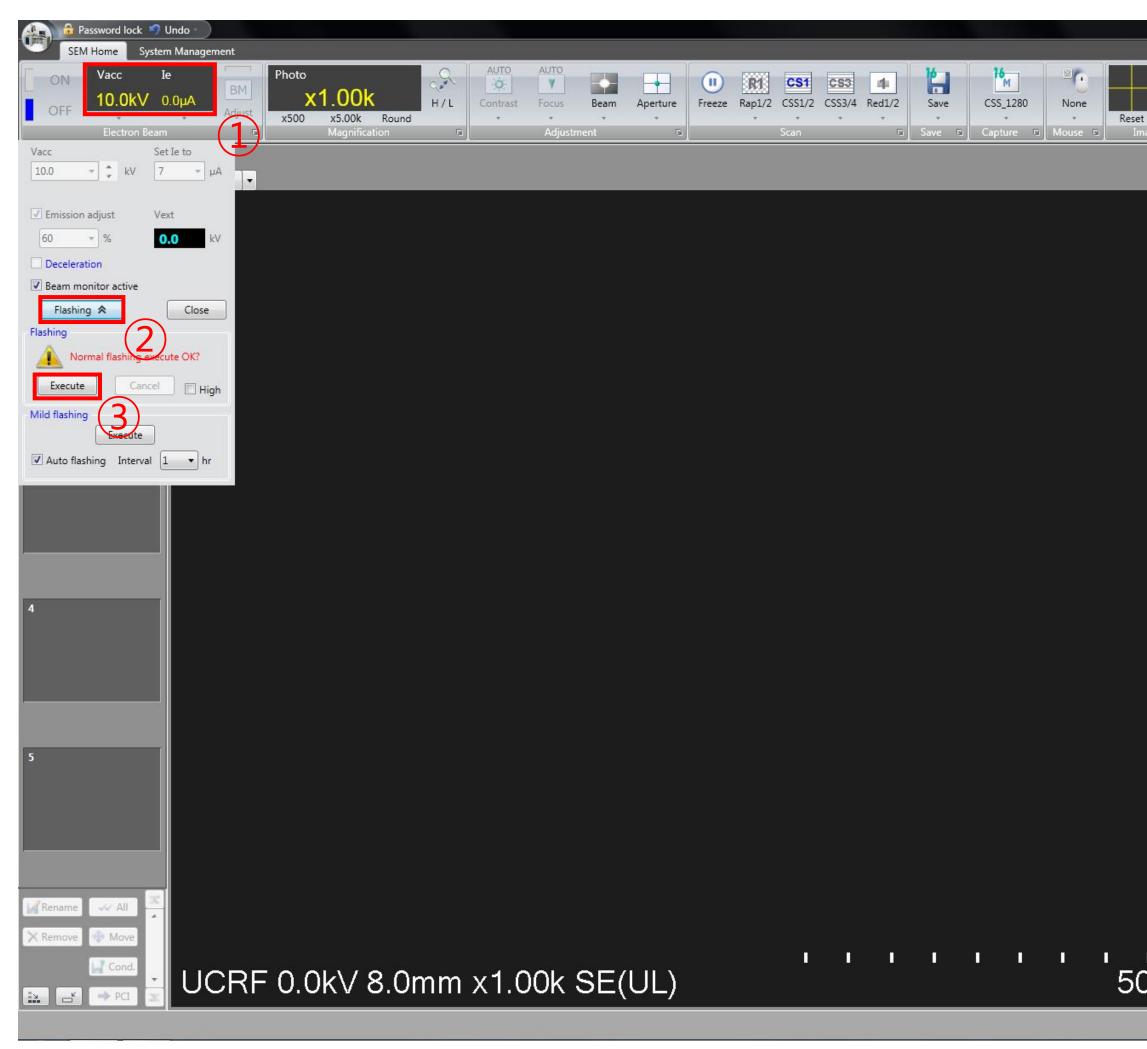
- 11. Pull out the rod all.
- 12. Turn the exchange rod locking knob.
- 13. Press [CLOSE], wait until the buzzer sounds.



10. Turn the specimen holder lock/unlock knob to UNLOCK position.



Starting Instrument





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	AUTO
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	Operating condition
	Probe current Norm High Detail
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	[2.8-40.0mm](Full)
	W.D. 8.0 - mm
	Degauss ABCC link
	🗌 Cross marker 🥒 📄 Center marker 🥖
	Stage Alignment ImageNavi Op. Cond History
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	Memory
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	Eucentric Rotation
	Priority Z Tilt Z-Focus Link Eucentric Tilt Calib. [1.5~30.0]
	Z (mm) 8.0 Move 4 1
	Z (mm) 8.0 Move () () (mm) [-5.0~30.9] EDX Z
.0µm	(mm) × 8.0 Move ()

- 1. Click [PC_SEM].
- 2. Hit [OK], no password required.
- 3. If a flashing message "Execute Normal Flashing" appears, click the electron beam

window.

- 4. Click [Flashing].
- 5. Click [Execute].

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Size & Height of Stub

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4		Specimen Size : 2 inches Height : Standard X/Y/R [-25~25] (mm) 0.000 [-25~25] Move 0
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Rename All Remove Move Cond.	UCRF 0.0kV 8.0mm x1.00k SE(U)	Priority © Z Tilt V Z-Focus Link Eucentric Tilt Calib. [1.5~30.0] (mm) + 8.0 [-5.0~30.9] EDX Z (I)



- 1. Click [Set].
- 2. For [Size] setting, select the diameter of the stub one size larger. ★
- 3. For Height setting, select Standard.
- 4. Click [OK].

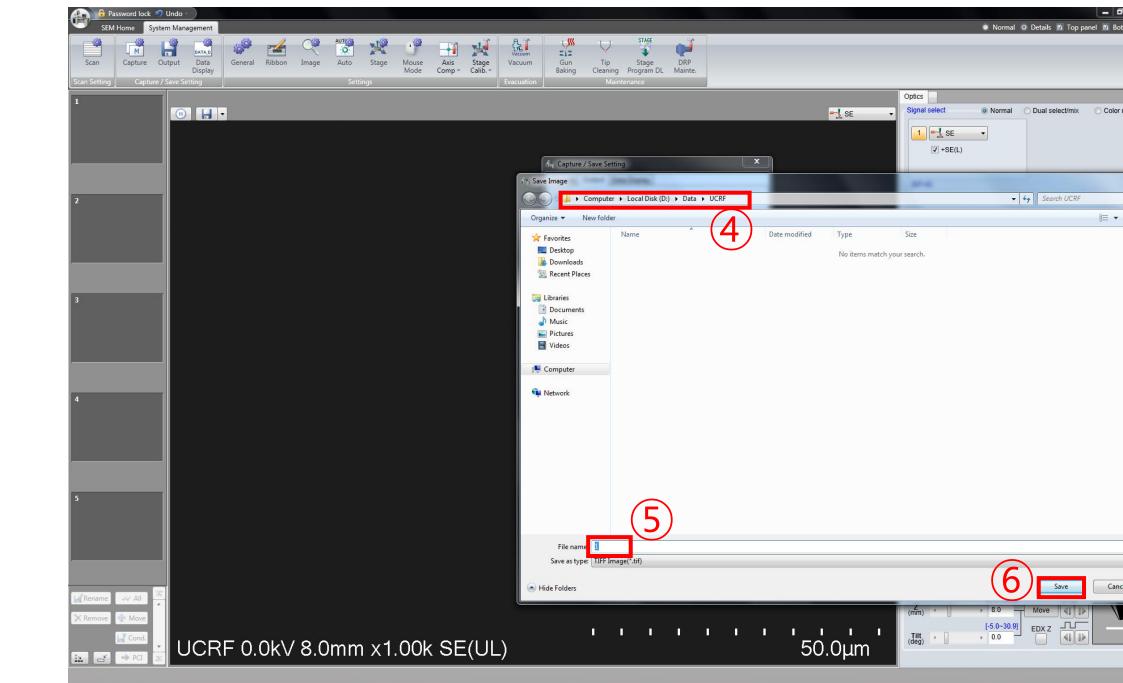


Setting the Data Storage Location

9 1	
Password lock 2 Undo SEM Home System Management	Normal O Details II Top panel II Bottom ;
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Remove Move Gond Gon	τι τ

- Click [System management] [Output] [Select]. 1.
- 2.
- Enter a sample name in [Image name] and click [Save]. 3.
- 4. Enter 1 in [Auto increment] and click [Close] [SEM Home].

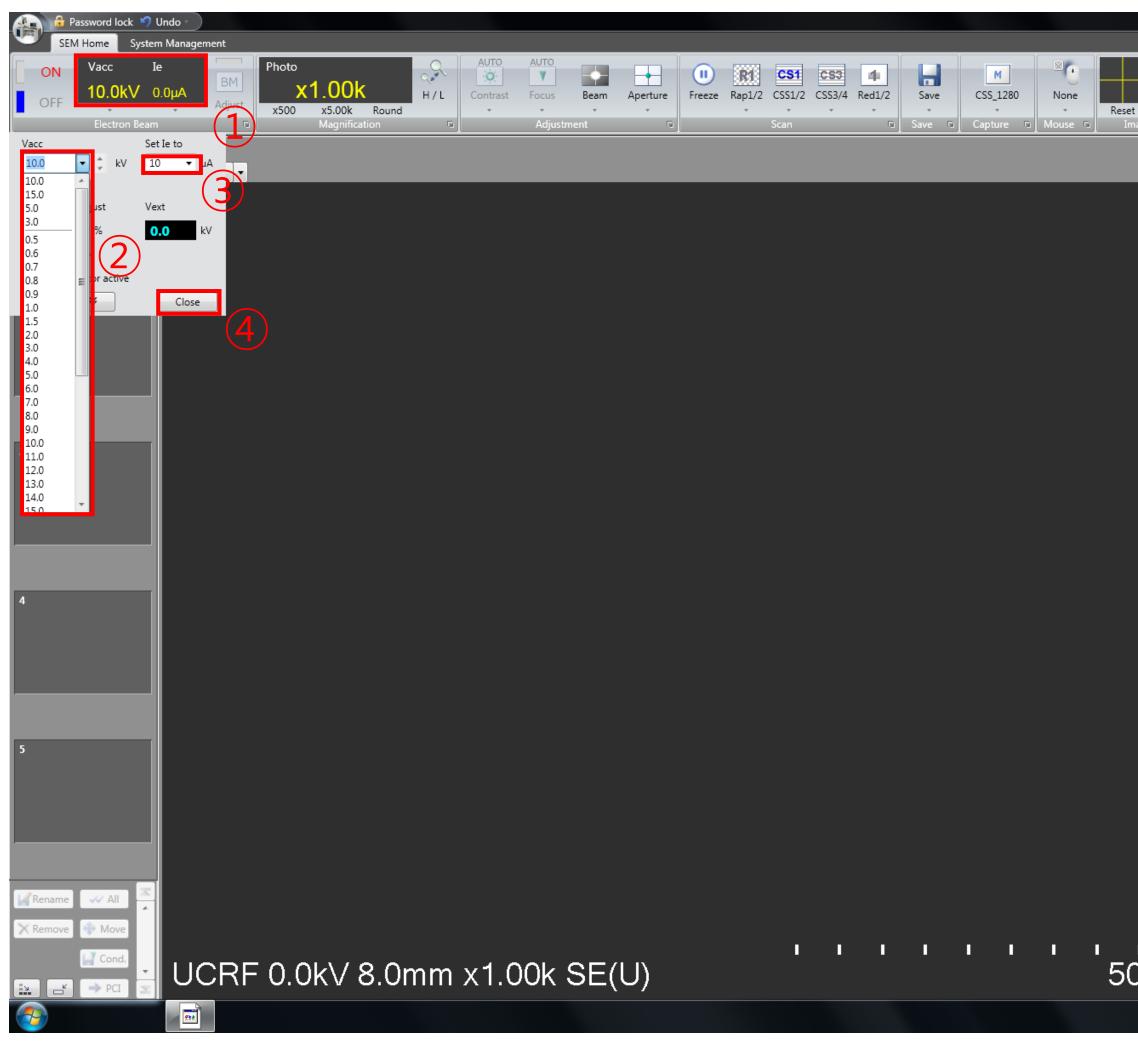




Create a folder.(Desktop-SEM data-Analysis year-Professor folder-Personal folder-Date folder)



Acceleration Voltage





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	(mm) × 8.0 Move
	[-5.0~30.9] EDX Z
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	2:20 PM 1/28/2022

- 1. Click the [Electron Beam].
- 2. Select the acceleration voltage in [Vacc].
- 3. Select beam current (7~10) in [Set le to].
- 4. Click [Close].
- 5. Select [Probe current] appropriately.



Beam on

Password lock Undo SEM Home System Management			
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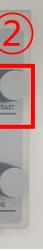
- 1. Click [ON].
- 2. If the screen is too dark or too bright, press [Auto].(You can manually adjust the [Brightness] or [Contrast] knob individually.) \rightarrow This process can be performed at any time during image observation.



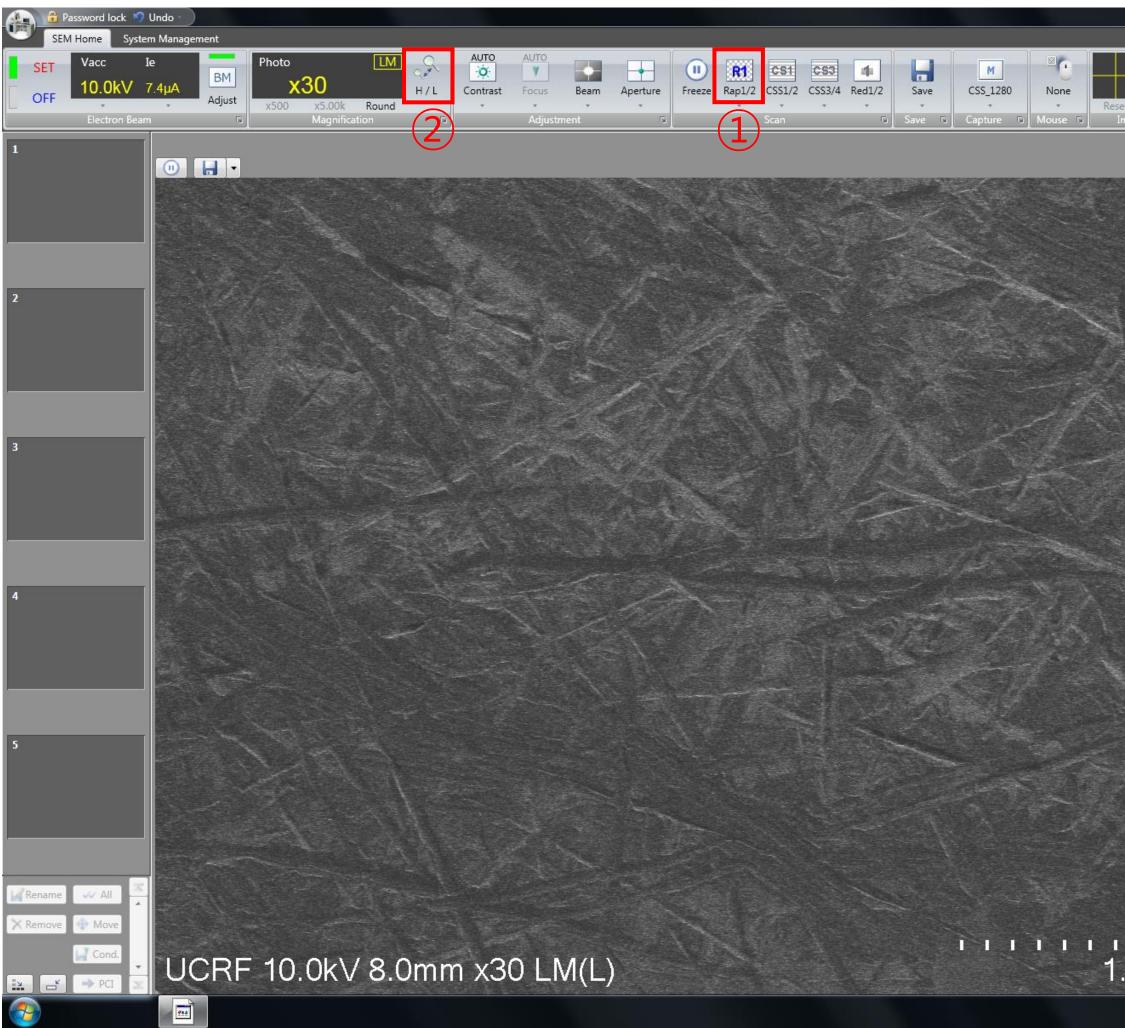








Finding the Specimen

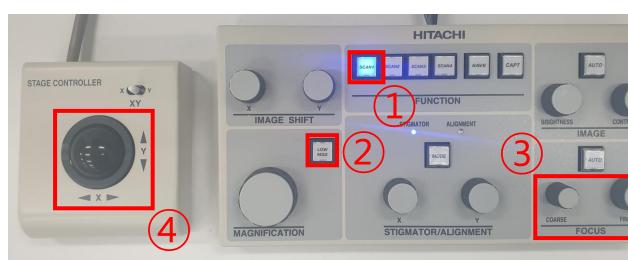




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	Stage Alignment ImageNavi Op. Cond History Specimen Size : 2 inches Height : Standard X / Y / R [-25~25] -25 (mm) 0.000 -25 Y [-25~25] Move 0.000 -25 0 Y 0.000 -25 Rotation Abs Rel (deg) 359.9 -Move ImageNave ImageNave -25 Y Eucentric Rotation Z/TILT Priority Z Tilt Z-Focus Link	Set Speed History Reg. Memory
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1 I I I OOmm	StageAlignmentImageNaviOp. CondHistorySpecimen Size : 2 inches Height : StandardStadardX / Y / R $[-25 - 25]$ (mm) -25 0.000Y (mm) 0.000 -25 0Y (mm) 0.000 -25 0RotationAbsRel 25 Rotation 0 AbsRel 25 Wove 25 25 0 -25 Y (deg) 359.9 $-$ MoveY Eucentric Rotation 2 Tilt 7 Z-Focus LinkZ / TILT $1.5 - 30.0$ (mm) 0 MoveY EDX Z 0 Move 0 Move	Set Speed History Reg. Memory

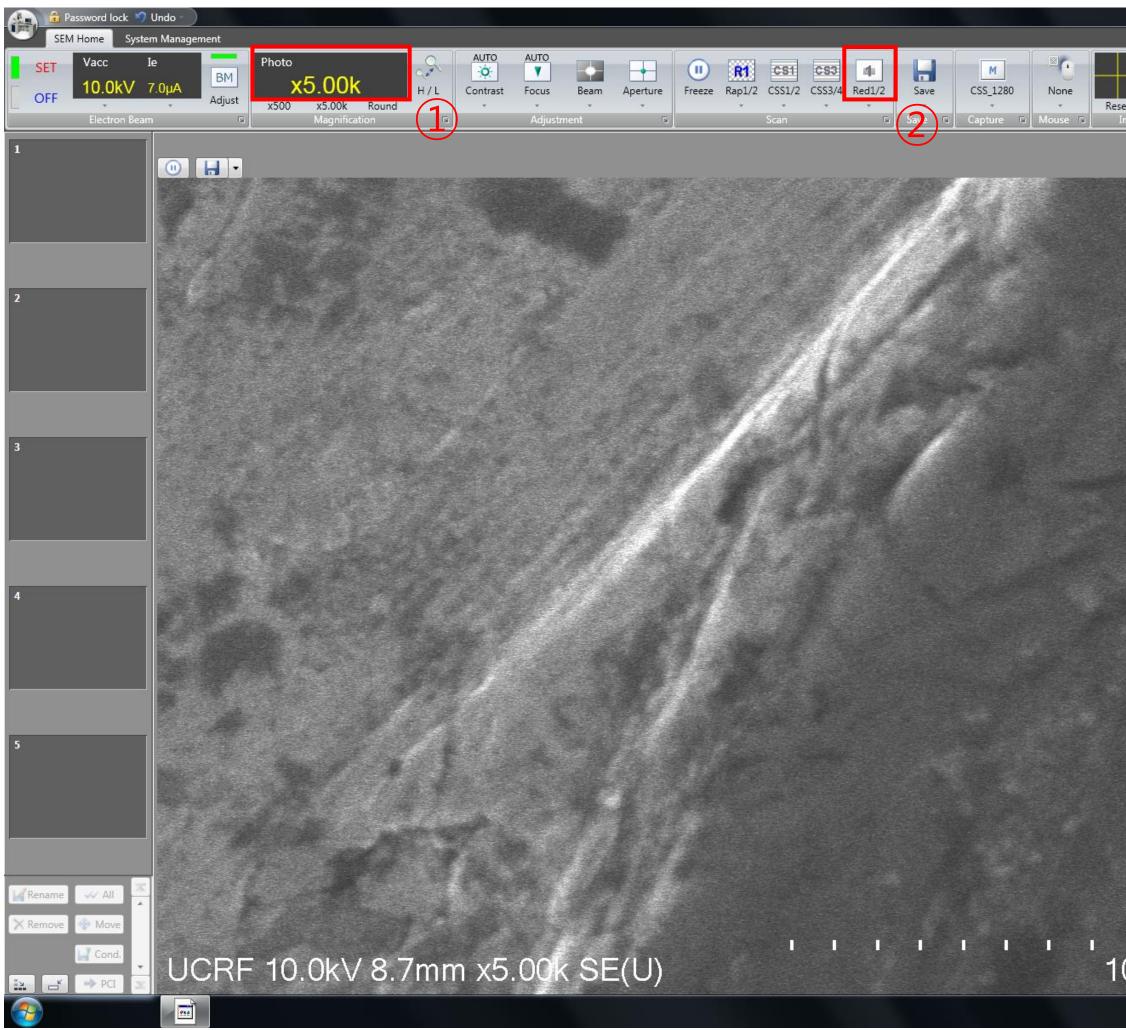
- 1. Press the [SCAN1]. (SCAN SPEED: SCAN 1>SCAN 2>SCAN 3)
- 2. Press the [LOW MAG].
- 3. If the image is blurry, use the focus knob to adjust the focus.
- 4. Adjust the trackball to move the stage to the desired

location for observation.





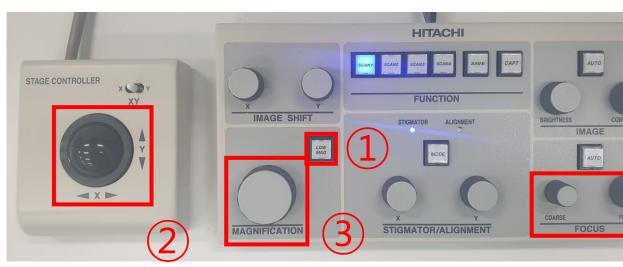
Focus





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	Z (mm) 8.0 Move IV [-5.0~30.9] EDX Z	
.0μm	(deg) ← 0.0 → 100	
		2,27 DM
		2:37 PM 1/28/2022

- 1. Press the [LOW MAG].
- 2. Move the stage to the location you want to observe.
- 3. Use the magnification knob to slowly raise the magnification to 5000 times and adjust the focus in between.
 - COARSE: fast adjustment
 - FINE: fine adjustment



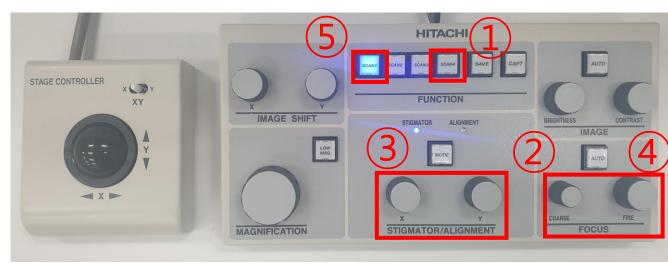


Astigmatism Aberration

Beassword lock 9 Undo SEM Home System Management	Normal O Details I Top panel I Bottom panel
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Image: Set in the set of	Optics Signal select Normal Dual select/mix Color mix SE +SE(L) (EF=0)
	AUTO AUTO
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	Specimen Size : 2 inches Set Height : Standard Set X/Y/R -25 (mm) -0.021 Image: Part of the standard -25 (mm) 0.072
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Rename	Priority • Z • Tilt Z-Focus Link Eucentric Tilt — Calib. $[1.5\sim30.0]$ (mm) • 8.0 Move • • • • • • • • • • • • • • • • • • •
	2:37 PM 1/28/2022

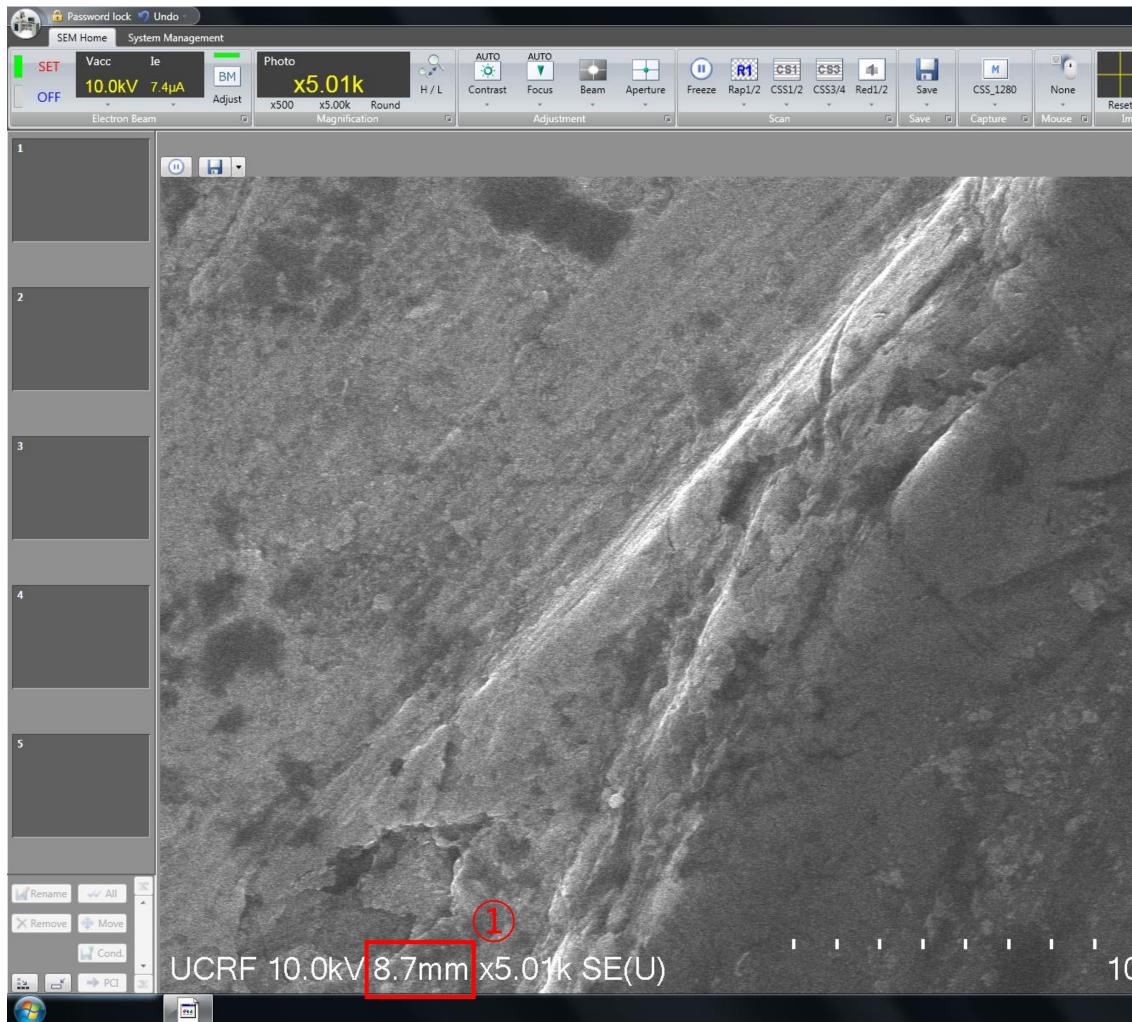


- 1. Press [SCAN 4].
- 2. Adjust the focus.
- 3. Adjust the Stigma X and Y knobs one by one.
- 4. Adjust the focus.
- 5. Press [SCAN 1].





Working distance





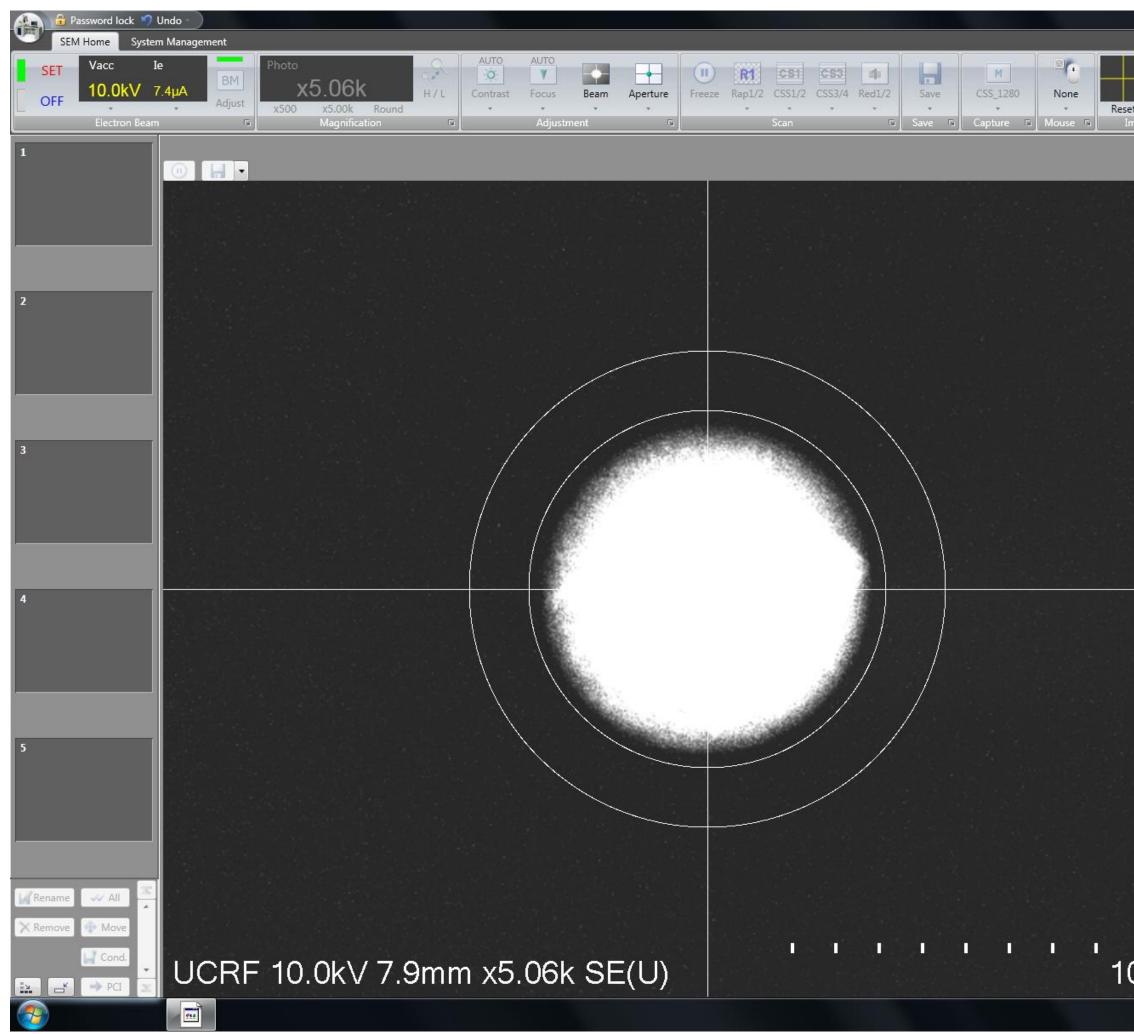
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	W.D. 8.7 • mm	
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	🗌 Cross marker 🥒 🔲	Center marker 🥖
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	(mm) 8.0 Move 1	
	[-5.0~30.9] EDX Z	
0.0µm		
Contractor of the State		
		2:37 PM

- 1. Check WD at the bottom of the screen.
- 2. Subtract the WD found in 8, and subtract that value from the [Z] value.
- 3. Enter the calculated value in [Z].
- 4. Click [Move].
- 5. Adjust the focus.





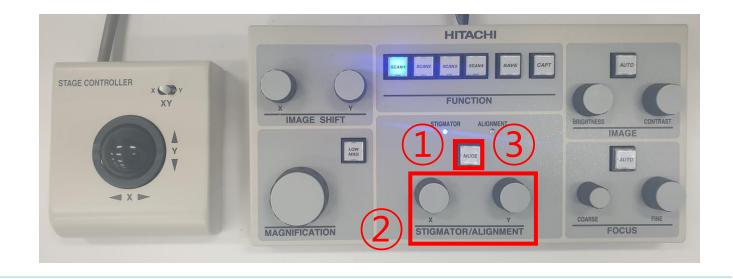
Beam Alignment





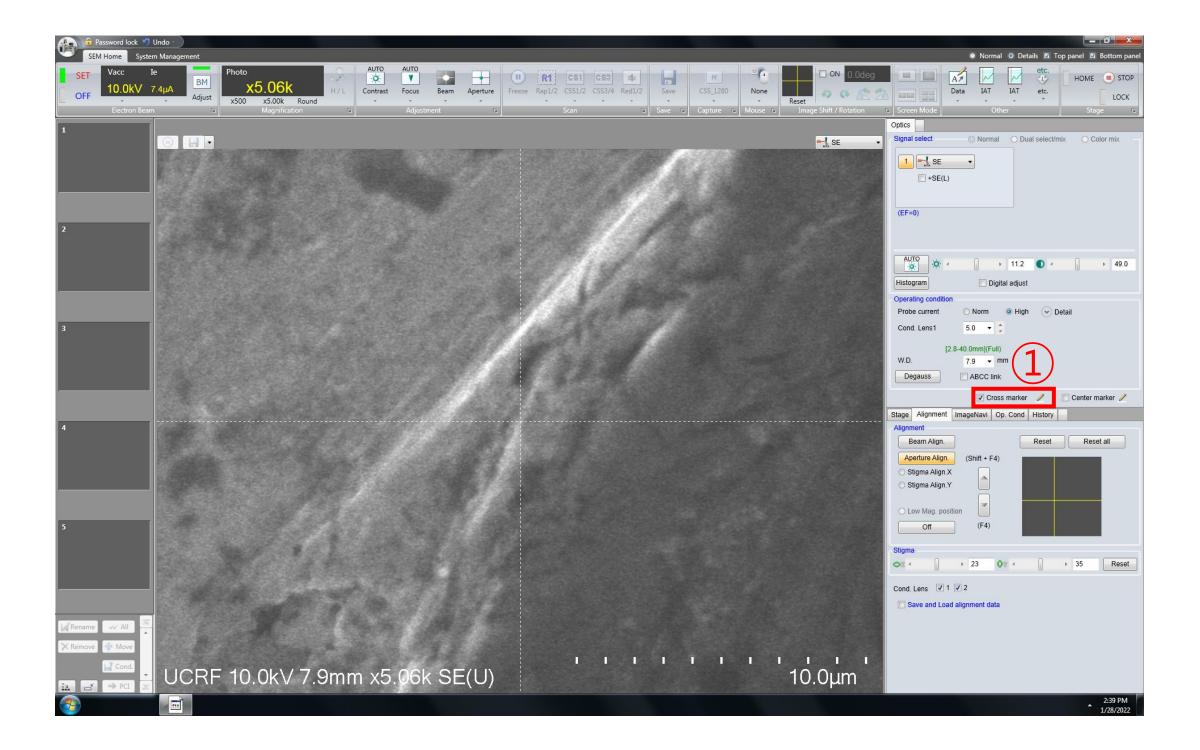
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ON 0.0deg	Data L	AT IAT etc.	HOME 🔳 STOP
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지 않는 것은 같은 것이다.			
그 영지 않았는 것			
D.0µm			
			2:38 PM
			1/28/2022

- 1. Press [MODE].
- 2. Adjust the Stigma X and Y knobs one by one to bring the beam to the center.
- 3. Press [MODE].



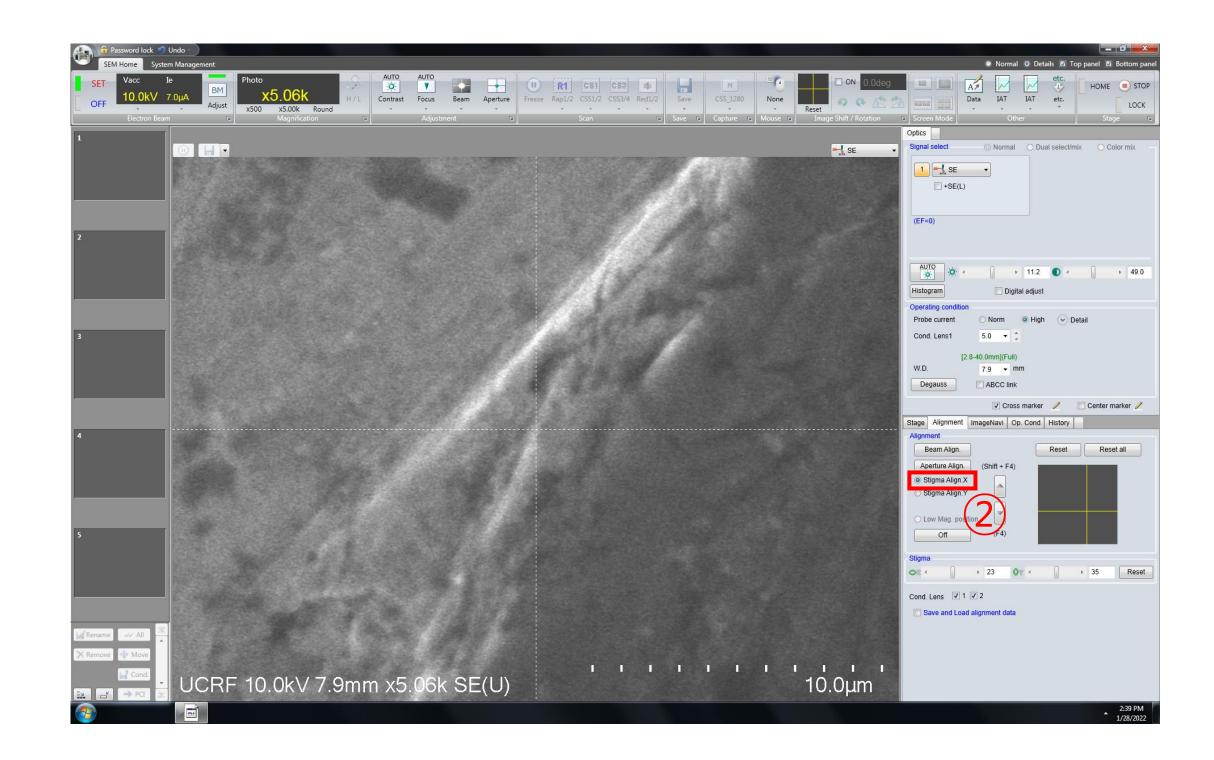


Beam Alignment



- 1. Check [Cross maker]. And adjust the stigma > place.(STIGMA X: \leftrightarrow , STIGMA Y: \ddagger)
- 2. Press [MODE]. And adjust the stigma X and Y place.(STIGMA X: $\checkmark \checkmark$, STIGMA Y: $\nearrow \checkmark$)

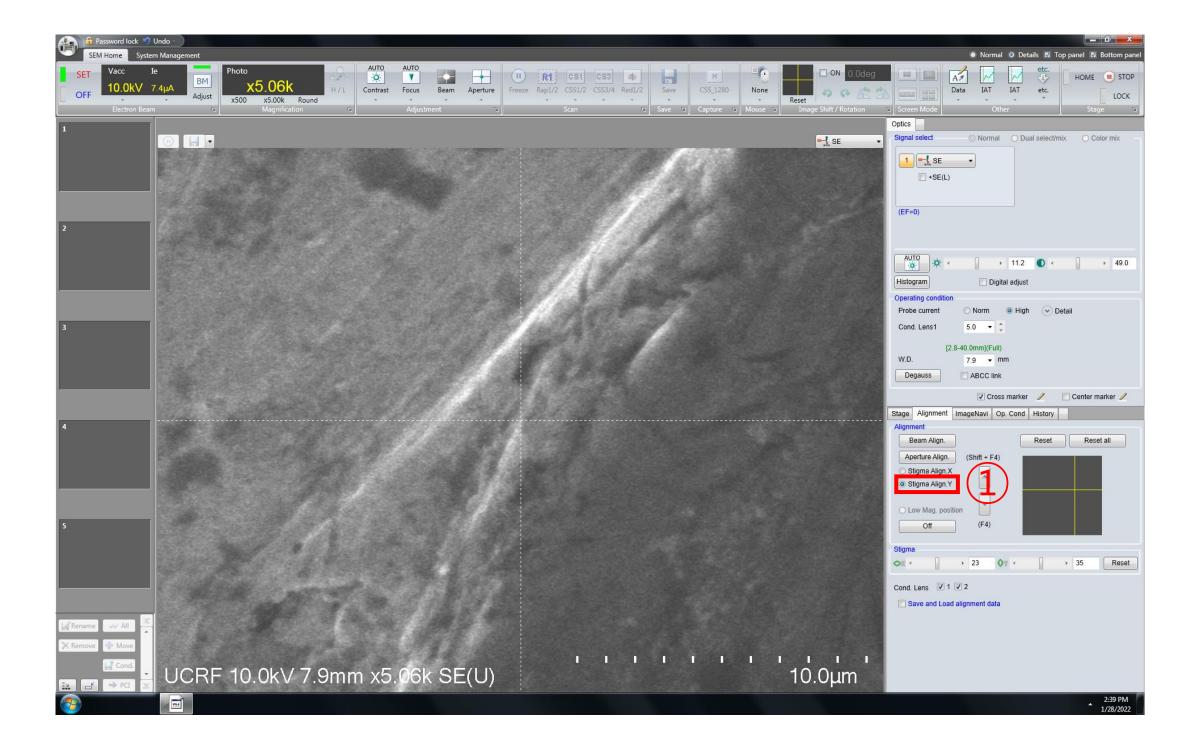
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1. Check [Cross maker]. And adjust the stigma X and Y knobs one by one so that the specimen moves in

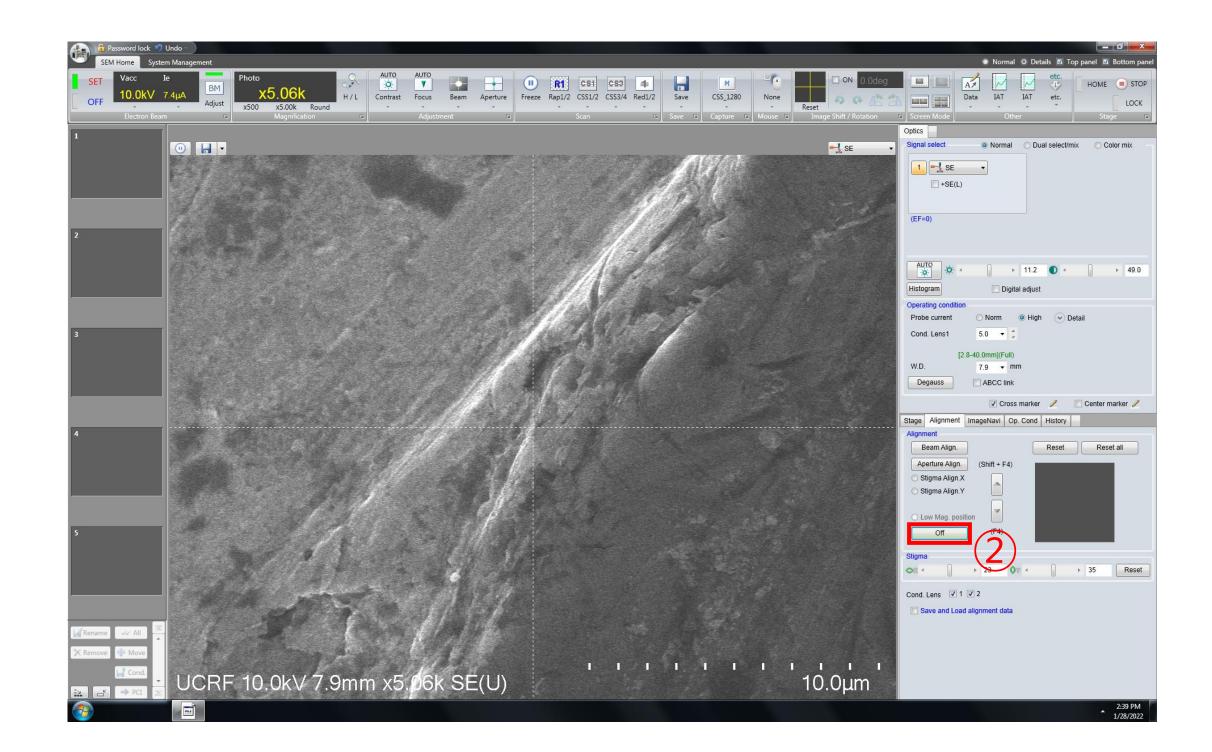
2. Press [MODE]. And adjust the stigma X and Y knobs one by one so that the specimen moves in

Beam Alignment



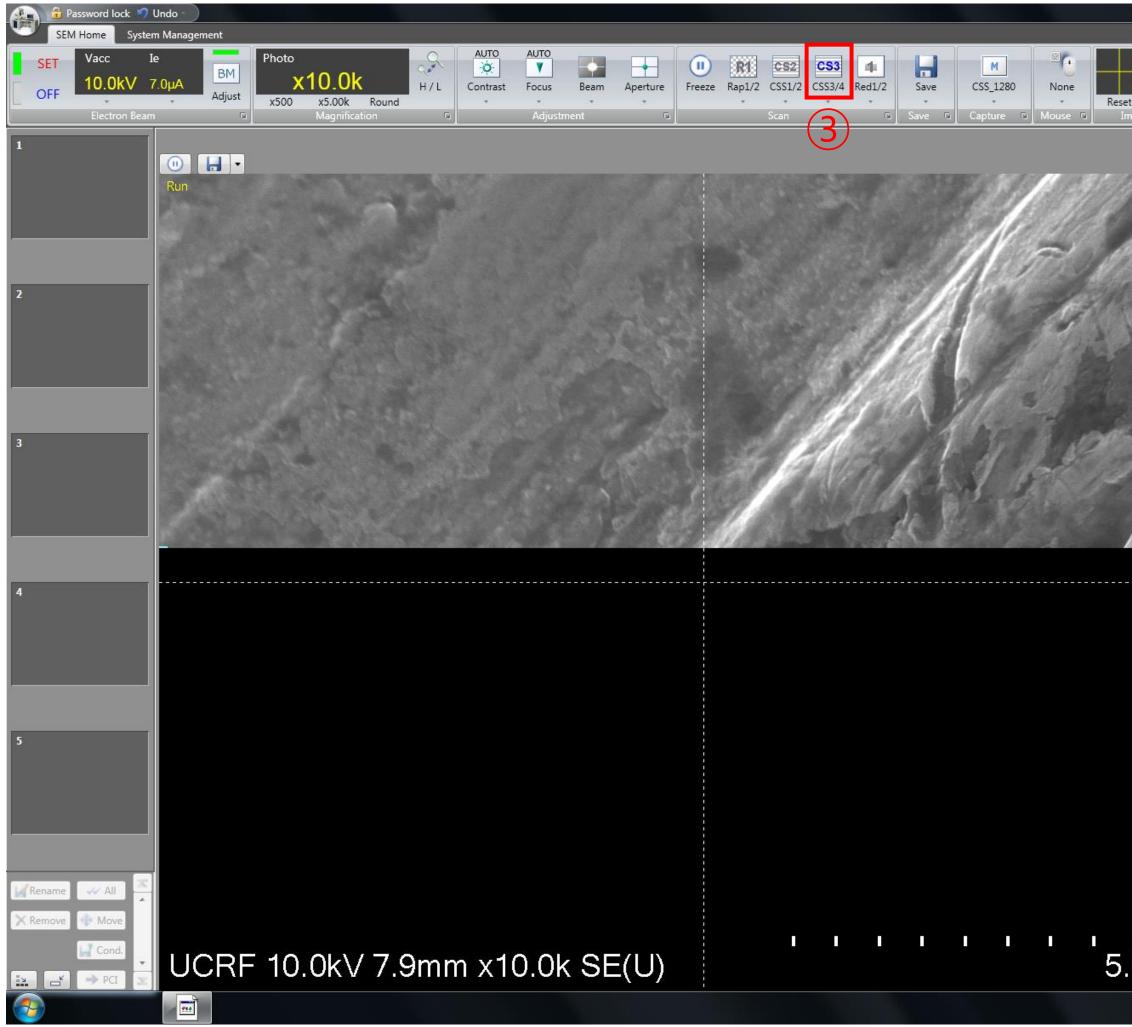
- 1. Press [MODE].
- 2. Adjust the stigma X and Y knobs one by one s STIGMA Y: $\nearrow \checkmark$)
- 3. Press [MODE].





2. Adjust the stigma X and Y knobs one by one so that the specimen moves in place.(STIGMA X: $\nabla \nabla$,

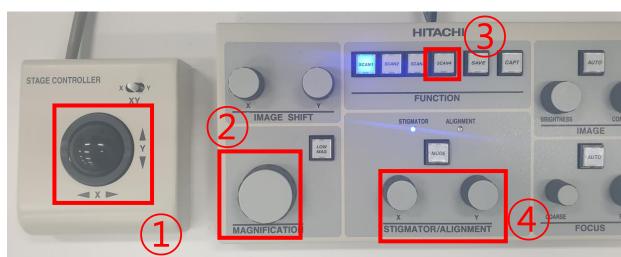
Saving the Image



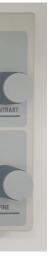


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	Save and Load alignment data
00µm	
	2:41 PM
	1/28/2022

- 1. Move to the location you want to observe.
- 2. Adjust the magnification slightly higher than the magnification you want to observe.
- 3. Click [SCAN 4].
- 4. Adjust the knobs [FOCUS]-[STIGMA X, Y]-[FOCUS].







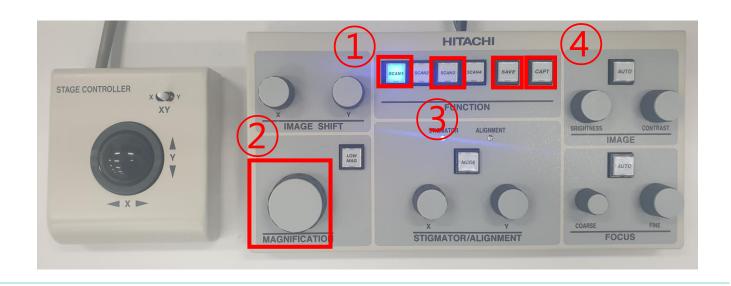
Saving the Image



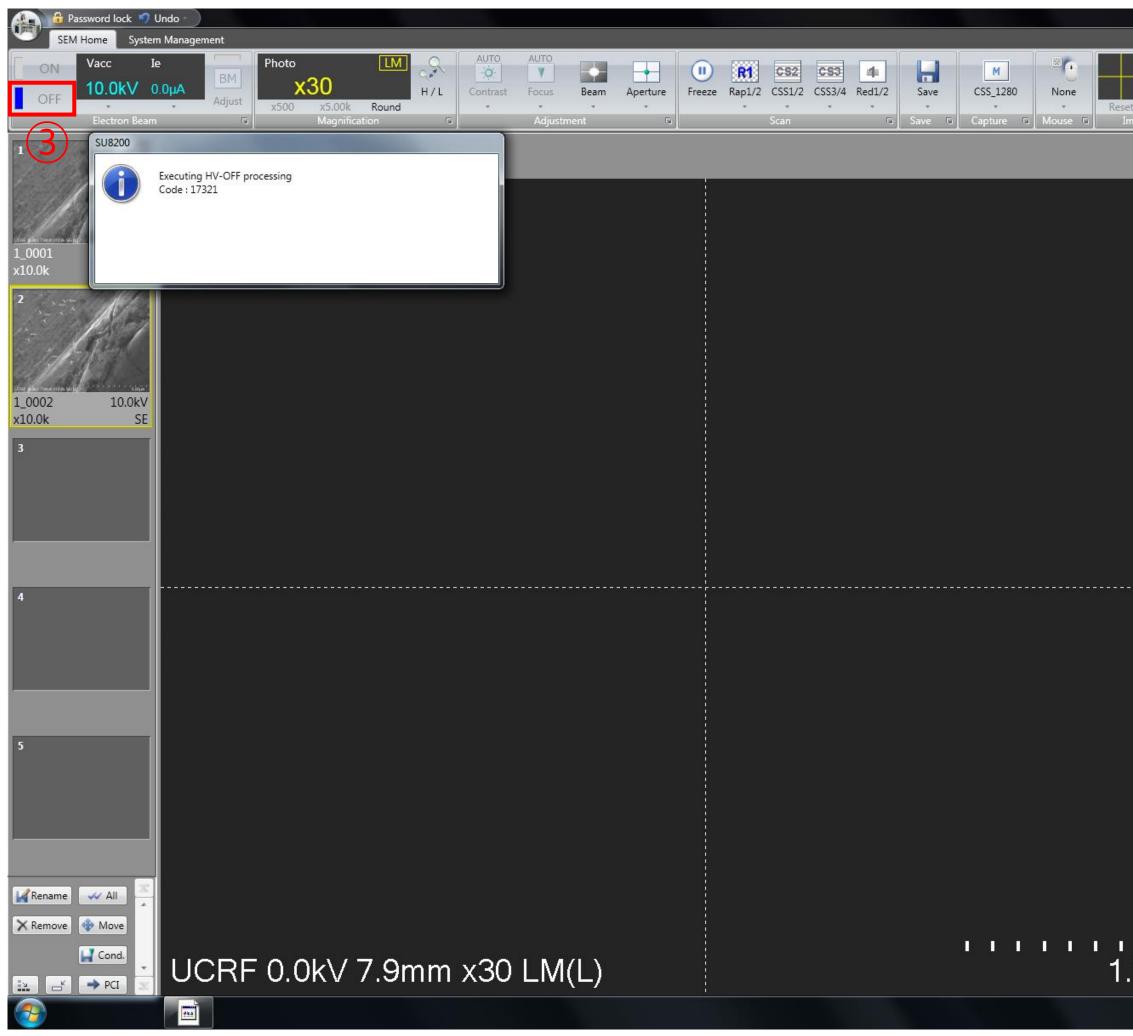


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00µm	
	2:41 PM 1/28/2022

- 1. Click [SCAN 1].
- 2. Adjust to the desired magnification.
- 3. Press [SCAN 3] -[SAVE] or [CAPT].
- 4. Press [SCAN 1].
- Repeat steps 1 in the previous slide to 5 in this slide.



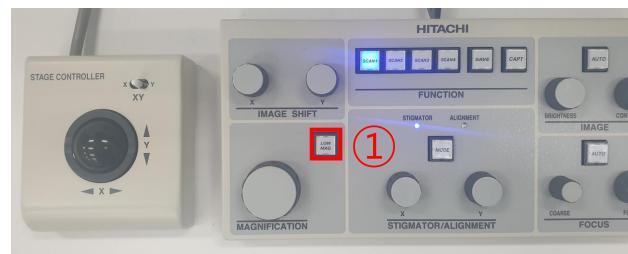






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	2:44 PM 1/28/2022	

- 1. Press [LOW MAG].
- 2. Click [HOME].
- Wait until the green light stops
 blinking.★
- 4. Click [OFF].★
- 5. Click [X] to close the program.
- 6. Click [OK].



FIRST IN

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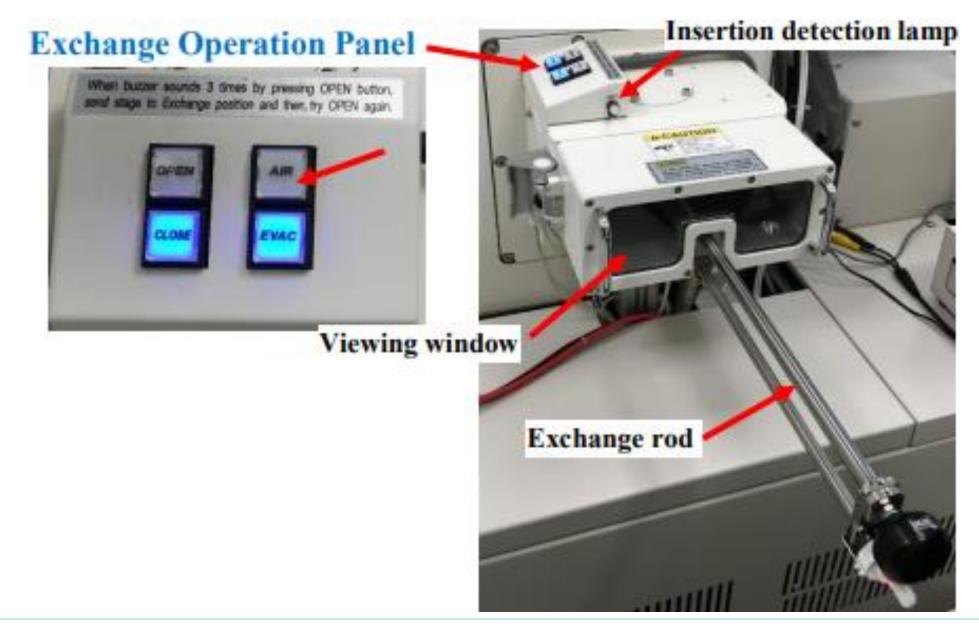


Retrieving the Specimen

- Press [OPEN], wait until the buzzer sounds. 1.
- Turn the exchange rod locking knob. 2.
- Push the rod into the chamber until the insertion 3. detection lamp.
- Turn the specimen holder lock/unlock knob to 4. LOCK position.
- Pull out the rod all. 5.
- Turn the exchange rod locking knob. 6.
- Press [CLOSE], wait until the buzzer sounds. 7.
- Press [AIR], wait until the buzzer sounds. 8.
- Open the exchange chamber door. 9.

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- 10. Turn the knob clockwise to release.
- 11. Remove the specimen stage from the exchange rod.
- 12. Close the exchange chamber door.
- 13. Press [EVAC], wait until the buzzer sounds.



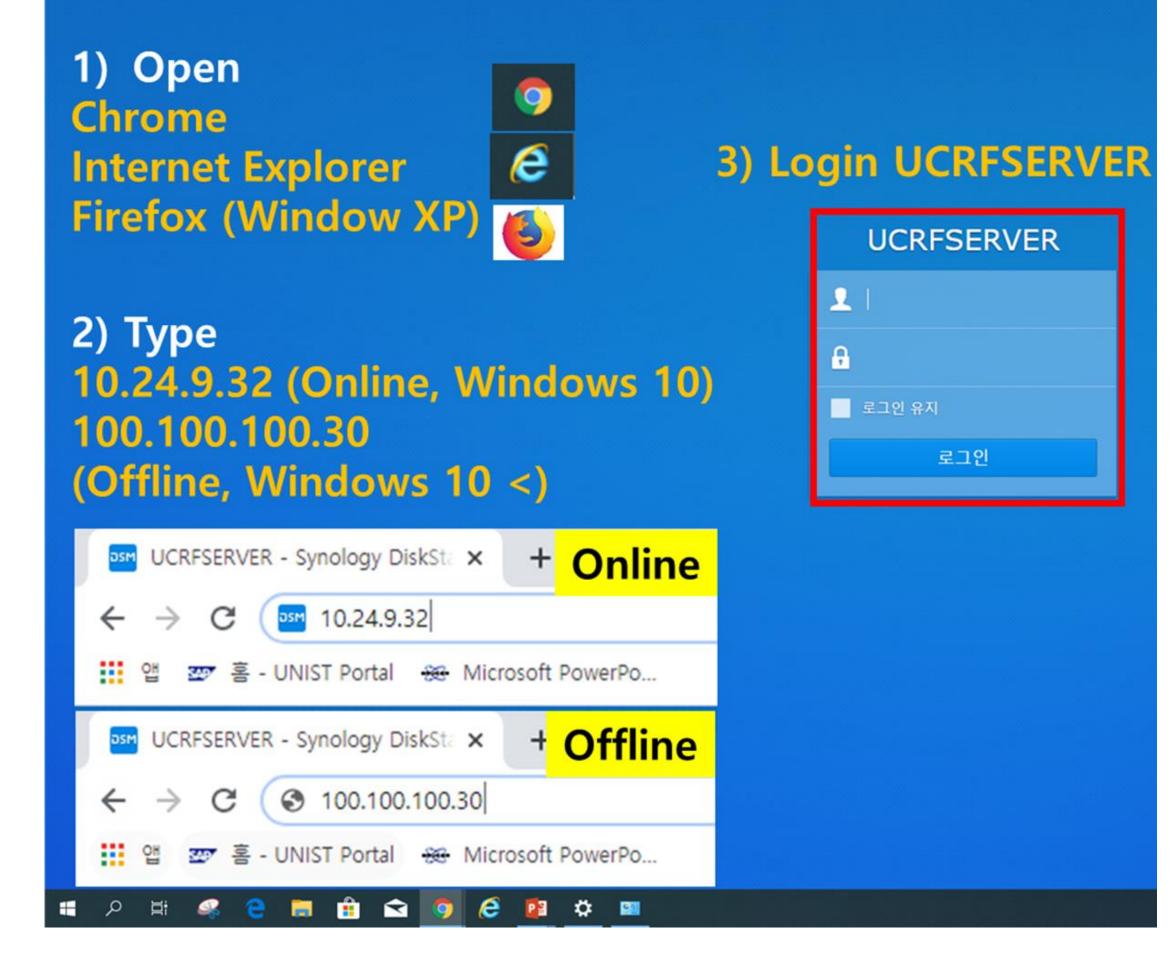


Transfer SEM data

UCRESERVER - Synology DiskSt: × +

주의 요함 | 10.24.9.32:5000

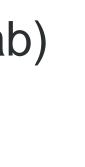
JNIST Portal 😣 Microsoft PowerPo.





1. Do not use USB when transferring SEM data.

- 2. Double-click the web browser.(Chrome, etc..)
- 3. Enter 100.100.100.30. in the address bar. (Enter 10.24.9.32 when downloading from Lab)
- 4. Enter your Lab ID and password.
- 5. Find your professor's folder and create your own folder.
- Drag the SEM data into your own folder. 6.
- 7. Close the window when the move is complete.
- UCRF server manager: Park Ji-hye(052-217-4035)









Checklist after Experiment

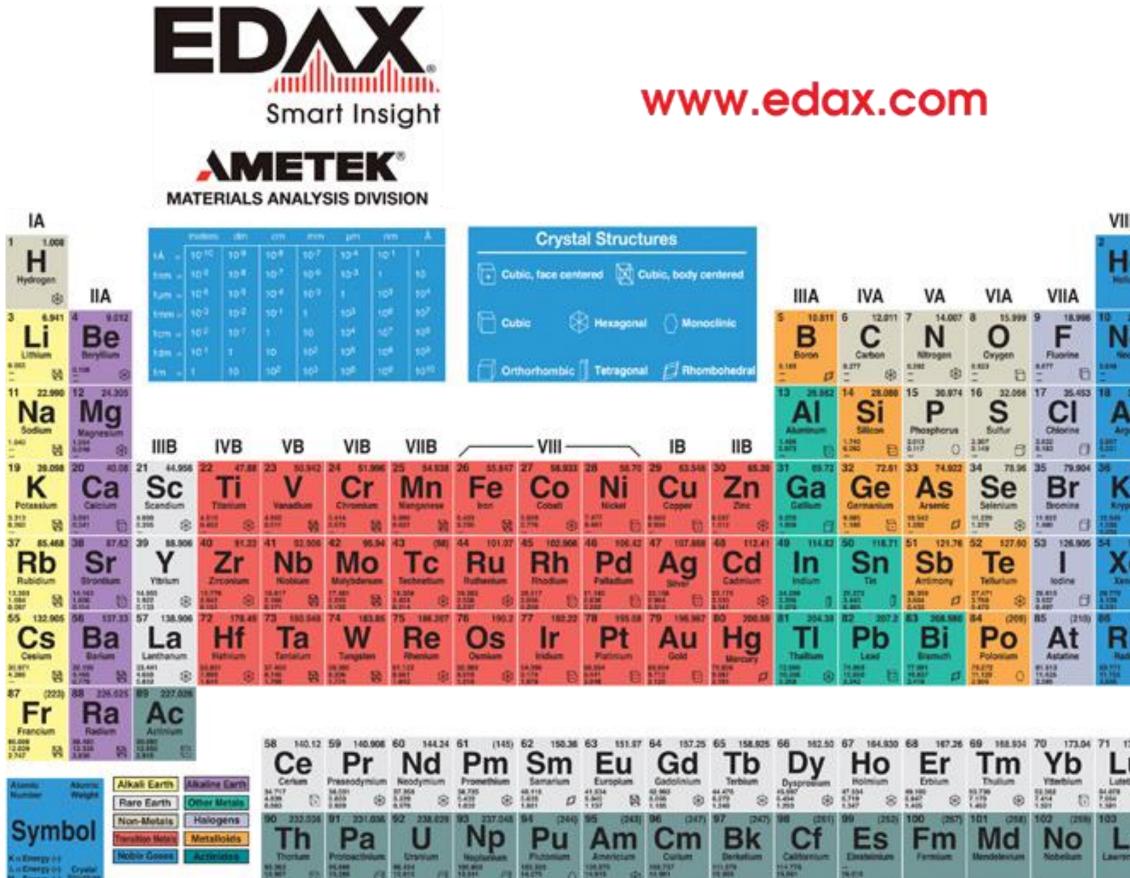
- Remove the sample from the stub. 1.
- Wipe the stub with ethanol. 2.
- 3. Put the specimen holder back in place. \star
- When using weekends or holidays, check the 4. [Daily checklist in lab] and sign the checker's signature.
- Enter the name of your advisor and submit it in the 5. original place with your signature or stamp. \bigstar



Daily checklist in lab.

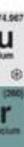
Lab title	Electron Microscopy Preparation	Bldg./NO.	102-B115	;	Date		
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	Laboratory c	verall cleanlines	s condition	۱.			
	Smoking or br	inging food into th	e lab.				
General Safety		status of experi safety signs, pe					
	Checking the	presence of a pre	-hazard risk	c analy	ysis rej	port.	
		ne power supp nd checking for				d electrical	
Electric	Using groun coating of ele	ided outlets, c ctric wiring, elec	hecking dar tric wiring a	mage arrang	on th gement.	ne insulating	
		ound conditions of the instrume		nting	exterr	nal or static	
	Non-load sta	tus around elec	tric panelbo	bards.			
	Fire extingu inspection st	isher sign, proj atus.	per fire ex	tingu	isher	and regular	
Fire	Emergency e passage.	xits, escape rou	tes, and ar	ny ob	stacle	blocking the	
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Chemical	Categorizing o in safety cabi	hemicals by desc nets.	ription and	storin	g chen	nical reagents	
Equipment check	SU8220 Cold I	FE-SEM user∹ Che	ck the press	aure o	f nitrog	en gas	
C~~	nfirm	Inspector	Signature				(sign)
CO		Lab Director	Signature				(sign)

Energy Dispersive X-ray Spectroscopy









- Click the [Electron Beam] 1.
- Select the acceleration voltage in [Vacc.]. \star 2.
 - (1.5 times kV of the x-ray value of the element)

to be observed or unknown specimens 20 kV)

- Select beam current (15~25) in [Set le to] 3.
- Click [Close] 4.
- Select [High] in [Probe Current]. 5.
- 6. Adjust [WD] to 10.
- Move to the position of the specimen to be 7. measured and adjust the magnification.



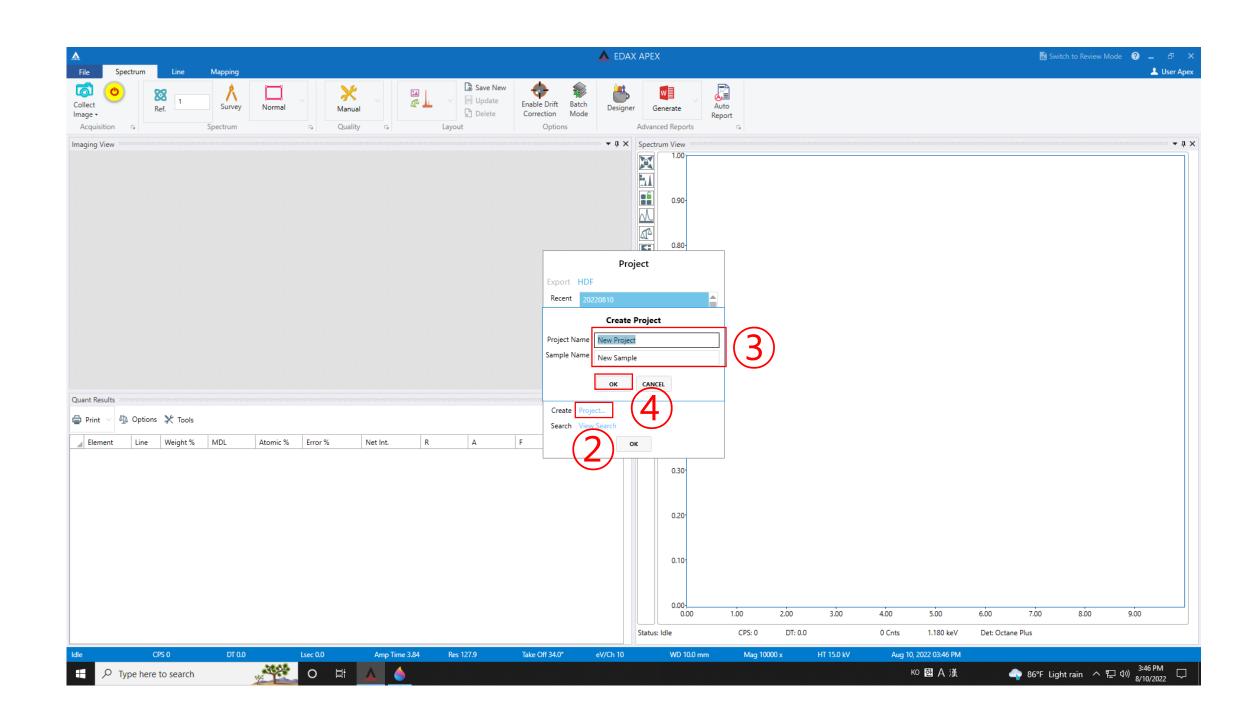


Energy Dispersive X-ray Spectroscopy

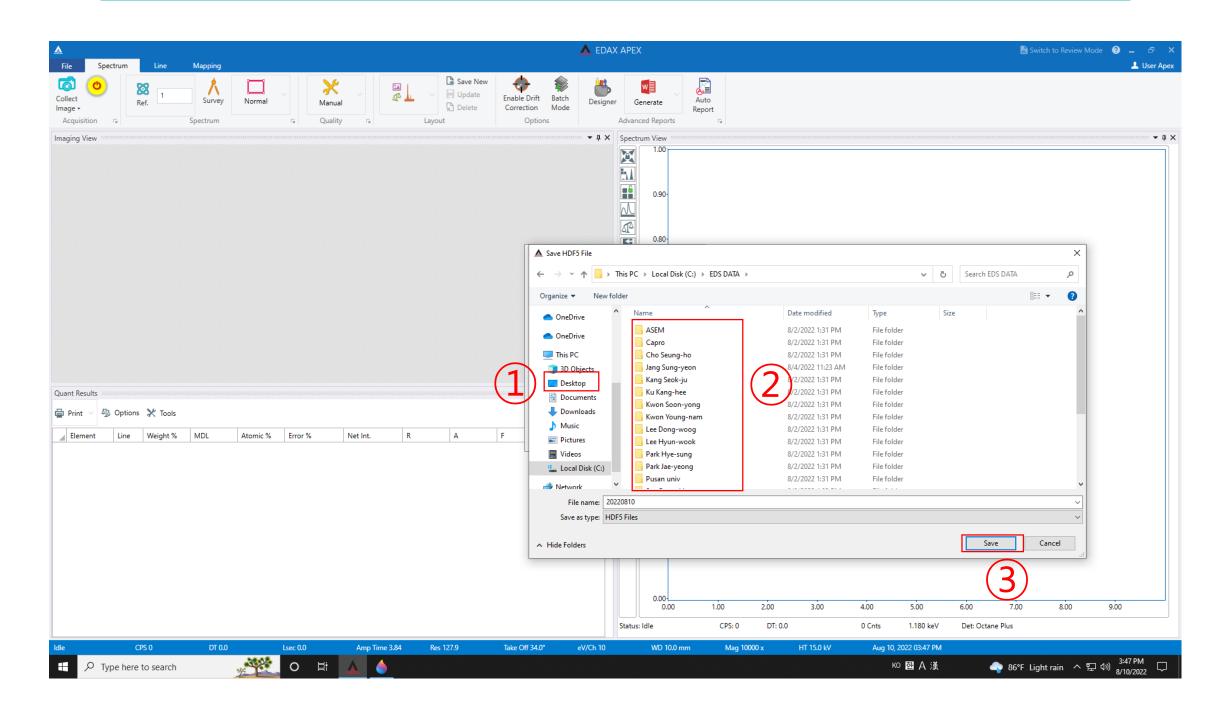


- 1. Click [APEX]
- 2. Click [Create Project...]
- 3. Enter [Project Name] and [Sample Name]
- 4. Click [OK]



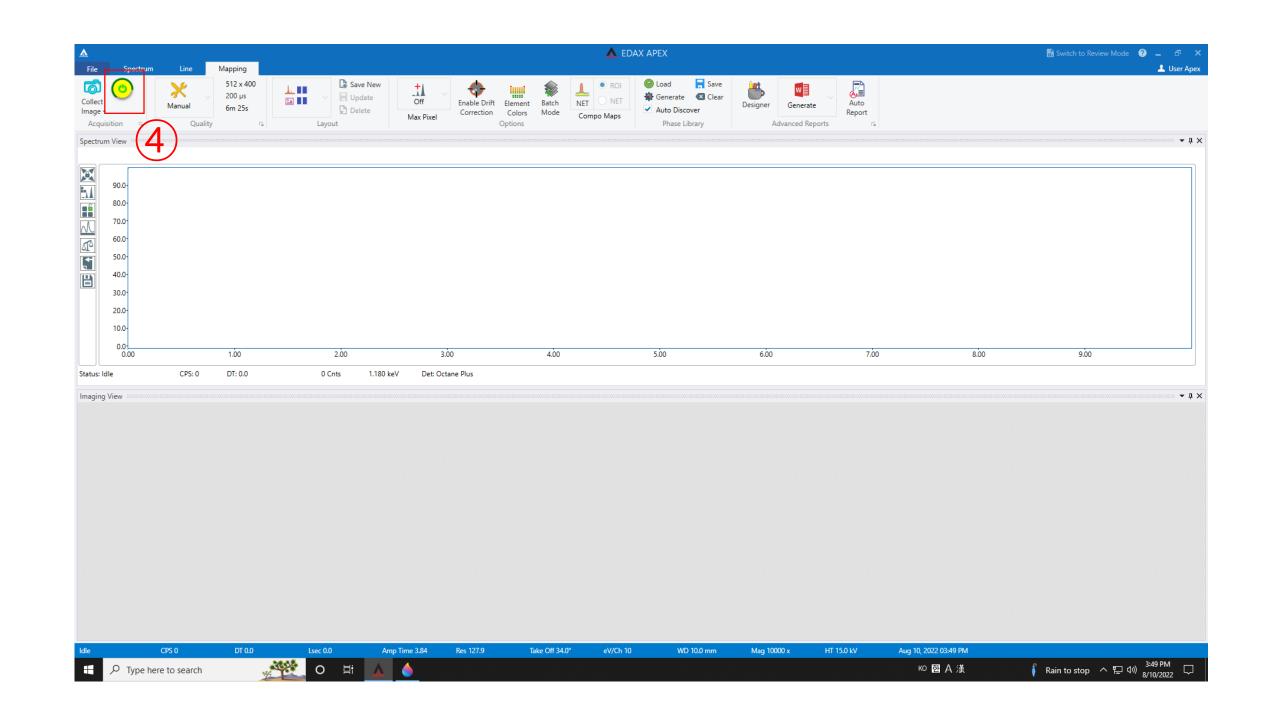


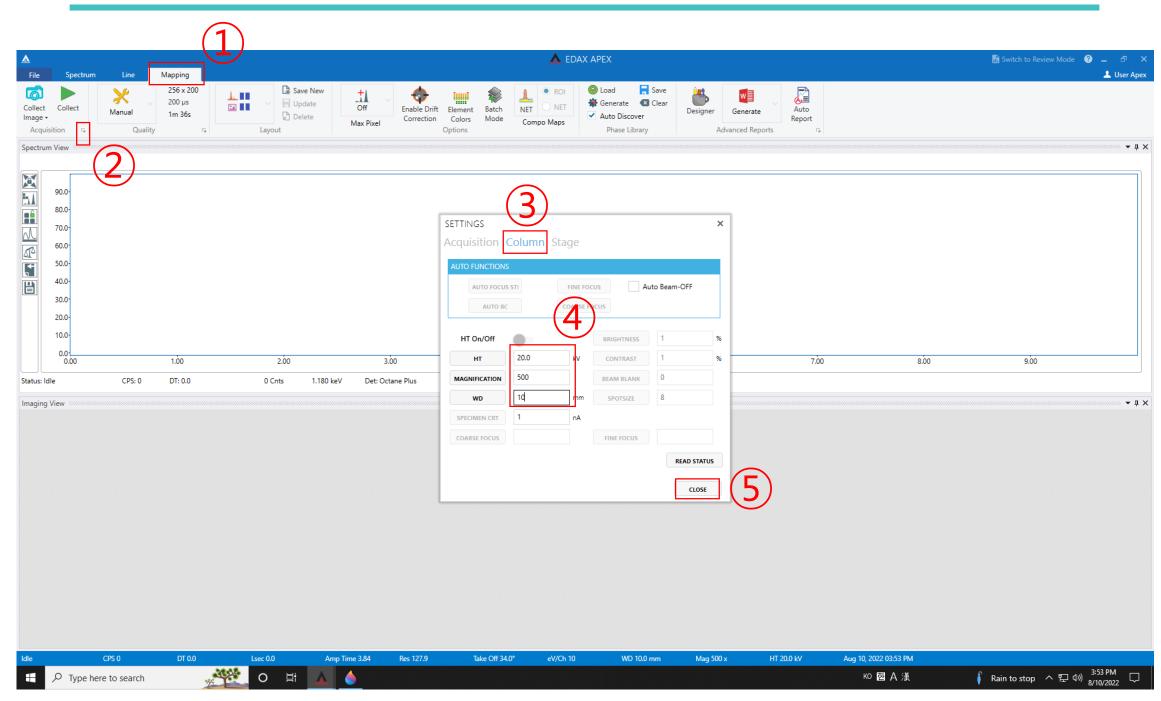
Energy Dispersive X-ray Spectroscopy



- 1. Click [Desktop] and click [EDS DATA]
- 2. Create a folder for each professor's lab, and create your own folder.
- 3. Click [Save]
- 4. Click [Detector]





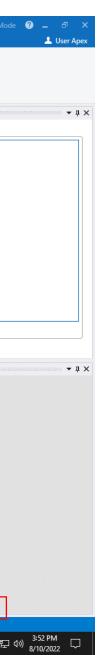


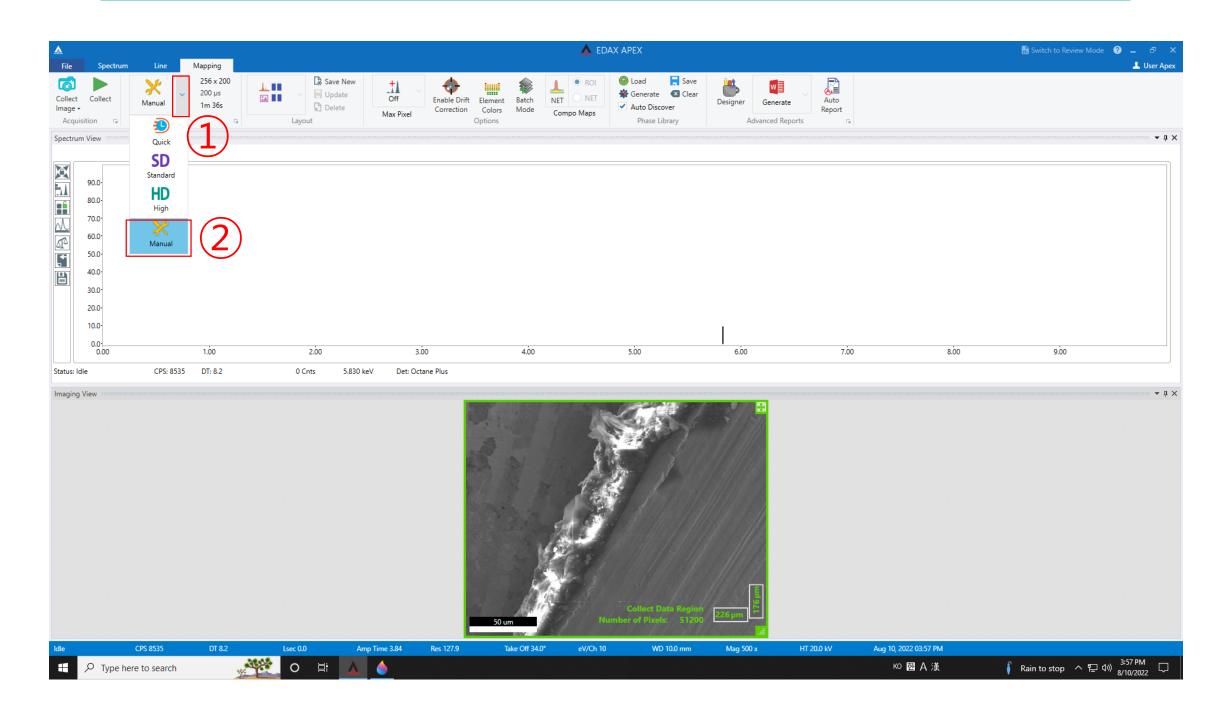
- 1. Click [Mapping] and click the arrow next to [Acquisition], click [Column]
- 2. Enter [HT] and [MAGNIFICATION], [WD]=10, click [CLOSE]
- 3. Click [Collect Image]
- 4. Click [Camera]



Image: Spectrum Gree Spectrum Gree Collect Manual 100 Collect Manual Gree 100 1024 x800 102 4 x800 103 4 x800 104 1 12 1 x800 105 1 12 1 x 80 105 1 12 1 12 1 x 80 105 1 12 1 12 1 12 1 12 1 12 1 12 1 12 1
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Dwell (µs) 30.1 ≈ 0 min 7 sec - + + Collect Image Delay (ms) 500 - Mag Reference Vidth (mm) Height (mm) 88.0
Width (mm) 113.0 Height (mm) 88.0
Tilt Correction

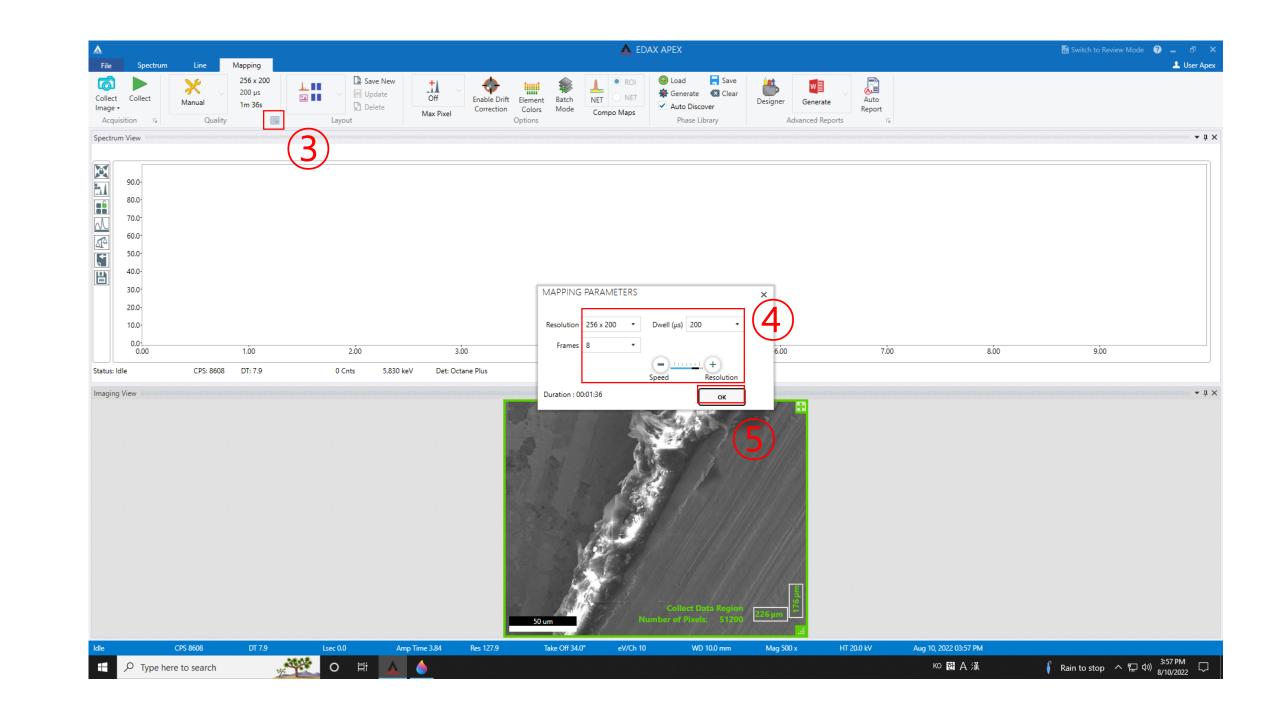
quisition], click [Column] click [CLOSE]

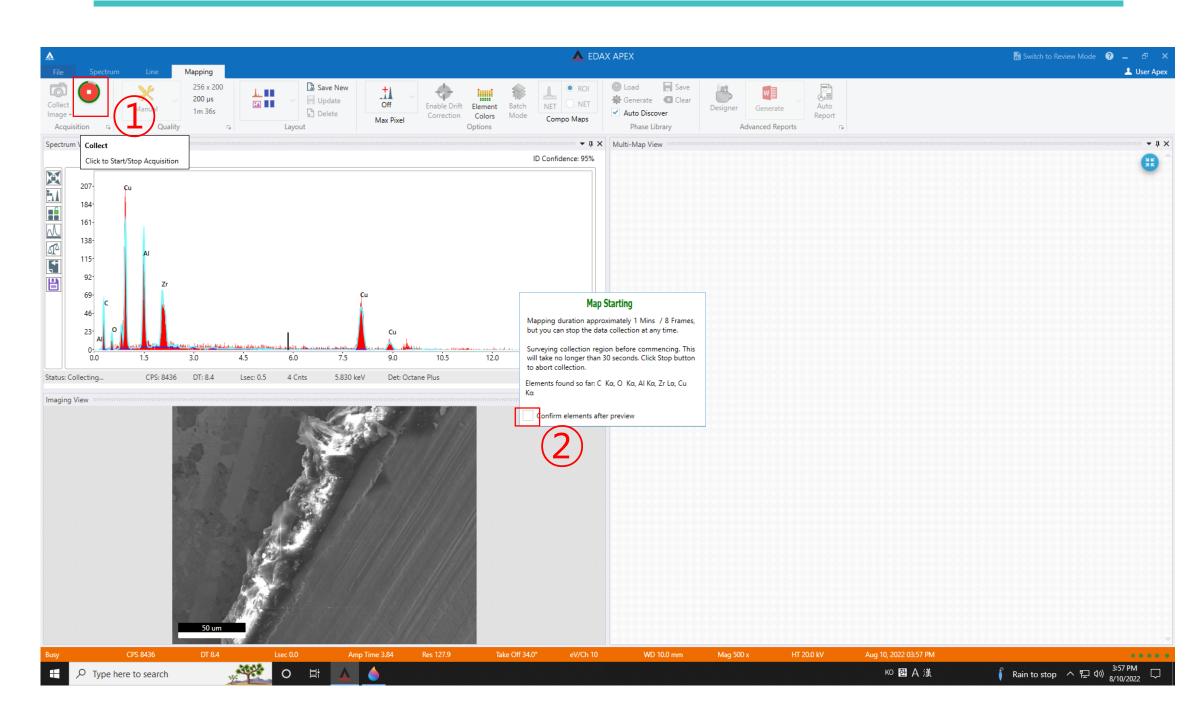




- 1. Click the arrow next to [Manual] and Click [Manual]
- 2. Click the arrow next to [Quality]
- 3. Adjust [Resolution] and [Dwell], Frames appropriately
- 3. Click [OK]

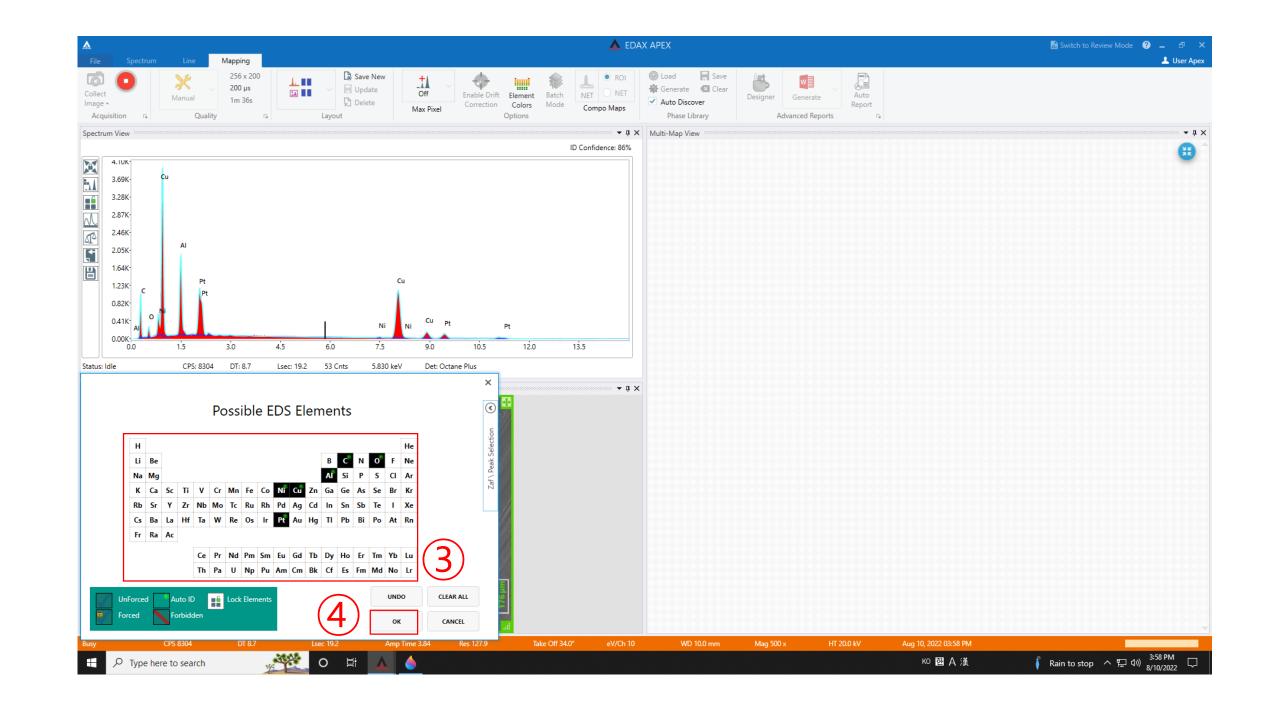


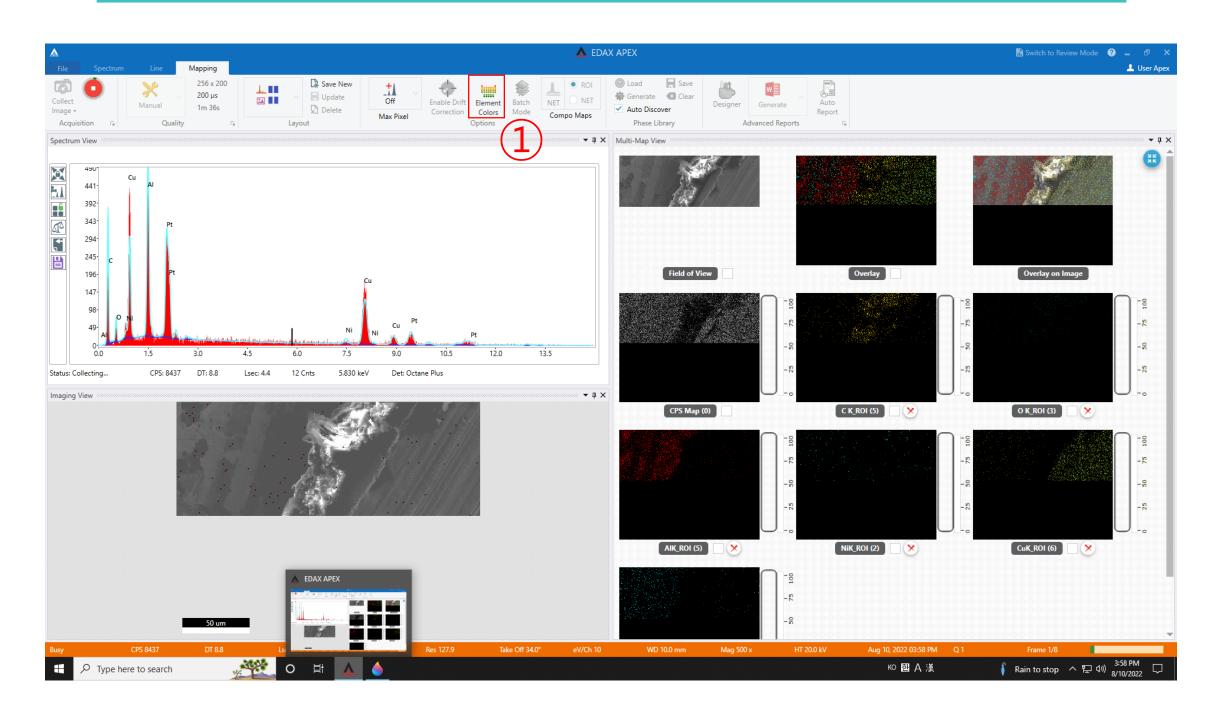




- 1. Click [Collect]
- 2. Check [Confirm elements after preview]
- Just click on the element of interest to make it black and click [OK] 3.
- 4. Click [OK]

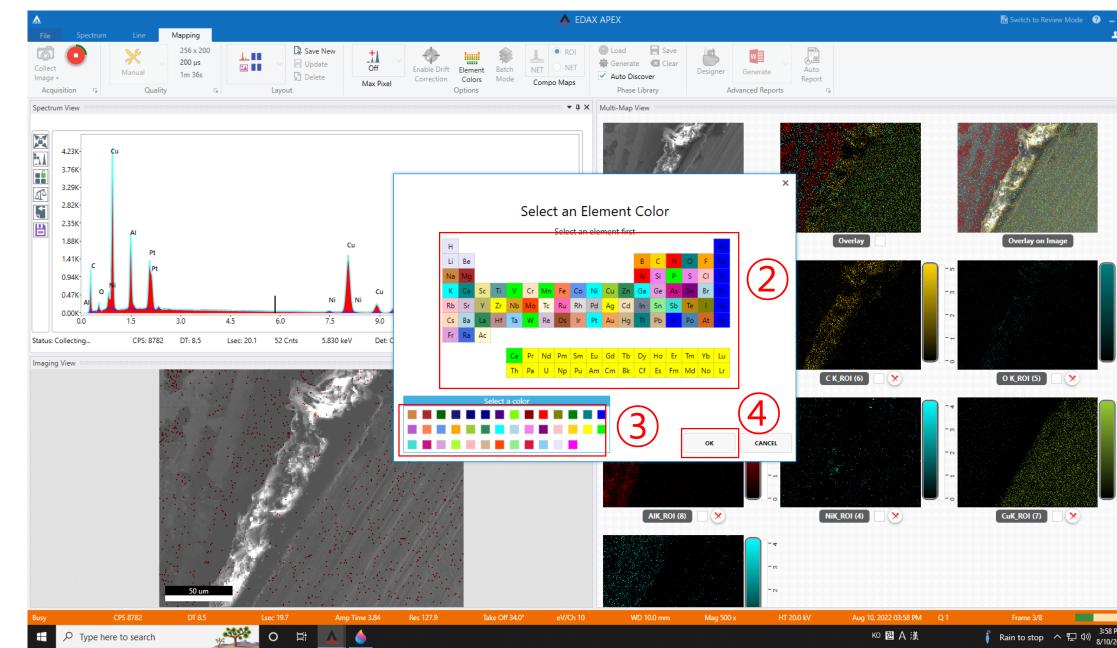




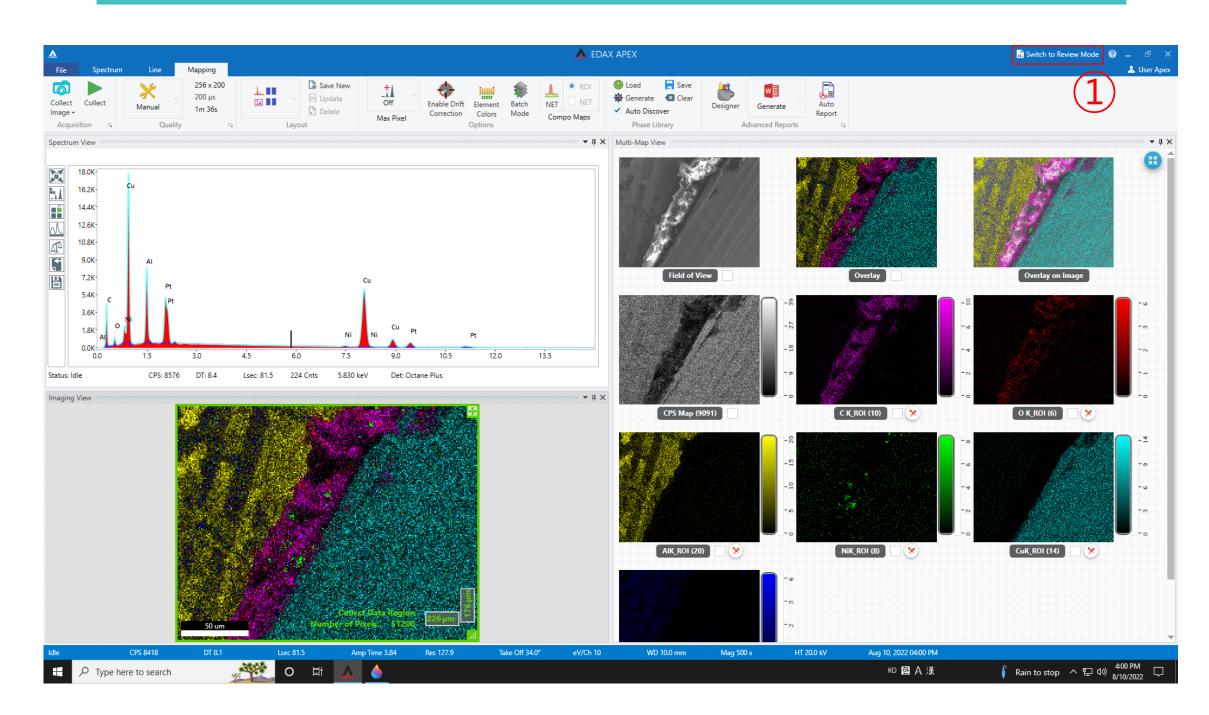


- 1. Click [Element colors] to change the color of an element
- Select the element you want to change 2.
- 3. Choose the color you want to change
- 4. Click [OK]



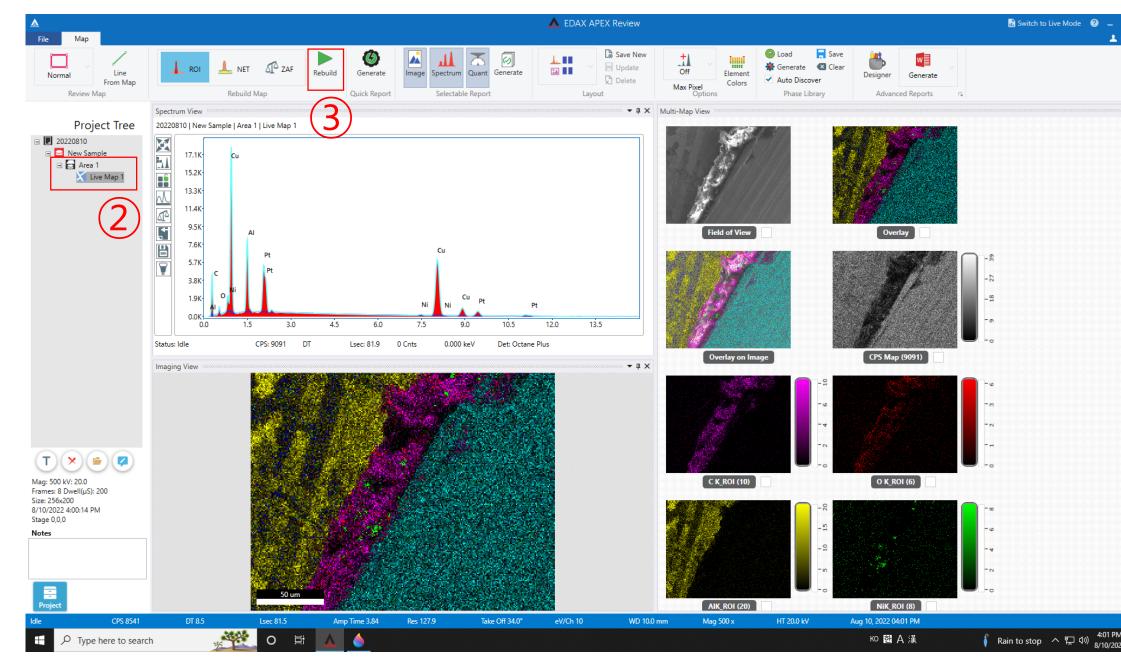




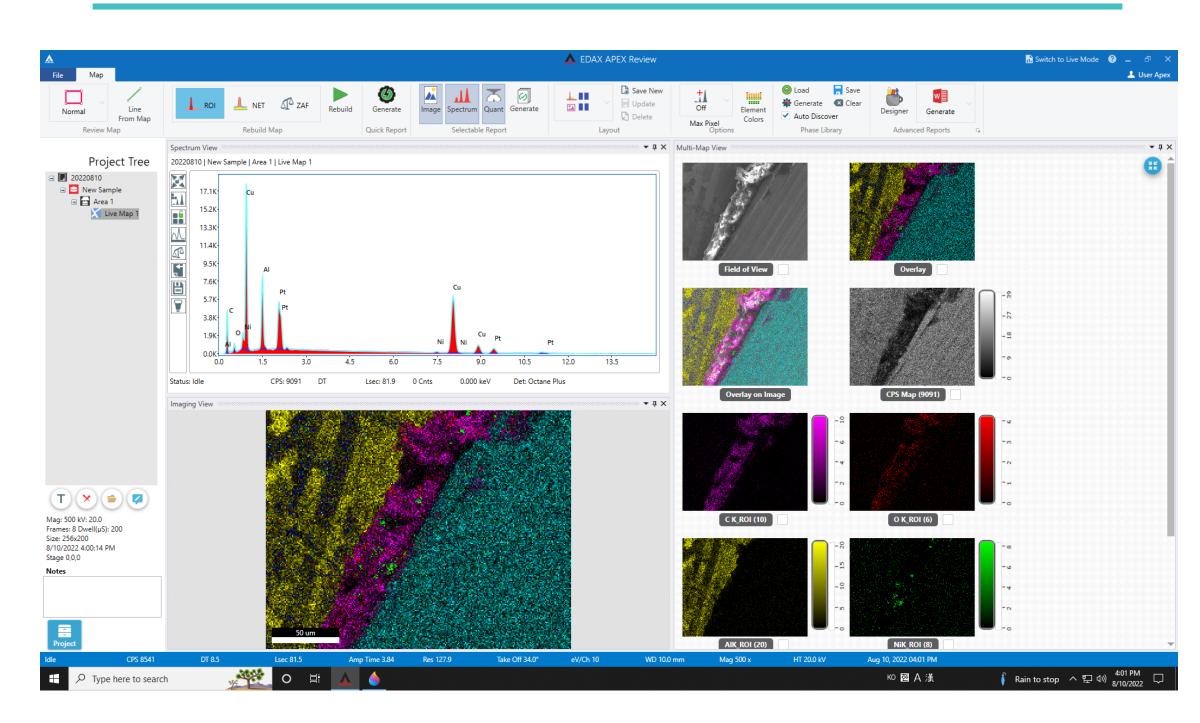


- 1. Click [Switch to Review Mode]
- 2. Double click on data in Project Tree
- 3. If you want to change the mapping element, click [Rebuild]

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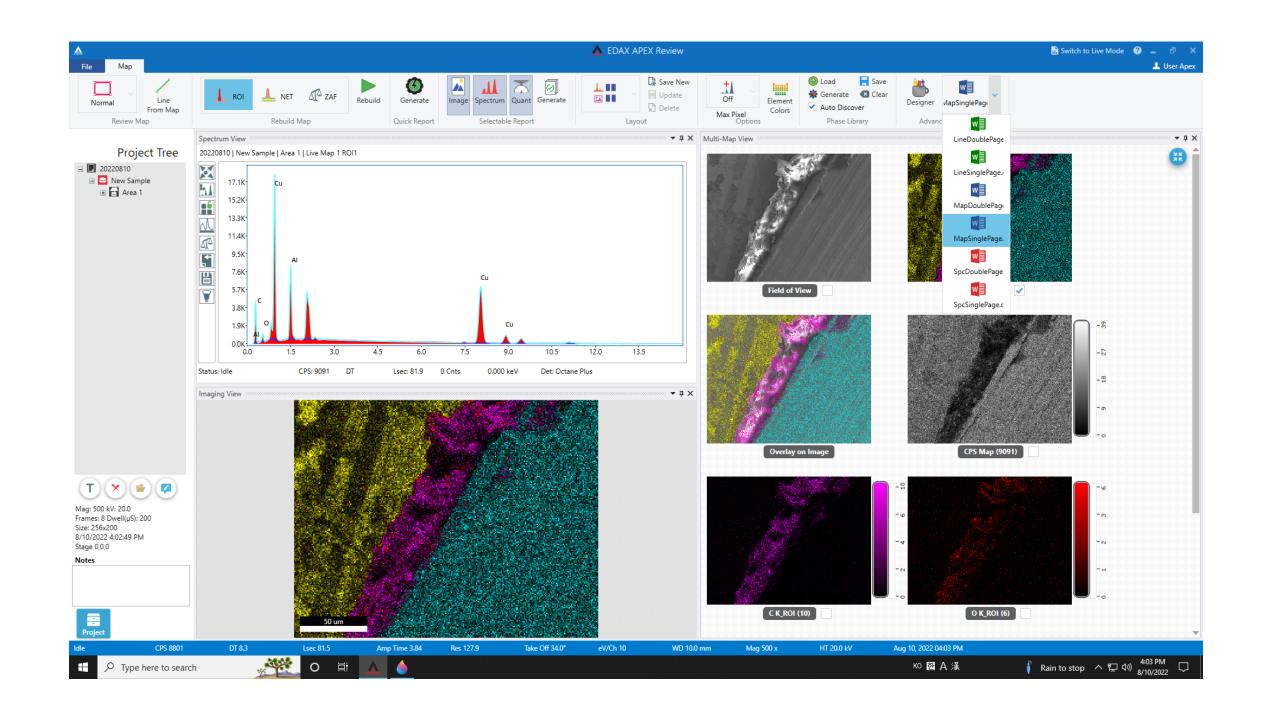


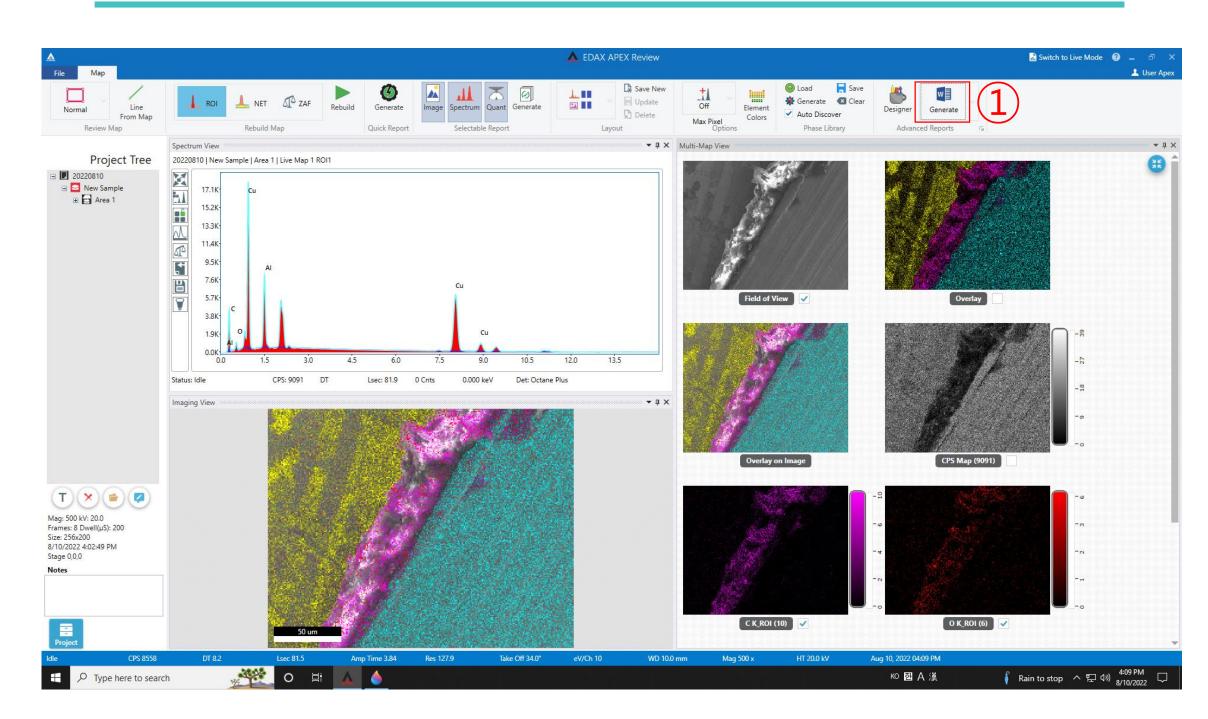




- 1. Select the element you want and make it black
- 2. Click [OK]
- 3. Wait for the conversion to complete
- 4. Choose the template you want

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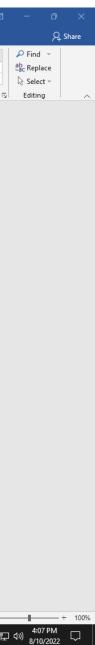




- 1. Click [Generate]
- 2. Create a folder for each professor's lab, and create your own folder.
- 3. Click [Save]

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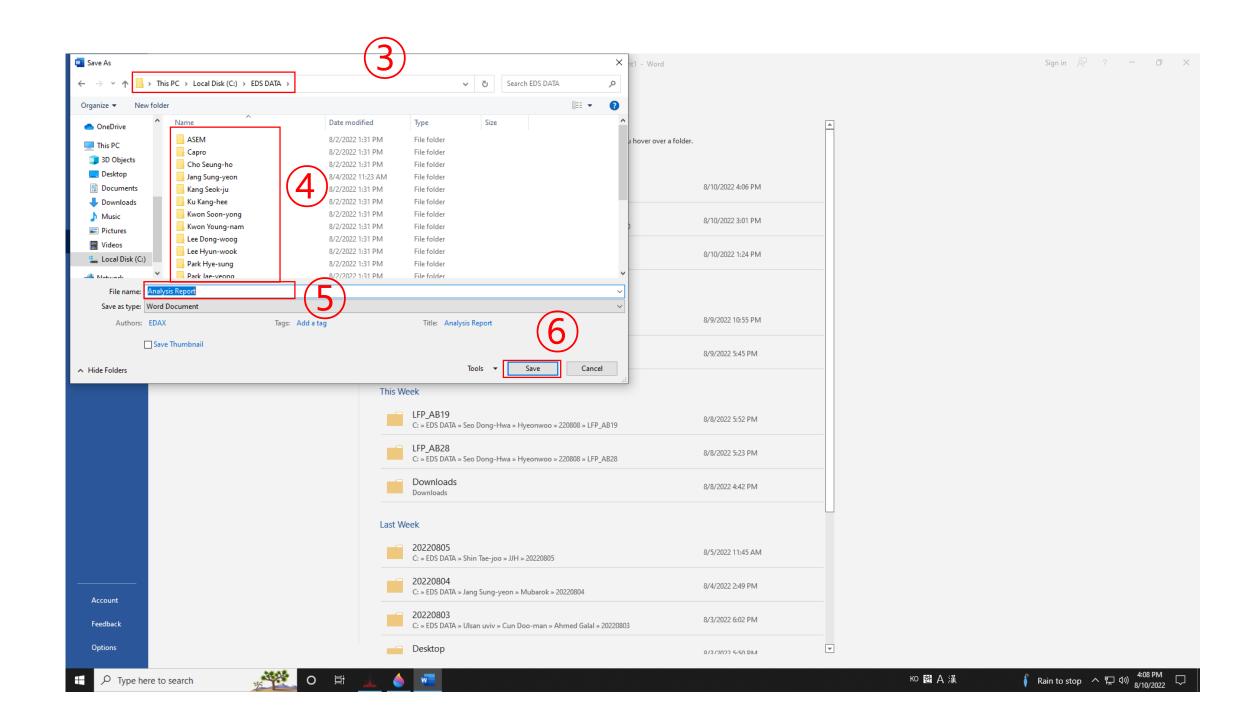
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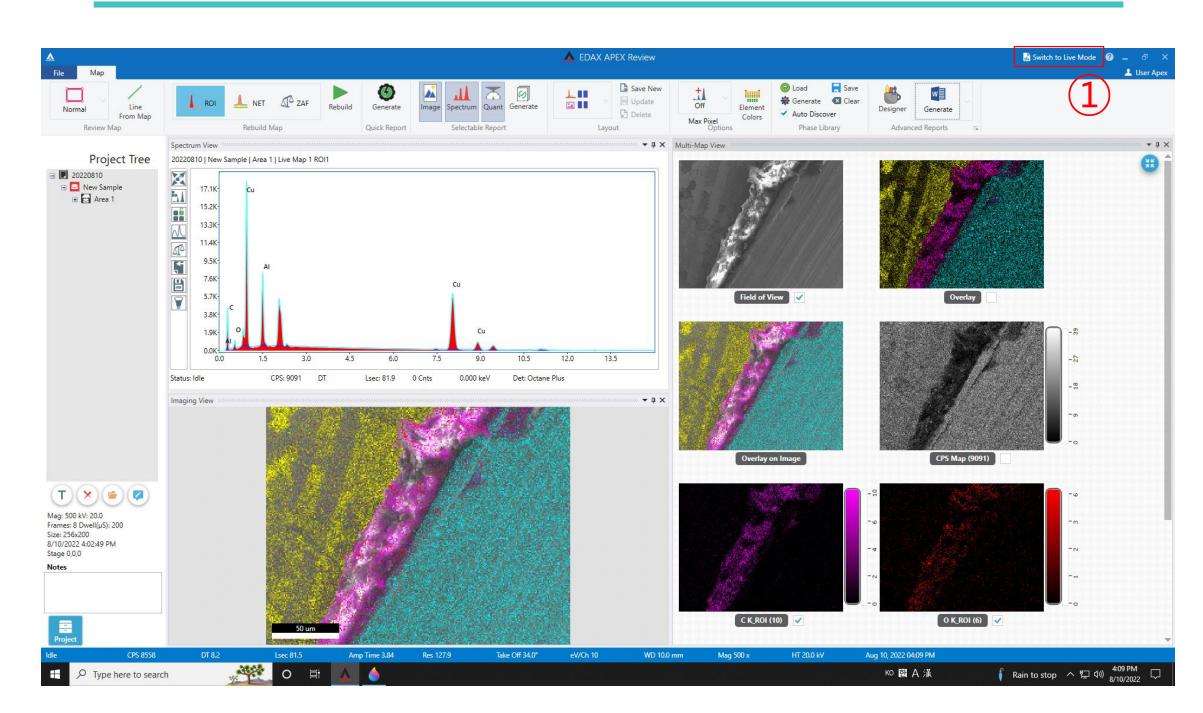


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- 1. Click [This PC]
- 2. Find the folder you created at startup
- 3. Enter the file name
- 4. Click [Save]

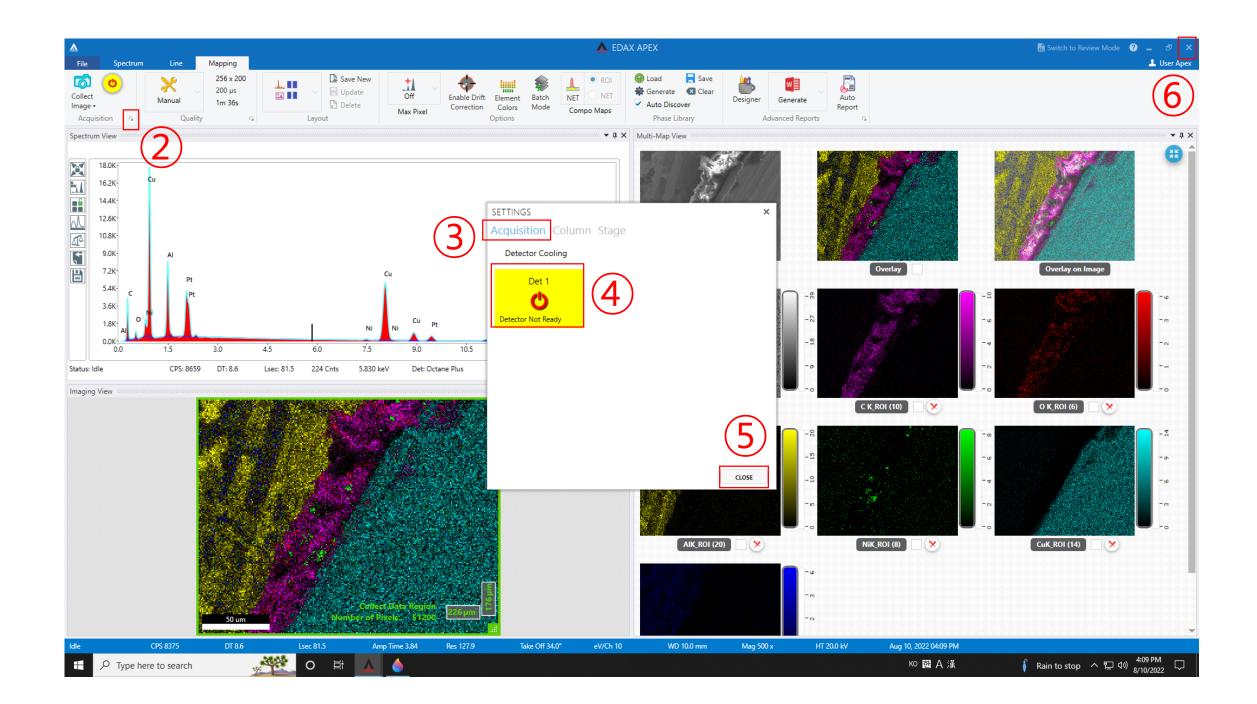






- 1. Click [Switch to Live Mode]
- 2. Click the arrow next to [Acquisition]
- 3. Click [Acquisition] and click [detector] ★
- 4. Click [CLOSE] and click [X]

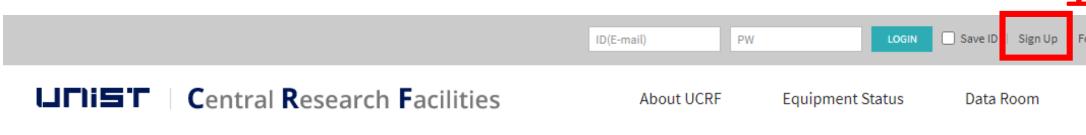
UNIST



Request for Self-user

Create Account

www.ucrf.unist.ac.kr



- 1. Click [Sign up]
- 2. Click [UNIST Member]
- 3. Input [Portal ID/PW] \rightarrow Click [Confirm] Please check your information
- 4. Input professor name in [Principal Investigation] \rightarrow Click [Professor search] \rightarrow Click professor name
- 5. Click [Create Account]

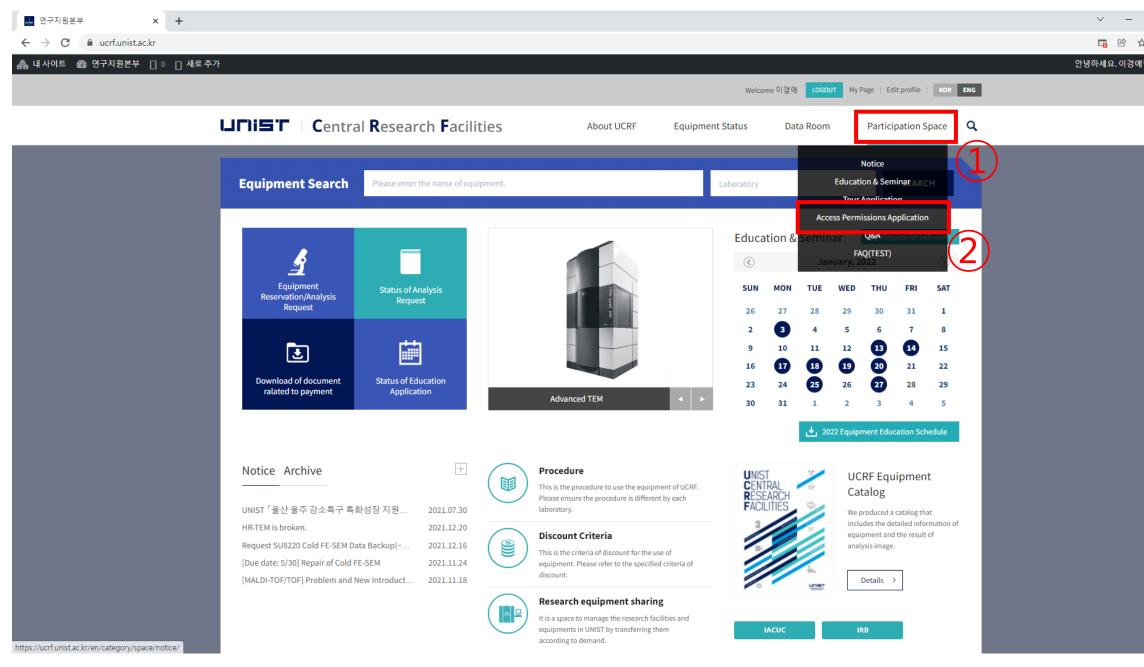




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Student ID No. / Professor ID No. / Staff ID No.		20*39		
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Principal Investigator	김	교수	Professor Search	
	Select		¢	

Access Permissions Application

www.ucrf.unist.ac.kr



- Click [Participation Space]
- Click [Access permissions Application] 2.
- Fill out the UCRF(UMCL) Access Application form 3.
- Click [Apply] 4.



LIFIISF Central Rese	earch F acilities	About UC	CRF Equipment Status Data Room	Participation Space
Participation Space	Access Permi	issions Applic	ation	on Space > Access Permissions Application
UNIST Central Research Facilites	UCRF(UMCL)	Access Applica	ation	~
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Education & Seminar V	Date for entrance			
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FAQ(TEST)	_	(Staff ID No.)		
		Office	Select 🔶 -	
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	Equipment for use			
	Reason of			

- When reissuing the ID card, you must apply for access again on UCRF website.
- Access Authorization Officer: Kang Yeong-bi(052-217-4168)



Request for Self-user

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Request for Self-user		Equipment	Status	Application date	Result of analysis	Print	Cancel
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Status of education application		Electron Microsco	ру	× (4)			
Status of tour application		SU7000 FE-SEM		(5)			
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Status of penalty							
ර Favorites							



After pass the test,

1. Login UCRF website

www.ucrf.unist.ac.kr

- 2. Click [My Page]
- 3. Click [Request for Self-user].
- 4. Select [Materials Characterization Lab]
- 5. Select [Electron Microscopy]
- 6. Select [SU8220 Cold FE-SEM]
- 7. Click [Apply]

]

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Reservation

portal.unist.ac.kr – Research Equipment – Equipment reservation/input result

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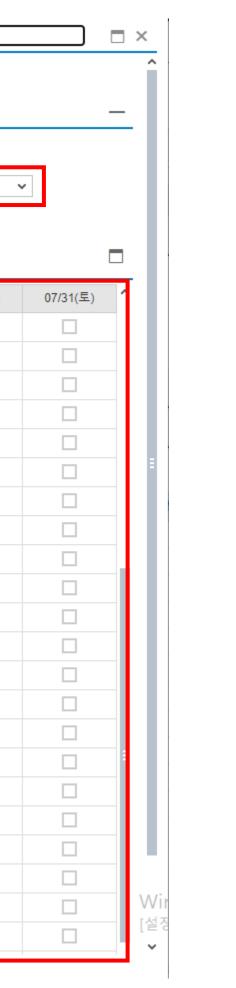


Reservation

portal.unist.ac.kr – Research Equipment – Equipment reservation/input result

회원ID: kale	e@unist.ac.kr] 24186 / 이경애				예약자:	24186 이경이	Η
대분류: UM(CL - 기기분석실	~	중분류:	Electron Micr	oscopy	~	소분류: SL	J7000 FE-SEM	
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- 1. Select the classification and equipment
- 2. Select the time you want on white box
 - Yellow box : my reservation
 - Red box : others reservation
- 3. Click [Application]

Reservation cancel

portal.unist.ac.kr – Research Equipment – Equipment reservation/input result

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		이약신청	Self	SU7000 FE-SEM		2021.07.2	2 15:00~16:00	0	Electron Mi	croscopy UMCL	- 기기분석실			2021.07.21 12:09	2021060969



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15:00~16:00	0		Electron Microscopy	UMCL - 기기분석실			2021.07.21 12:09	2021060969

Input result

After measurement, you have to input result instead of filling in log sheet UCIST

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				예약신청	Self	SU7000 FE-S	BEM			2021.07.22	1

- 1. Select the reservation
- 2. Click the [Input result]
- 3. Check the information and click [Save]

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22:00~24:00	0		Electron Microscopy	UMCL - 기기분석실			2021.07.22 12:24	2021061388
20:00~22:00	0		Electron Microscopy	UMCL - 기기분석실			2021.07.20 21:17	2021060863
18:00~20:00	0		Electron Microscopy	UMCL - 기기분석실			2021.07.22 09:00	2021061306
15:00~16:00	0		Electron Microscopy	UMCL - 기기분석실			2021.07.21 12:09	2021060969





Article 1. Access

(1) A person who wishes to be authorized access to UMCL must obtain approval from the manager in charge after submitting an application form to "Access Permissions Application" of the "Participation Space" menu on the UCRF homepage (http://ucrf.unist.ac.kr).

2 A person who wishes to enter UMCL without access authority shall be accompanied by the equipment manager or shall obtain approval for access from the equipment manager. ③ Each user must enter (exit) individually using the pass card with their own identity, and it is prohibited to enter using another person's pass or to enter together without permission. (4) A person who uses UMCL at night (PM18-AM09 on the next day) or on holiday must enter after establishing personal safety and protection rules (accompanying 2 or more people, preparing for an emergency contact, etc.) for lab accidents.

(5) A person who violates above paragraph $(1) \sim (4)$ regarding access to UMCL shall be obligated to compensate for all safety and property damage caused by the violation.

Article 2. Use of laboratory space

① A UMCL user must understand and follow the common safety rules for the laboratory (Attachment 1).





② A UMCL user on weekends or holidays must fill out the laboratory daily checklist (Attachment 2) provided in each laboratory room, and must submit it to equipment manager, with the signature of the professor(or supervisor) within 3 days from the date of use.
③ A UMCL user should clean up the area after using the equipment, and must promptly notify the equipment manager if there is any problem with the equipment or environment. Violation of the notification obligation may result in restrictions on the use of the equipment.

Article 3. Use of Equipment

A person who wishes to use the equipment of UMCL must make a reservation and use the equipment after completing the training of the equipment manager, assessment test, and acquiring self-user qualification. (Analysis or process request is irrelevant to equipment training and qualification evaluation.)
 A user who completes the regular or occasional training (including practice) by the equipment manager can receive practical training from the senior student of his or her laboratory to improve proficiency before the assessment test. The qualification of the senior must be at least 1 year of experience (more than 5 times in the previous 6 months) in using the equipment. The laboratory is responsible for all safety and property issues arising from the practical training conducted by the senior student.



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③ If there is no record of equipment used in the last 90 days, the qualification for self-use ends. A person who wants to reacquire the self-user qualification must receive equipment training and pass the assessment test conducted by the equipment manager. The upgrading for self-user can be made on the website of UCRF. (http://ucrf.unist.ac.kr)

④ Equipment reservations or requests can be made on the UNIST Portal System and the website of UCRF, and the reservation time should not be unnecessarily occupied for a long time so it does not affect the opportunity for others.

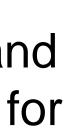
(5) A user should be familiar with the safety rules for each equipment before using, and use the equipment after wearing appropriate safety gear.

6 Bringing chemicals and other items for personal use should be consulted with the equipment manager. ⑦ A user must check that there is no problem before using equipment, chemicals, and etc. If there is a problem before or after use, a user should promptly report to the equipment manager. 8 A user must thoroughly fill out the "Performance Records" after using the equipment. (9) A user must take safety measures by posting the contents of the experiment to deliver accurate information to others if he inevitably leaves his seat during the experiment. 1) The laboratory (in case of outsiders, affiliated institution) of self-user shall be obligated to compensate for all safety and property damage such as accidents (equipment damage, breakdowns, losses, etc.) caused by the negligence of the self-user.



















Article 4. Cancellation after equipment reservation 1 A self-user can cancel equipment reservation by himself up to 2 hours before equipment reservation time. However, TEM (HR-TEM, FE-TEM, Normal TEM, Bio-TEM) can be canceled up to 4 hours before. (X Cancellation is not possible after the cancellation deadline has passed.) 2 If a user has reserved an analysis request but wants to cancel it, he must notify the equipment manager at least 24 hours in advance. (However, in the case of NMR, notification would be allowed up to 1 hour left.) A user who does not appear at the reservation time without prior notice will be charged a usage fee for the reservation time.

Article 5. Laboratory safety and user management

(1) A person who harms the safety of the laboratory or violates the rules of using the UMCL and damages the equipment use of another person, can be subject to penalties according to [Attached Table 1] and be taken appropriate action.

(2) If the violation of the rules is deliberately determined, the sanctions may be strengthened. If a user voluntarily declares after violating the rules, the sanctions may be eased. ③ If it is judged that the sanctions are difficult to be properly implemented due to the status of the violator (graduation or resignation), the user may be blocked from accessing UMCL.





④ A person who damages the property and facilities of UMCL by violating the rules shall be held liable to compensate for the damage.

(5) If a violator does not follow the sanctions, the advisor of the violator will be held jointly responsible. (In the case of an outsider, the supervisor in charge of the affiliated institution)



Self-user Penalty

1. Criteria for penalty points

A user shall be fined the penalty points in the event that any inappropriate behavior falls under the following.
 Each penalty item may be counted multiple times. (The expiration of penalty points is 1 year from the date of imposition.)

No.	Case description		
1	Equipment is used by an unpermitted user who does not have a qualification of self-user.	5	
2	Equipment is used without reservation (Including excessive use of equipment without additional reservation	3	
3	A user operates an unpermitted function of the equipment	3	
4	An abnormality or malfunction discovered before or after using the equipment did not immediately reported to the manager	3	
5	Damage, malfunction, and loss of equipment due to user negligence (* The user is responsible for all costs incurred due to the negligence. *)	5	
6	A user does not provide the accurate information of the sample to the equipment manager, which is essential for protecting the safety, equipment or facilities	3	
7	A person causes the leakage of a harmful substance, gas, or any risk of fire	5	
8	A person uses or occupies the public items and other person's items without prior consent	1	
9	A person leaves the laboratory without switching off the lights, locking the doors, tidying up the area, etc. after using equipment	1	
10	A person does not follow the common lab safety rules (including clothing, prohibition of eating, etc.)	1	





Self-user Penalty

2. Actions taken after subjecting penalty points

1 If the cumulative penalty points exceed a certain criterion, the action corresponding with the table below will be taken.

② When a user violates the rule, an official letter from UCRF is sent to the department or institution(in case of the user outside) of the violator.

③ Even if the following actions have been taken due to the sum of the penalty points, the penalty points within the validity period(1 year) are effective.

Туре	Penalty points	
Total penalty points awarded	5 points or more	- The user is - When the assessment
to 1 user	8 points or more	 The user i When the assessment
Total penalty points awarded to 1 laboratory for 1	12 points or more	- Notify the than 15 pc for 1 mont
equipment	15 points or more	- The memb - Send an o



Action

is prohibited from using the equipment for 1 month.

e prohibition period is finished, the user must complete the training and t again.

is prohibited from using the equipment for 3 months.

e prohibition period is finished, the user must complete the training and it again.

e user and the advisor(supervisor) by e-mail that "If the penalty score is more oints, the members of your laboratory are prohibited from using the equipment oth."

bers of the laboratory are prohibited from using the equipment for 1 month official letter of action to the affiliated department(institution)



THANK YOU





FIRST IN CHANGE