



Cross Section

Korea EM Application

❖ 단축기

- Navi Cam => Control + shift + Z
 - 정지 이미지
- Stage 조작
 - Double click => 센터이동
 - Wheel Click 상태에서 Drag => 스테이지 이동
- Focus
 - 마우스 오른쪽 버튼
- Stigmator
 - Shift + 마우스 오른쪽
- Auto brightness and contrast => F9
- 선택된 화면 확대 => F5
- Scanning start and stop => F6
- Photo shot => F2
- 마우스 오른쪽 버튼
 - Shift + 마우스 오른쪽

❖ Link

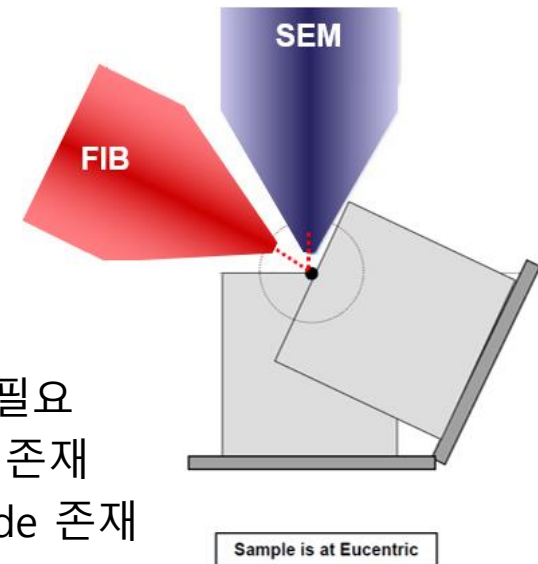
- Stage Z 값-> Working Distance 값으로 변경
- Procedure
 - Mag = 3500x
 - Focus on sample
 - Click Link
 - WD = 4mm 변경

❖ Eucentric point

- SEM과 FIB의 초점이 만나는 Point
- WD = 4mm (around)

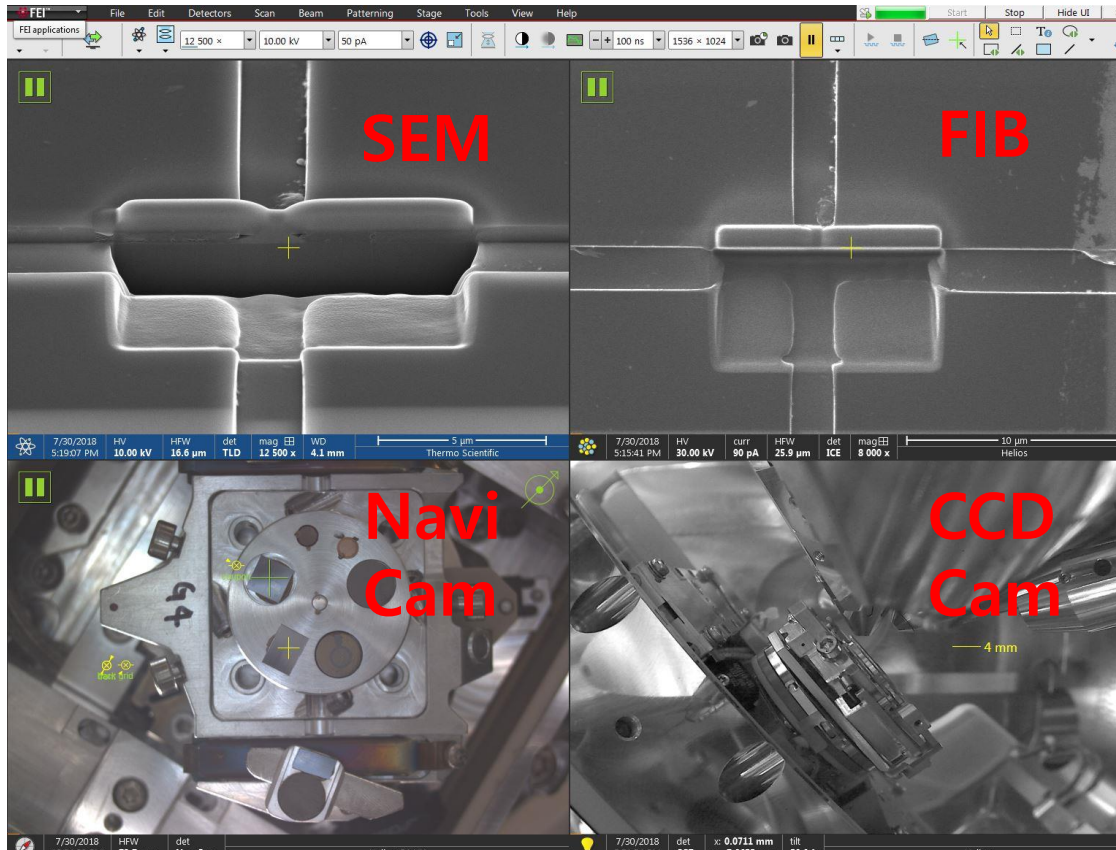
❖ FE SEM Image

- WD, Beam current, align 등등에 따른 이미지 설정 필요
- HV 값에 따른 WD값 limit 존재
- Field free, Immersion mode 존재
 - Mode2에만 적용
- Reduce function



❖ User interface

➤ 화면구성



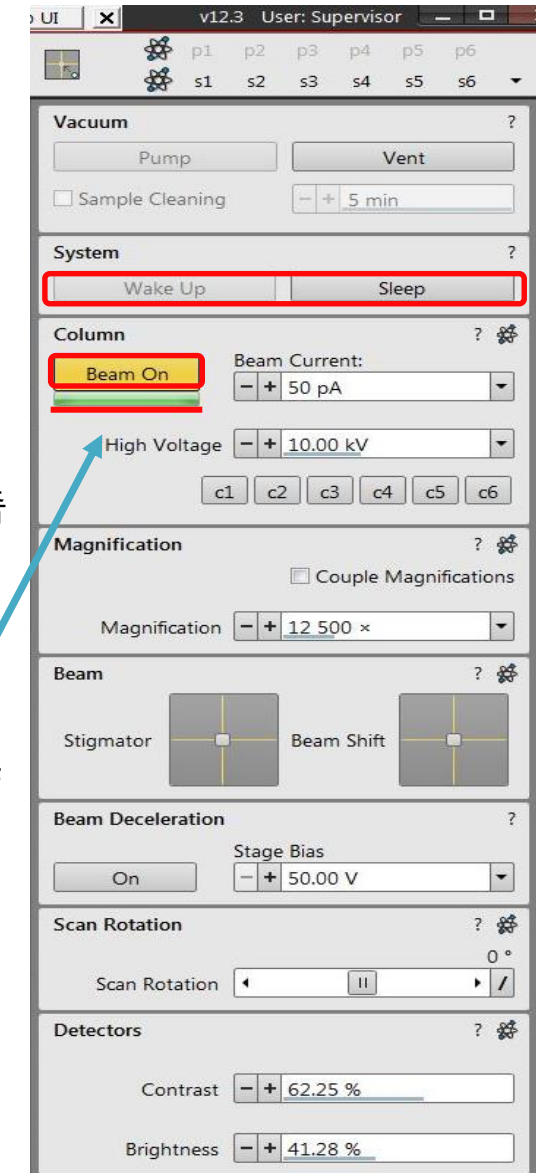
❖ Beam control tab

➤ System

- Wake up
 - SEM, FIB 동시 On
- Sleep
 - SEM, FIB 동시 Off
 - FIB의 경우 과도한 on, off 시 수명단축

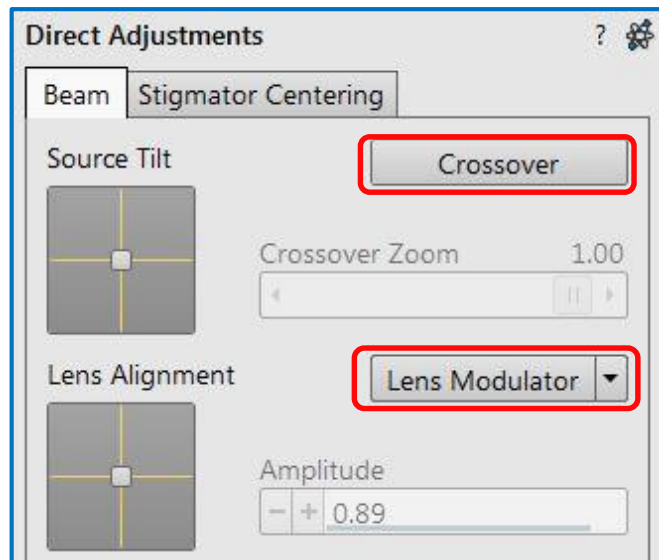
➤ Column

- Beam on
 - SEM, FIB 각각 On
 - 한번 더 Click시 Off
- Green gauge
 - Heating 여부



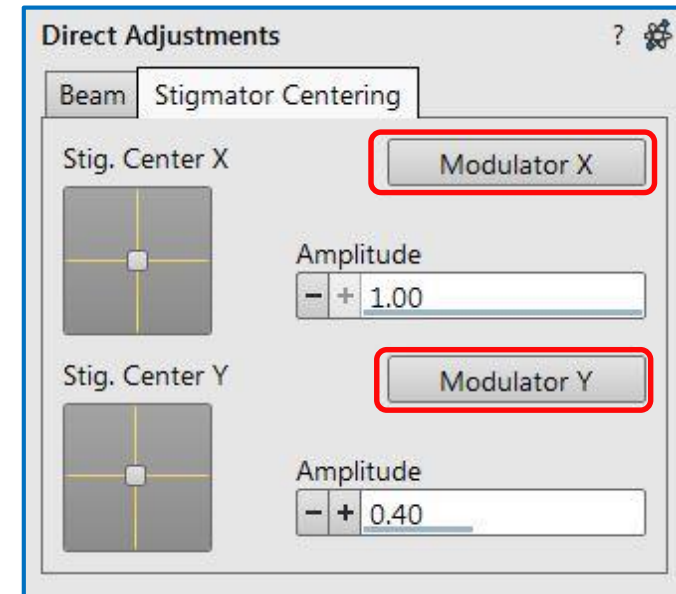
❖ Direct Adjust(Beam)

- Beam position 조정
- Crossover => Beam align
 - Crossover Zoom
- Lens Modulator => wobble align
 - amplitude



❖ Direct Adjust(Stigmator centering)

- Modulator X
 - Stig Center X 조정
 - Amplitude
- Modulator Y
 - Stig Center Y 조정
 - Amplitude

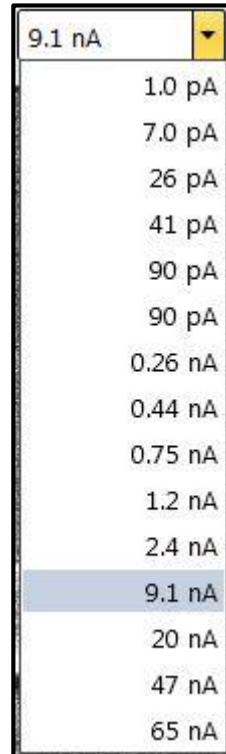


❖ SEM 초기 조건 설정

- Focus on sample surface
- Link and WD = 4mm
- Eucentric 설정(Y axis 맞춰야함)
 - Tilt 7degree
 - 맞지 않으면 Z축 조정
 - Tilt 52degree
 - Z축 조정

❖ FIB 조건 및 준비과정

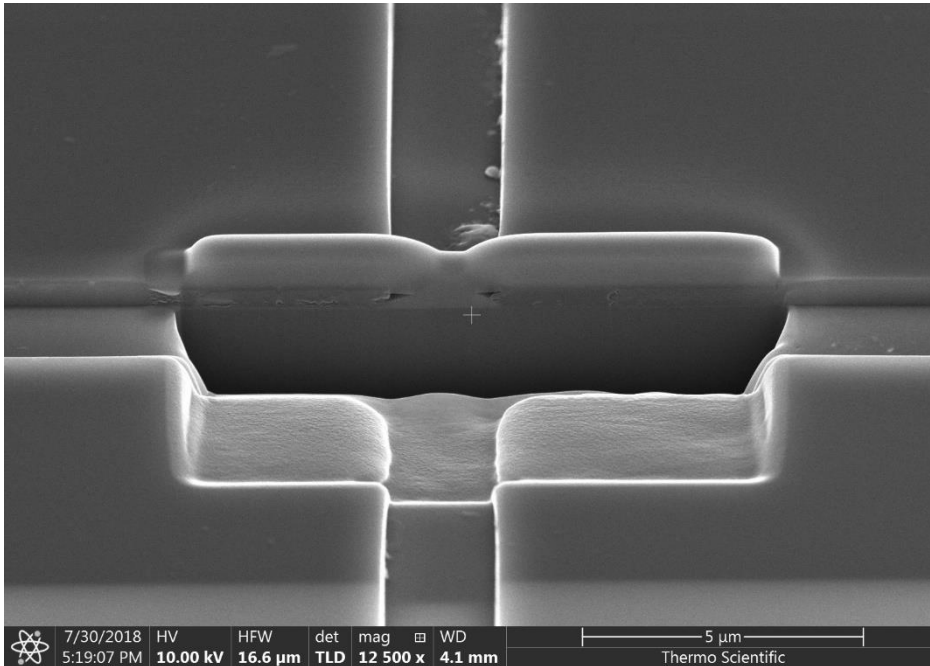
- EHT => 500v ~ 30Kv
 - 95% 이상 30Kv에서 사용
- Beam current => 1pA ~ 65nA
 - <90pA => **이미지 관찰**
 - 0.25~2.4nA => **fine milling**
 - 9.1~65nA => **rough milling**



- Live image 사용하지 않음
 - Sample damage 발생
 - Snap shot 또는 F6 더블 클릭 활용
- SEM과 FIB Eucentric position 맞지 않을 경우
 - 빠르게 Live 이미지 활용해서 Beam shift로 조정
 - **Shift + 마우스 왼쪽 => 샘플 포지션 이동(추천)**

❖ Cross section rough step

- Deposition
- Rough milling
- Fine milling



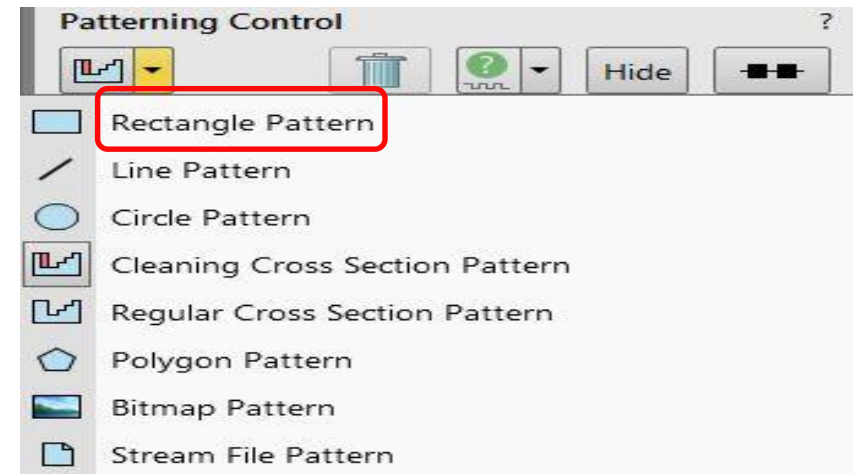
❖ Cross section fine step

➤ Deposition

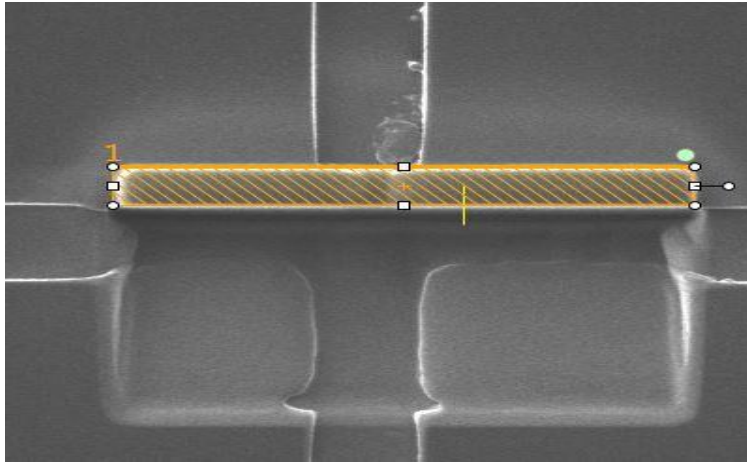
- X, Y, Z size 결정(예: 10um, 1um, 1um)
- Beam current 결정 => (X size) x (Y size) x 10pA
 - W의 경우 20배 or 30배

Basic Properties	
Application	C_M
X Size	10.45 μm
Y Size	1.01 μm
Z Size	1.00 μm

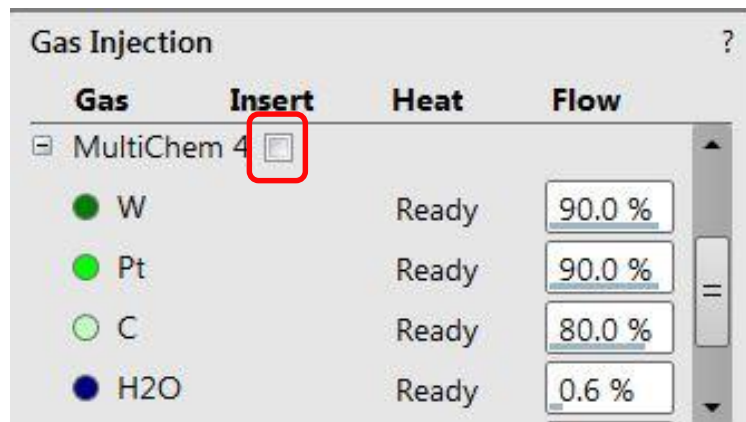
- Rectangle pattern 생성



- Rectangle pattern 생성



- Insert Nozzle



- Start patterning click



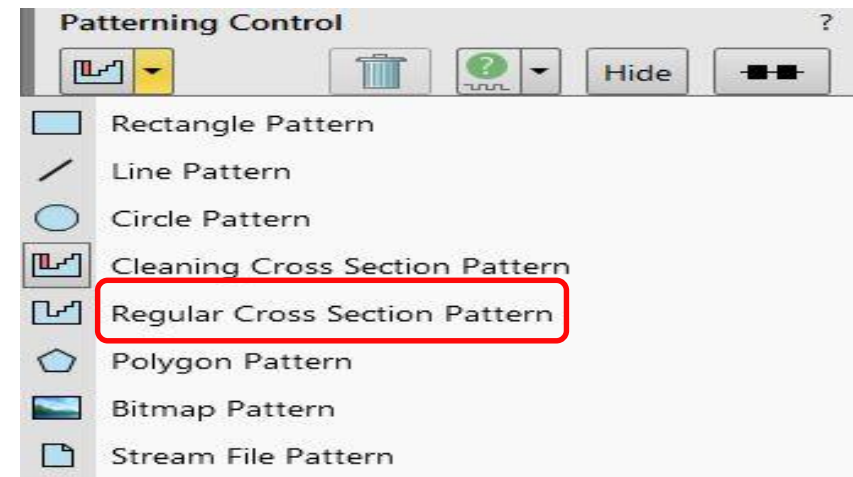
- Sample rotation이 필요할 경우 Align feature 활용



- Uncheck Insert Nozzle

➤ Rough milling

- Regular Cross section pattern 생성



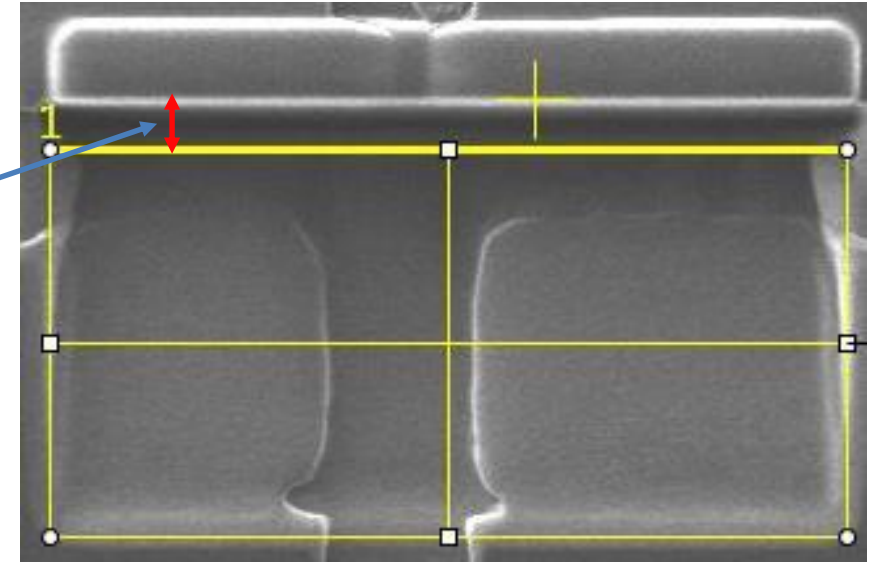
- Z, Y size 결정
 - Y size 1.5배 크게

Basic Properties	
Application	Si-ccs
X Size	10.62 μm
Y Size	4.50 μm
Z Size	3.00 μm
Scan Direction	Bottom To Top

- Depo position에서 거리 유지
 - Total Diameter(Aperture size) 보다 크게
 - Max 2배

Total Diameter	267.0 nm
Maximum Dose per Area	0 nC/ μm^2
Saturation Current Density	1.000E-18 A/nm ²
Total Volume Sputter Rate	1.182E+1 $\mu\text{m}^3/\text{s}$

- Regular Cross section pattern



- Beam current = 9.1nA
- Snapshot 사용 하여 위치 재확인

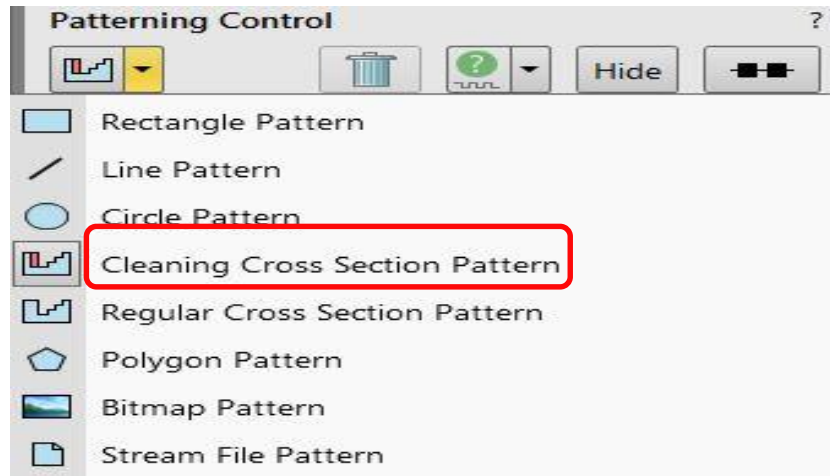


- Start patterning click

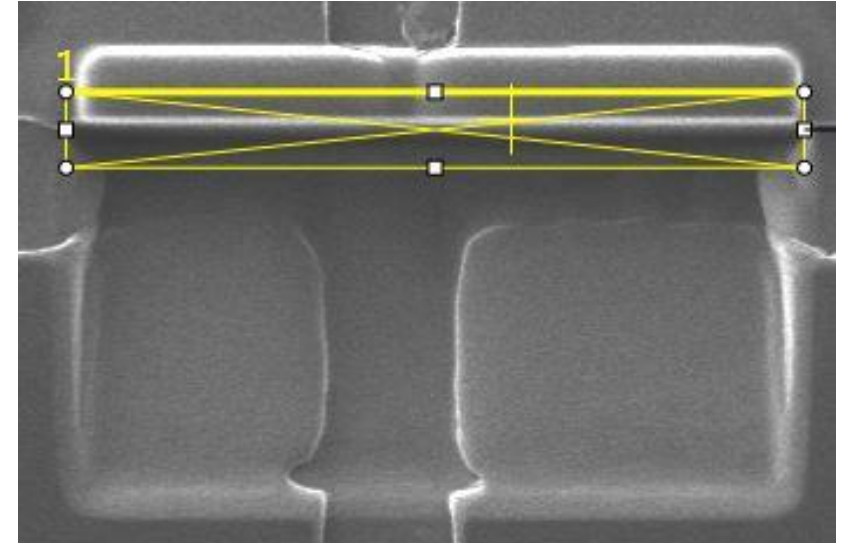


➤ Fine milling

- Beam current setting
 - Rough milling 보다 두단계 아래 설정
 - 1.2nA
- Cleaning Cross section pattern 생성



- Deposition과 Rough milling 중간에 pattern생성



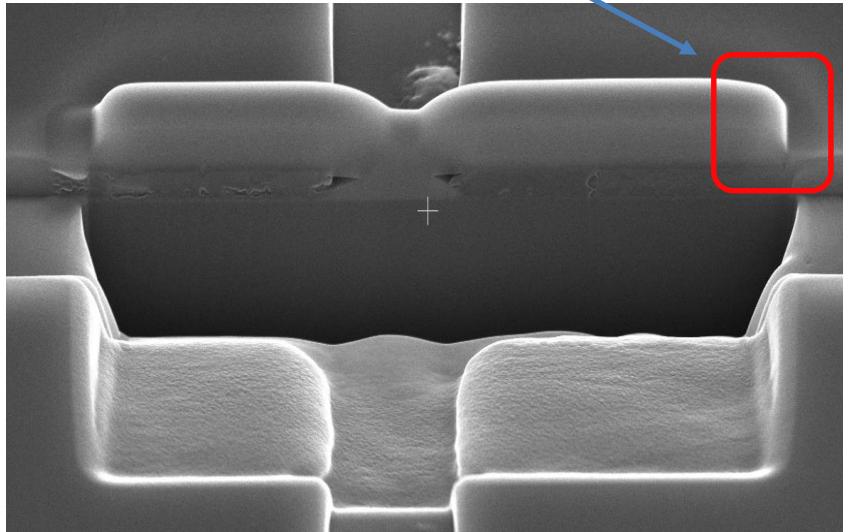
- Snap shot 사용하여 이미지 재확인



- Start patterning click



- 완료 후 SEM 이용하여 Edge기준으로 Focus



- Image scanning 및 관찰