

Dual Beam FIB

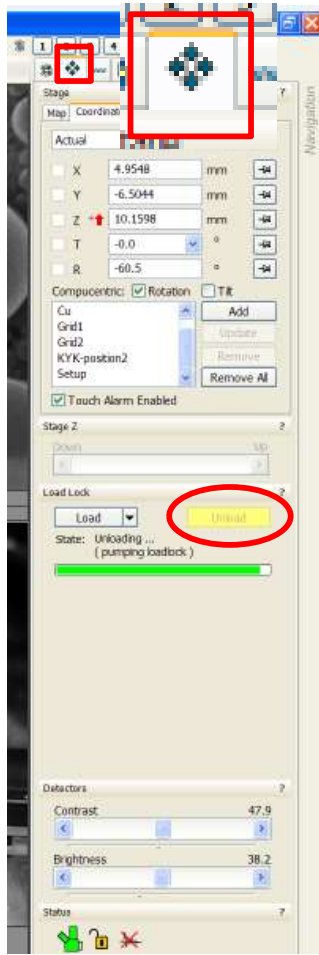
-Helios FIB-



Unload

- 1) Ion Beam 확인 – Beam On 두 번 클릭
- 2) Navigation-Load lock- Unload 클릭
- 3) Clamp & Release 램프에 불이 둘 다 들어오면 뚜껑 열고, 3-1) Release 눌러서 clamp 해지
- 4) Holder 제거 후 샘플 준비(샘플 준비 할 때는 꼭 뚜껑 닫기)
- 5) Holder를 올리면 Clamp&Load 램프에 불이 들어오고 홀더가 잘 장착 되었는지 가운데 눌러서 확인 후 버튼을 눌러 clamp진행
- 6) 뚜껑을 닫으면 램프 두군데 불이 들어오고 Clamp&Load 버튼을 누른다(Chamber안으로 샘플 로딩)

2)



3)



5)



3-1)



6)



Sample loading

1) 진공도 -6 mbar까지 떨어지면 E&I display Beam on

The screenshot displays the xT microscope control software interface, version 5.0 build 3305. The interface is divided into four camera views and a control panel on the right. The top-left view shows a sample surface with a green crosshair. The top-right view shows a similar surface with a green crosshair. The bottom-left view shows a mechanical component with green crosshairs and labels. The bottom-right view shows a mechanical component with a green crosshair and a 4 mm scale bar.

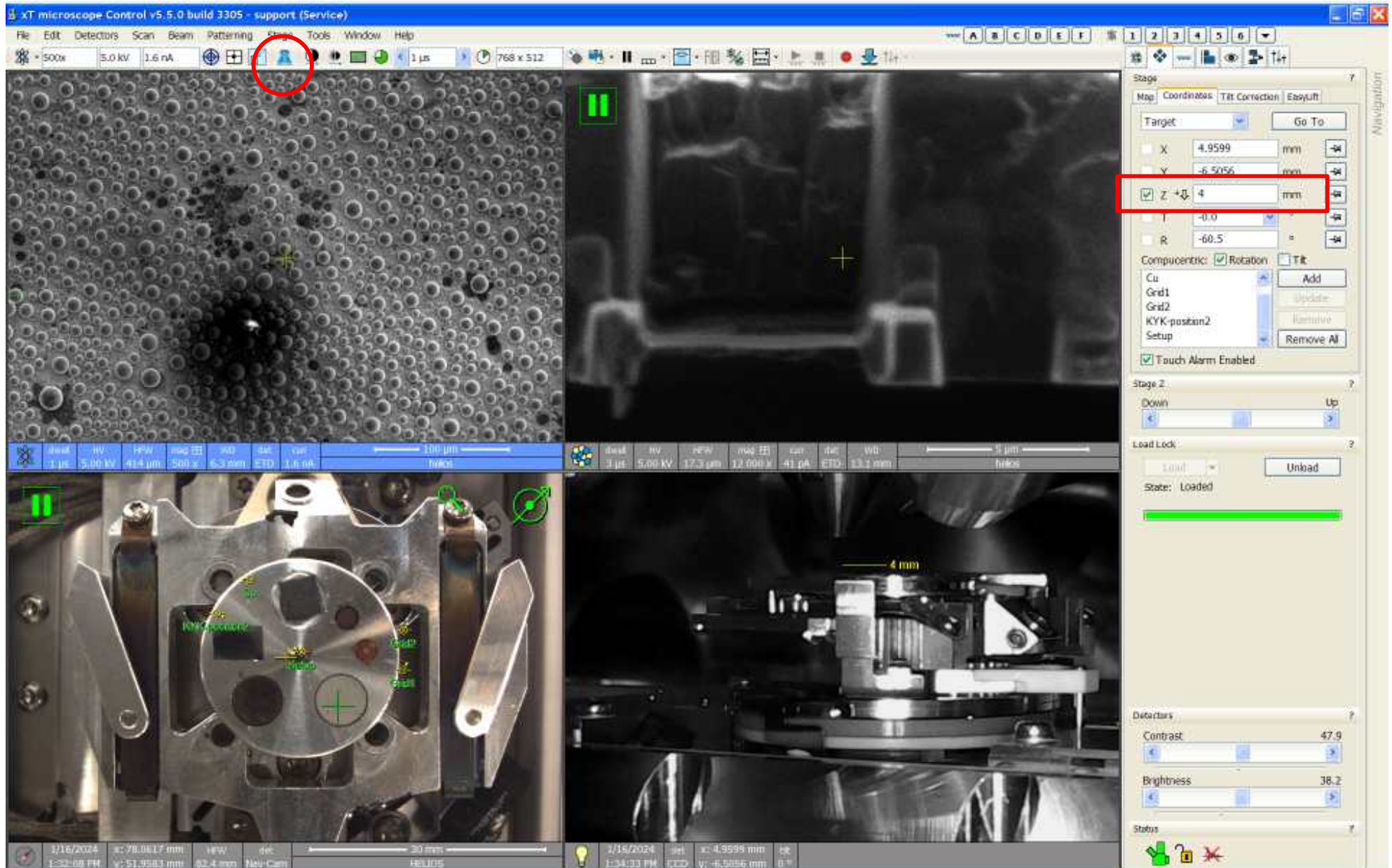
The control panel on the right side of the interface includes the following sections:

- Vacuum:** Pump, Vent
- System:** Wake Up, Sleep
- Beam:** Beam On (highlighted with a red circle and labeled '2'), Beam Current (1.6 nA), High Voltage (5.00 kV)
- Magnification:** Couple Magnifications, Magnification (12000 x)
- Scan Rotation:** Rotation (0.0)
- Beam:** Stigmator, Beam Shift
- Beam Deceleration:** Stage Bias (50 V), On
- Detectors:** Contrast (53.2), Brightness (38.2)
- Status:** Specimen Current (0.1 nA), Ion Beam Current (0.3 pA), Chamber Pressure (1.87e-6 mbar, highlighted with a red circle and labeled '1')

The status bar at the bottom of the interface shows the date and time (2/16/2024 1:32:08 PM), coordinates (x: 78.0617 mm, y: 51.9583 mm), and other parameters (FWHM: 62.4 mm, det: Nav-Cam, HELIOS).

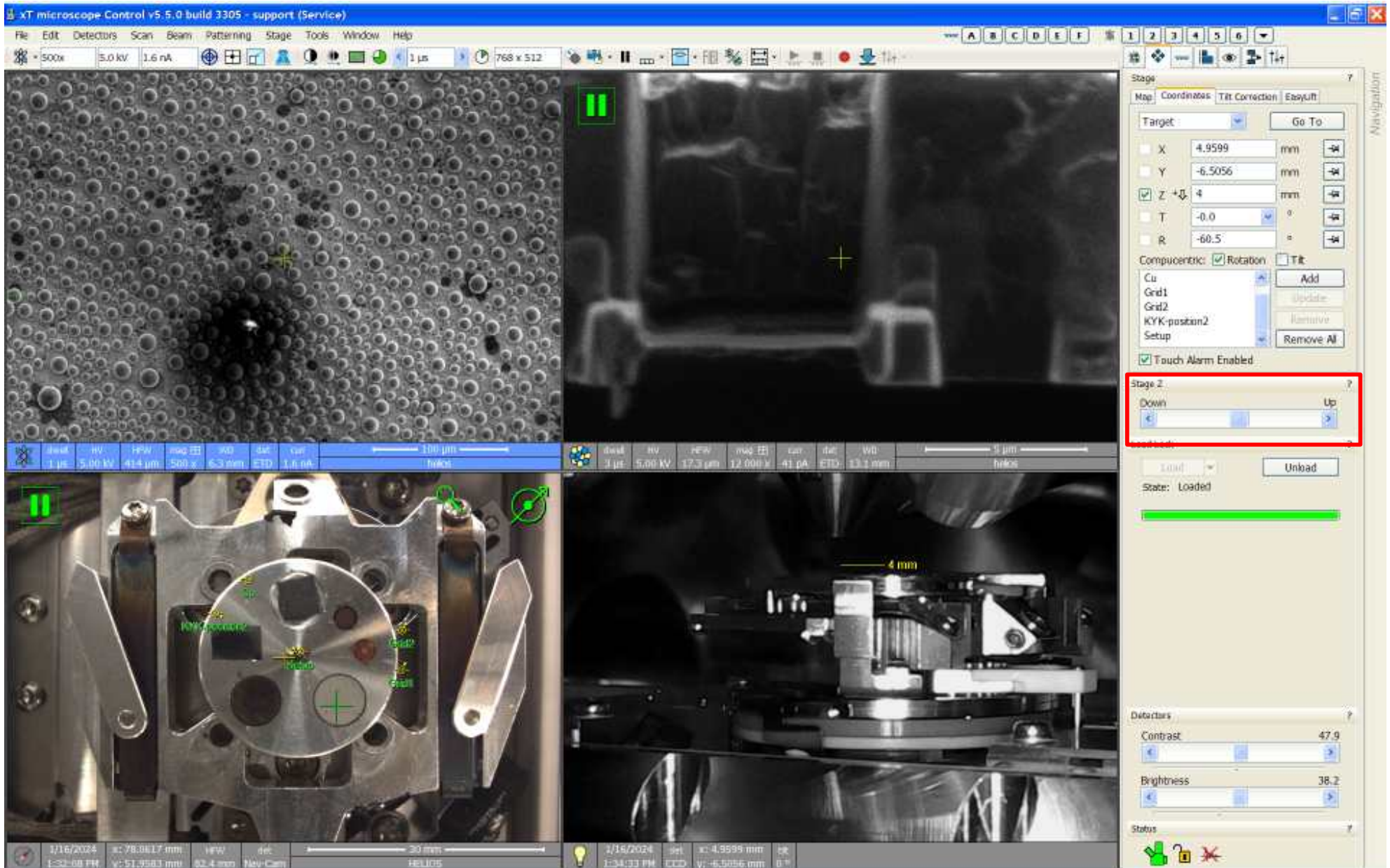
WD 확인

1) 배율 x3000 이상에서 focus 후 Link Z 누르고 z값에 4mm 입력



Eucentric position

1) T: 0° - 52° stage Z에서 마우스로 Up- Down을 눌러서 처음 위치로 이동



Deposition

1) Pattern-MultiChem체크-Insert(Yes)

The screenshot displays the xT microscope control software interface. The main window is divided into four quadrants: top-left shows a low-magnification SEM image of a porous surface; top-right shows a high-magnification SEM image of spherical particles; bottom-left shows a mechanical view of the sample stage; bottom-right shows a close-up of the MultiChem gas injection system. A central confirmation dialog box asks "MultiChem needle is retracted. Insert?". The "Yes" button is highlighted with a red box. On the right side, the "Pattern" panel has a red box around the "Run" button (labeled '1'). Below it, the "MultiChem Gas Injection" panel has a red box around the gas status indicators (labeled '2'). The status bar at the bottom shows the date 1/16/2024 and time 1:32:08 PM.

Confirmation dialog box text: **3** MultiChem needle is retracted. Insert?

Buttons: Yes, No, Cancel

MultiChem Gas Injection table:

Gas Type	Status	Flow
Ar	Ready	80.00%
N ₂	Ready	80.00%
O ₂	Ready	80.00%
H ₂ O	Ready	0.20%

Status bar: 1/16/2024 1:32:08 PM, x: 78.0617 mm, y: 51.9581 mm, z: 4.0 mm, Helios

Deposition

1) Pattern – Basic - Size

The screenshot displays the xT microscope Control v5.5.0 build 3305 - support (Service) software interface. The main window shows a grayscale image of a surface with a pattern of circular features. A red box highlights the 'Pattern' button in the top toolbar. A green box highlights the 'Pattern' dropdown menu in the right-hand panel, which is currently set to 'C_M'. Below the dropdown, a list of materials is visible, including Pt, Pt_M, Pt_M_weld, and BCE_m. The 'Progress' section shows a total time of 0:11:30 and overall progress bars. The 'MultiChem Gas Injection' table shows the status of various gases:

In	Gas Type	Status	Flow
W		Ready	80.00%
Pt		Ready	80.00%
C		Ready	80.00%
H2O		Ready	0.20%

The 'End Point Monitor' section shows the 'ISPI Monitor Settings' with 'On', 'Pause', and 'Save' checkboxes, and a 'Time Interval' of 1.00 s. The 'Status' section at the bottom right shows 'Specimen Current: -0.0 pA' and 'Ion Beam Current: -252.4 pA'. The bottom status bar displays the date and time as 1/16/2024 1:32:08 PM, and the current position as x: 78.0617 mm, y: 51.9583 mm, z: 82.4 mm.

Milling

1) Patterning – Basic - Size

The screenshot displays the xT microscope Control v5.5.0 build 3305 - support (Service) interface. The main window is divided into several sections:

- Top Panel:** Contains menu items (File, Edit, Detector, Scan, Beam, Patterning, Stage, Tools, Window, Help) and a toolbar with various icons. A red box highlights a play button icon in the toolbar.
- Left Panel:** A dropdown menu is open, listing current and available beam currents: 1.1 pA, 7.7 pA, 24 pA, 40 pA, 80 pA, 80 pA, 0.23 nA, 0.43 nA, 0.79 nA, 0.79 nA, 2.5 nA (highlighted), 9.3 nA, 21 nA, 47 nA, 65 nA. A green box highlights this list.
- Center Panel:** Shows a grayscale image of a sample with a yellow 2x2 grid overlaid on it. A green box highlights the 'Patterning' tab in the right-hand sidebar.
- Right Panel:** The 'Patterning' sidebar is active, showing parameters for '1 - Regular Cross Section 1'. A green box highlights the 'Basic' tab and the parameter table below it.
- Bottom Panel:** Contains two live video feeds. The left feed shows a mechanical assembly with labels for 'Cu', 'Position 1', 'Position 2', 'Position 3', 'Position 4', and 'Position 5'. The right feed shows a close-up of a mechanical part with a '4 mm' scale bar.
- Bottom Status Bar:** Displays system information including date (1/15/2024), time (11:35:17 AM), coordinates (x: 78.0617 mm, y: 51.9583 mm), magnification (6,500x), and detector type (CCD).

Name	Value
Application	Et-multipass New
X size	15.00 μ m
Y size	8.00 μ m
Z size	8.00 μ m
ScanDirection	Bottom To Top
DwellTime	1.000 μ s
Beam	Ion
Time	0:06:02
Beam Current	2.57 nA

In	Gas Type	Heat	Flow
<input checked="" type="checkbox"/>	Pt dep	Warm	Closed

Specimen Current	4.4	μ A
Ion Beam Current	2.66	nA

Milling

1) Patterning – Basic - Size

xT microscope Control v5.5.0 build 3305 - support (Service)

File Edit Detectors Scan Beam Patterning Stage Tools Window Help

5 000x 30.0 kV 0.79 nA 768 x 512

1-Rectangle 1

Basic	Advanced	Progress	Multi-Chem
Name	Value		
Application	Bi New		
X size	Pt dep		
Y size	Pt_M		
Z size	Pt_M_wald		
ScanDirection	SCE_m		
DwellTime	Bi New		
Beam	Bi_M		
Time	W_M		
Beam Current	none		

Progress

Total Time: 0:04:20

Overall Progress

Current Progress

Select All

In	Gas Type	Heat	Flow
<input checked="" type="checkbox"/>	Pt dep	Warm	Closed

End Point Monitor

GPI Monitor Settings

On Pause Save

Time Interval: 1.00 s

CO2 Live Interval: 1.00

Status

Specimen Current: 0.2 pA

Ion Beam Current: 832.6 pA

1/15/2024 11:35:17 AM x: 78.8617 mm HPW: 82.4 mm det: Nav-Cam

1/15/2024 3:45:03 PM det: CCD x: 13.5140 mm y: -19.1496 mm 54%

Easy lift

1) Patterning – Multichem – Insert(Yes)

The screenshot displays the xT microscope control software interface. A central confirmation dialog box asks "MultiChem needle is retracted. Insert?" with "Yes", "No", and "Cancel" buttons. The "Yes" button is highlighted with a red box. The interface includes a top menu bar, a toolbar, and several panels:

- Pattern Panel:** Shows a grid of pattern points and a "Pattern" table with columns for Name and Value.
- Progress Panel:** Displays "Total Time: 0", "Overall Progress", and "Current Progress".
- MultiChem Gas Injection Panel:** Shows a table of gas injection parameters, with the "In" column highlighted by a red box.
- End Point Monitor Panel:** Includes "SPI Monitor Settings" with checkboxes for "On", "Pause", and "Save", and input fields for "Dwell Interval" and "CO2 Live Interval".
- Status Panel:** Shows "Specimen Current: -449.7 pA" and "Ion Beam Current: 77.6 pA".

The main view area is split into four quadrants: top-left shows a grayscale image of a specimen; top-right shows a magnified view of a specific feature; bottom-left shows a mechanical view of the MultiChem system with labeled positions (Position 1-4); bottom-right shows a close-up of the MultiChem needles with a 4 mm scale bar.

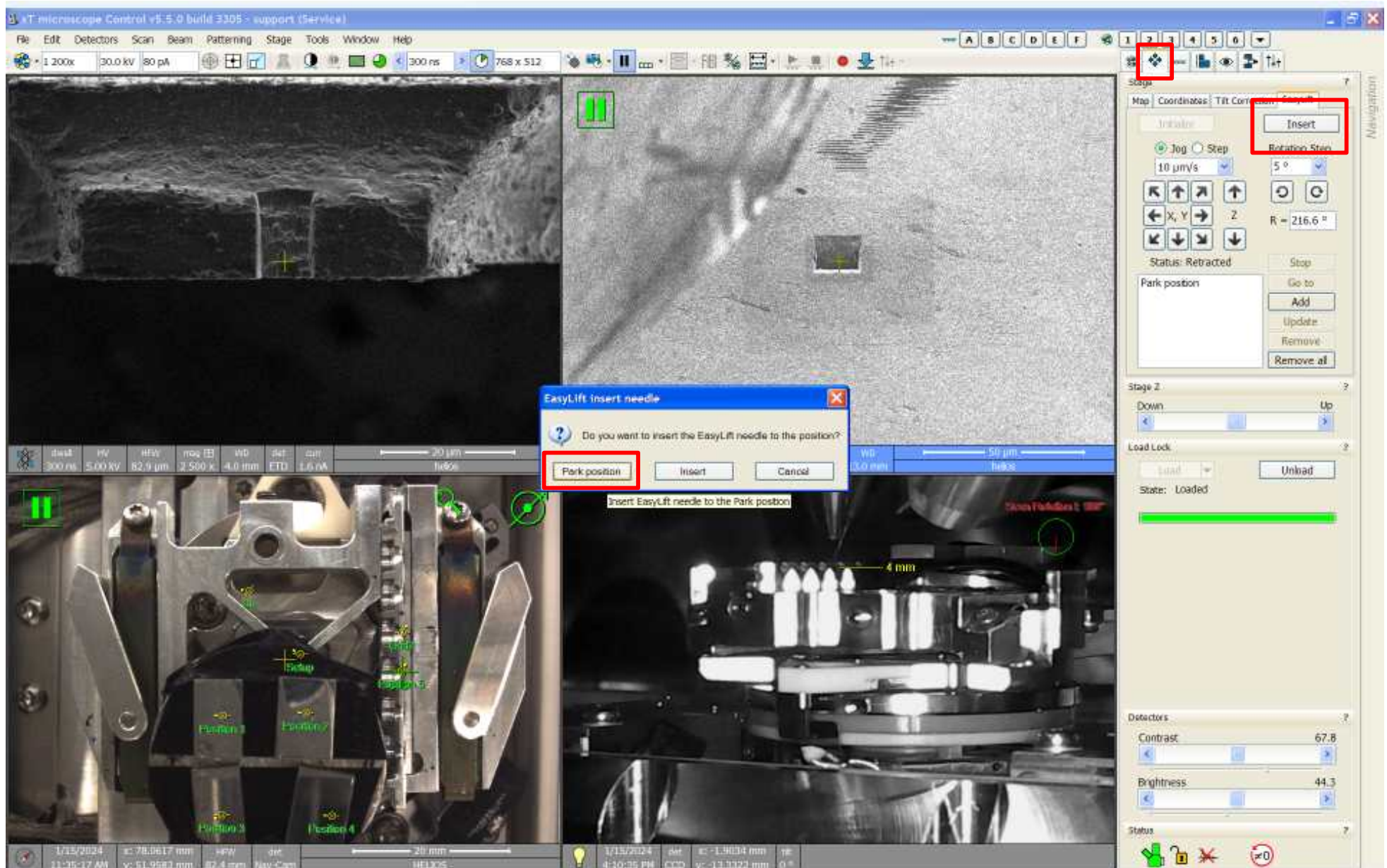
Name	Value
Application	
X size	0 µm
Y size	0 µm
Z size	0 µm
ScanDirection	Bottom To Top
DwellTime	0 ps
Beam	Electron
Time	0 ps
Beam Current	0 pA

In	Gas Type	Status	Flow
■	Ar	Ready	80.00%
■	N ₂	Ready	80.00%
■	O ₂	Ready	80.00%
■	H ₂ O	Ready	0.20%

Specimen Current	Ion Beam Current
-449.7 pA	77.6 pA

Easy lift

1) Navigation – EasyLift – Insert – Park position



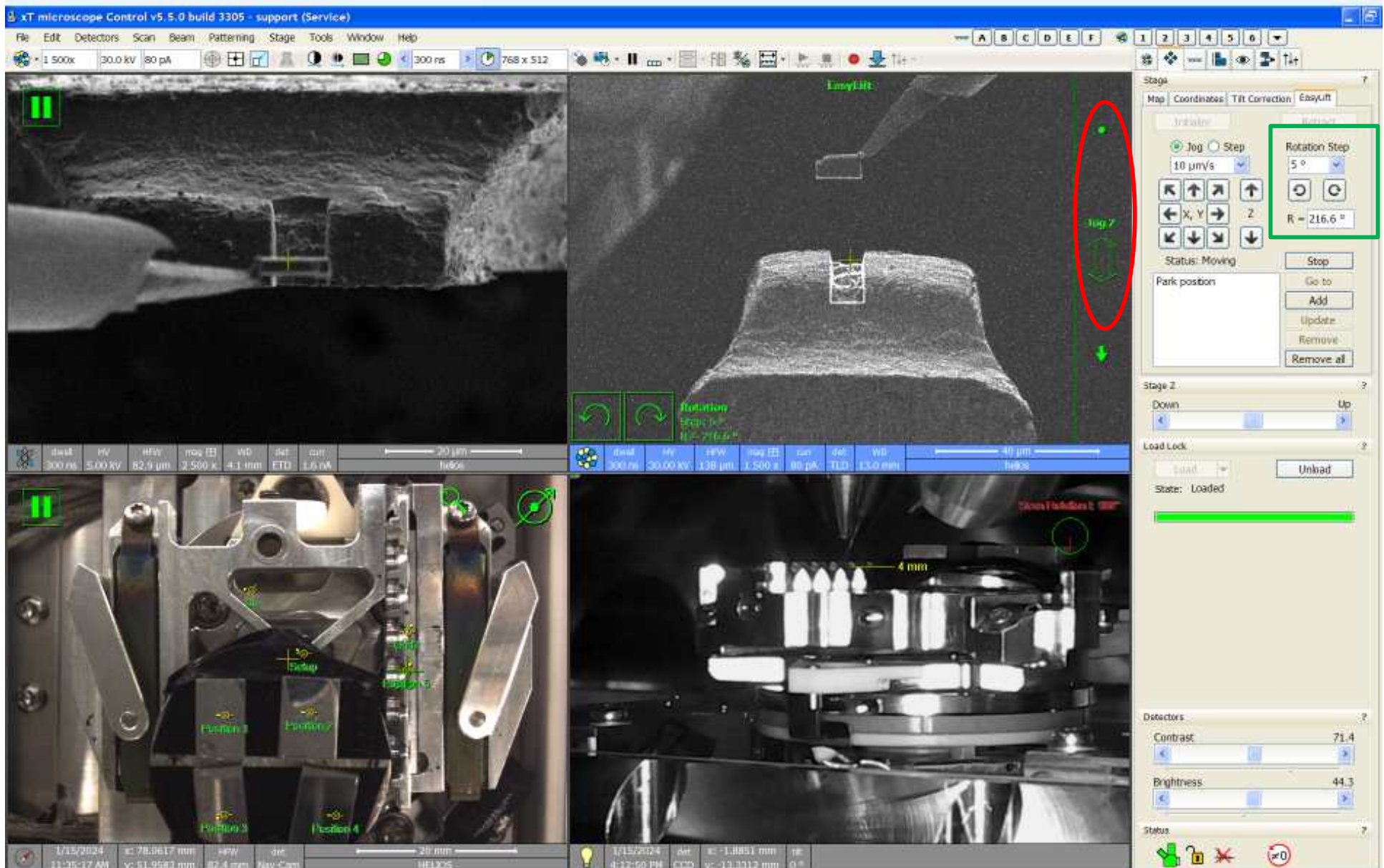
Easy lift

- 1) Navigation – EasyLift – Insert – Park position
- 2) 마우스로 이동



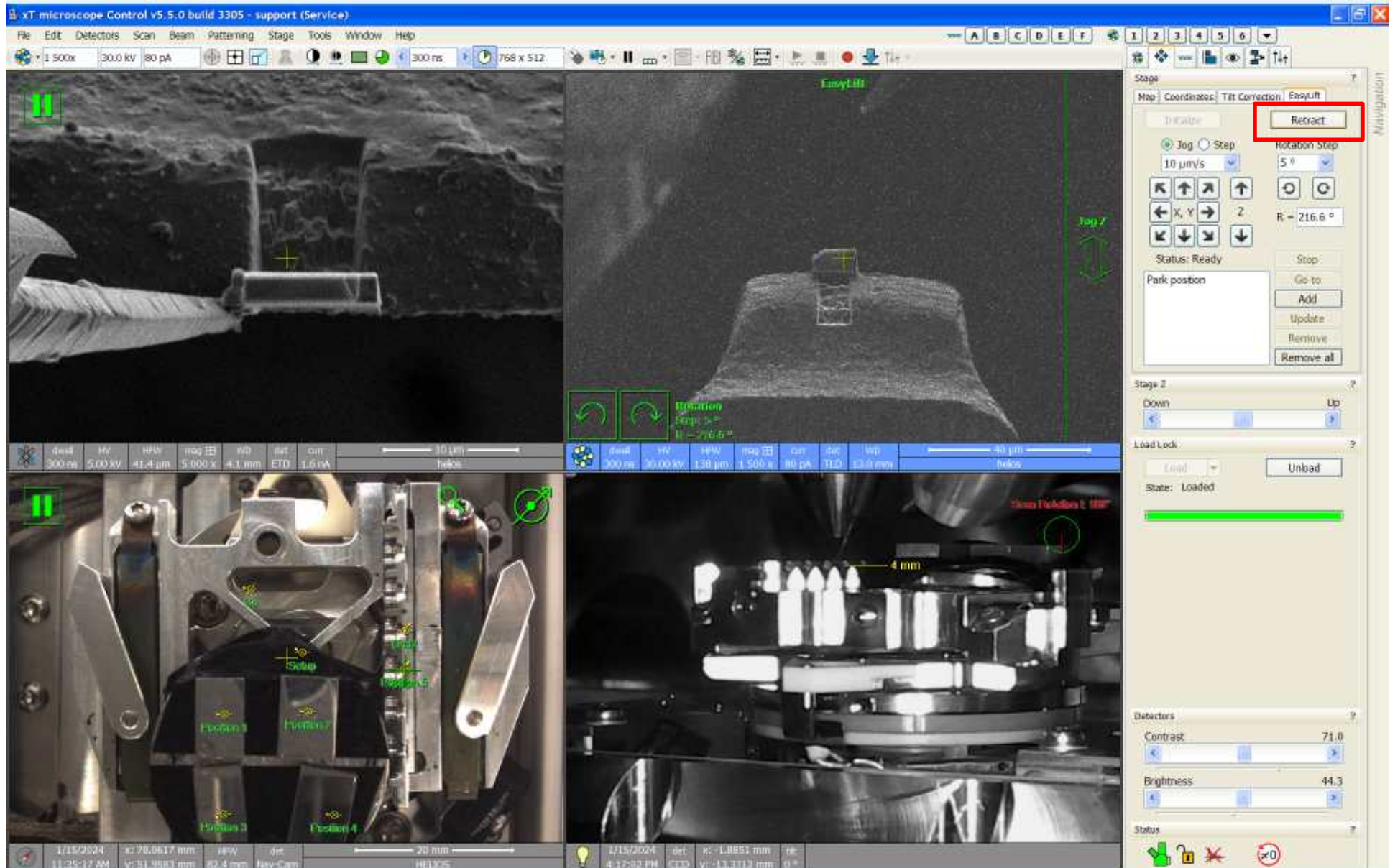
Easy lift

- 1) Navigation – EasyLift – Insert – Park position
- 2) 마우스로 이동
- 3) EasyLift 상태가 좋지 않으면 rotation해서 깎아서 사용



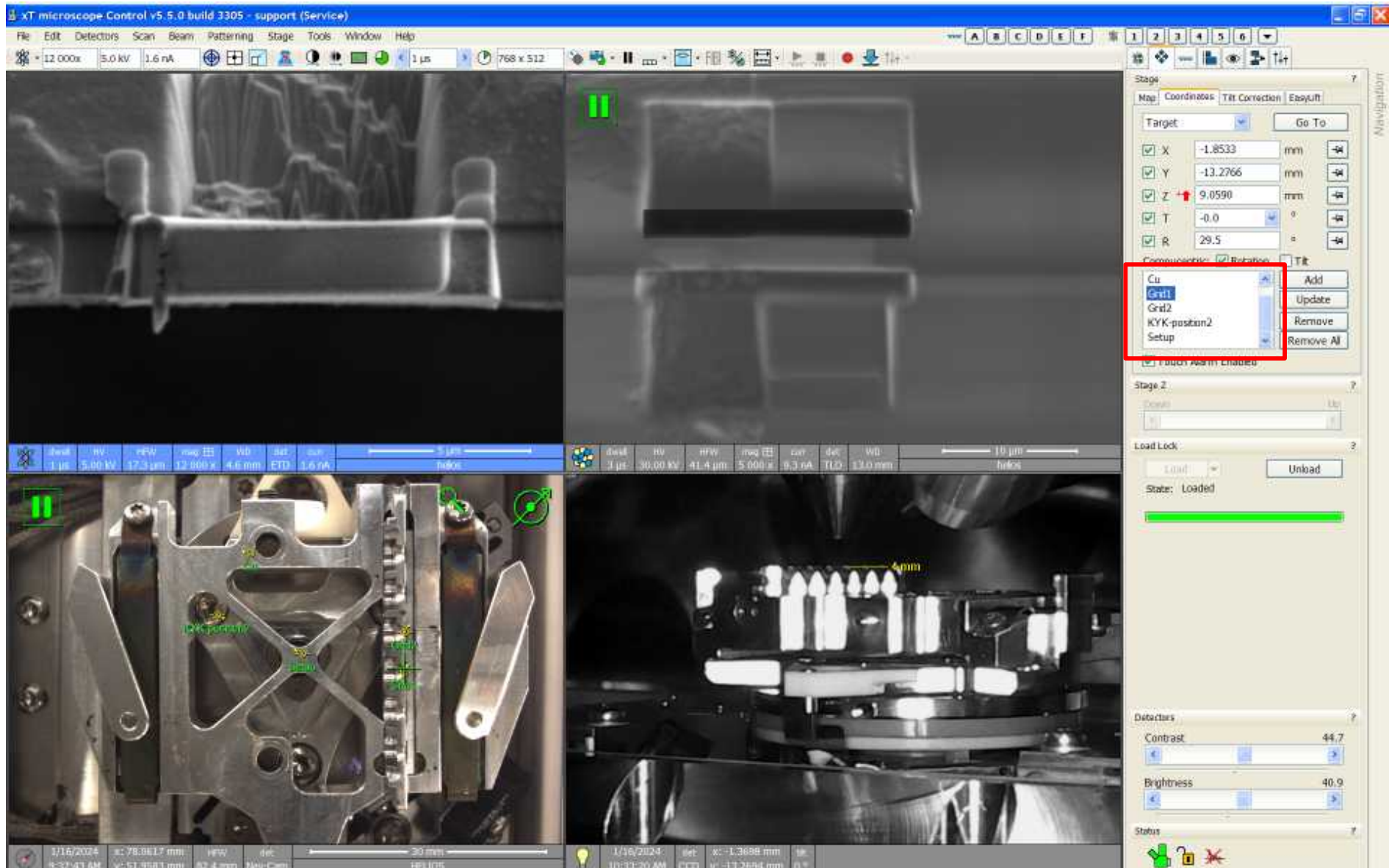
Easy lift

- 1) 제거 -Z로 EasyLift를 올리고 - Retract
- 2) MultiChem 체크 - 제거



Grid 이동

1) Navigation – Coordinates- 저장된 position Grid 클릭



Fine mill

xT microscope Control v5.5.0 build 3305 - support (Service)

File Edit Detectors Scan Beam Patterning Stage Tools Window Help

10 000x 30.0 kV 0.43 nA 1 μm 768 x 512

1.1 pA
7.7 pA
24 pA
40 pA
80 pA
80 pA
0.23 nA
0.43 nA
0.79 nA
0.79 nA
2.5 nA
9.3 nA
21 nA
47 nA
65 nA

1-Rectangle 1

Name	Value
Application	Si Now
X size	7.50 μm
Y size	1.29 μm
Z size	3.00 μm
ScanDirection	Bottom To Top
DwellTime	1.000 μs
Beam	Ion
Time	0.0348
Beam Current	479.12 pA

Progress

Total Time: 0.0348
Overall Progress:
Current Progress:

Select All

MultiChem Gas Injection

In	Gas Type	Status	Flow
W	Ready	80.00%	
Pt	Ready	80.00%	
C	Ready	80.00%	
H2O	Ready	0.20%	

End Point Monitor

ISPI Monitor Settings

On Pause Save

Time Interval: 1.00 s

Specimen Current: 0.0 pA
Ion Beam Current: 477.2 pA

1/16/2024 9:27:43 AM x: 78.8617 mm y: 51.9583 mm def: 62.4 mm Helios

1/16/2024 10:36:01 AM CCD x: -1.3578 mm y: -13.2744 mm S4

Fine mill

xt microscope Control v5.5.0 build 3305 - support (Service)

File Edit Detectors Scan Beam Patterning Stage Tools Window Help

15 000x 30.0 kV 0.23 nA 1 μm 768 x 512

1.1 pA
7.7 pA
24 pA
40 pA
80 pA
80 pA
0.23 nA
0.43 nA
0.79 nA
0.79 nA
2.5 nA
9.3 nA
21 nA
47 nA
65 nA

1-Cleaning Cross Section 1

Beam: Advanced Progress Sel. Mtl EasyLit

Name	Value
Application	Si-ccc New
X size	6.89 μm
Y size	359.72 nm
Z size	30.00 μm
ScanDirection	Top To Bottom
DwellTime	1.000 μs
Beam	Ion
Time	0:02:34
Beam Current	253.96 pA

Progress

Total Time: 0:02:34
Overall Progress:
CCS Line Progr:
Select All

MultiChem Gas Injection

In	Gas Type	Status	Flow
W		Ready	80.00%
Pt		Ready	80.00%
C		Ready	80.00%
H2O		Ready	0.20%

End Point Monitor

EPI Monitor Settings

On Pause Save

Time Interval: 1.00 s

CCS Line Interval: 1.0

Status

Specimen Current: -56.8 pA
Ion Beam Current: 254.2 pA

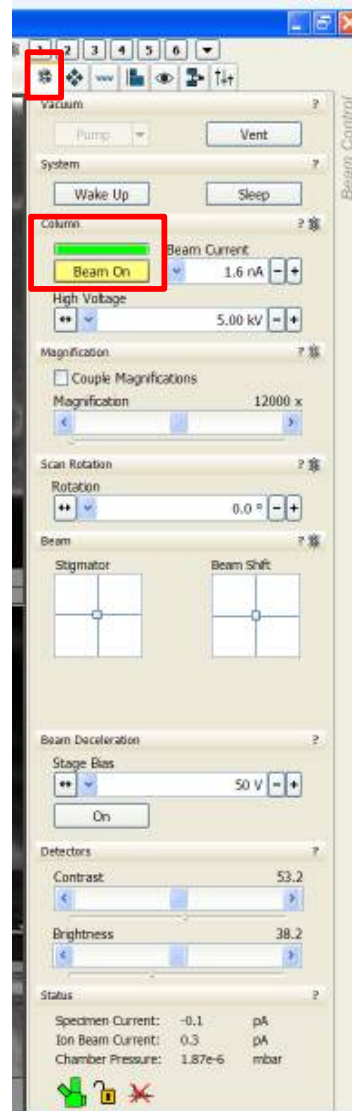
1/16/2024 9:37:43 AM x: 78.0617 mm y: 51.9581 mm hwy det: 30 mm Helios

1/16/2024 10:46:30 AM det: x: -1.3610 mm y: -11.2794 mm hwy det: 30 mm Helios

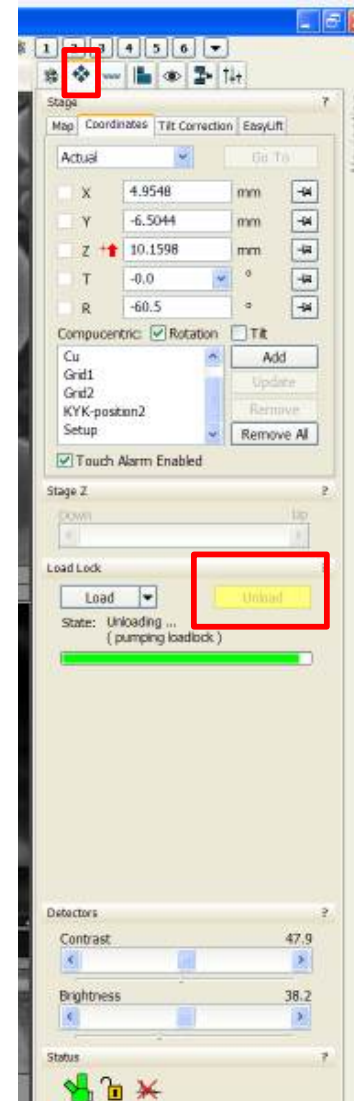
Finish

- 1) Beam control - E display Beam off, I display Beam off
- 2) Navigation - Unload

1)



2)



Unload

- 1) Clamp & Release 램프에 불이 둘 다 들어오면 vent 완료 뚜껑 열고
- 2) Release 눌러서 clamp 해지
- 3) 본인 샘플 Holder 제거 후 loadlock 안의 holder 장착
- 4) Holder를 올리면 Clamp&Load 램프에 불이 들어오고 홀더가 잘 장착 되었는지 가운데 눌러서 확인 후 버튼을 눌러 clamp 진행
- 5) 뚜껑을 닫으면 램프 두 군데 불이 들어오고 Clamp&Load 버튼을 누른다(Chamber안으로 샘플 로딩)

