| KLA-DSE Standard Operating Procedure | |
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## 1. Equipment Purpose

This document outlines the procedures required to safely and effectively operate the KLA-DSE deep silicon etch system. It is intended for trained and authorized users working within the nano@stanford facility. Labels are marked on the software screens below to help operators understand the on-screen terminology used throughout this SOP.

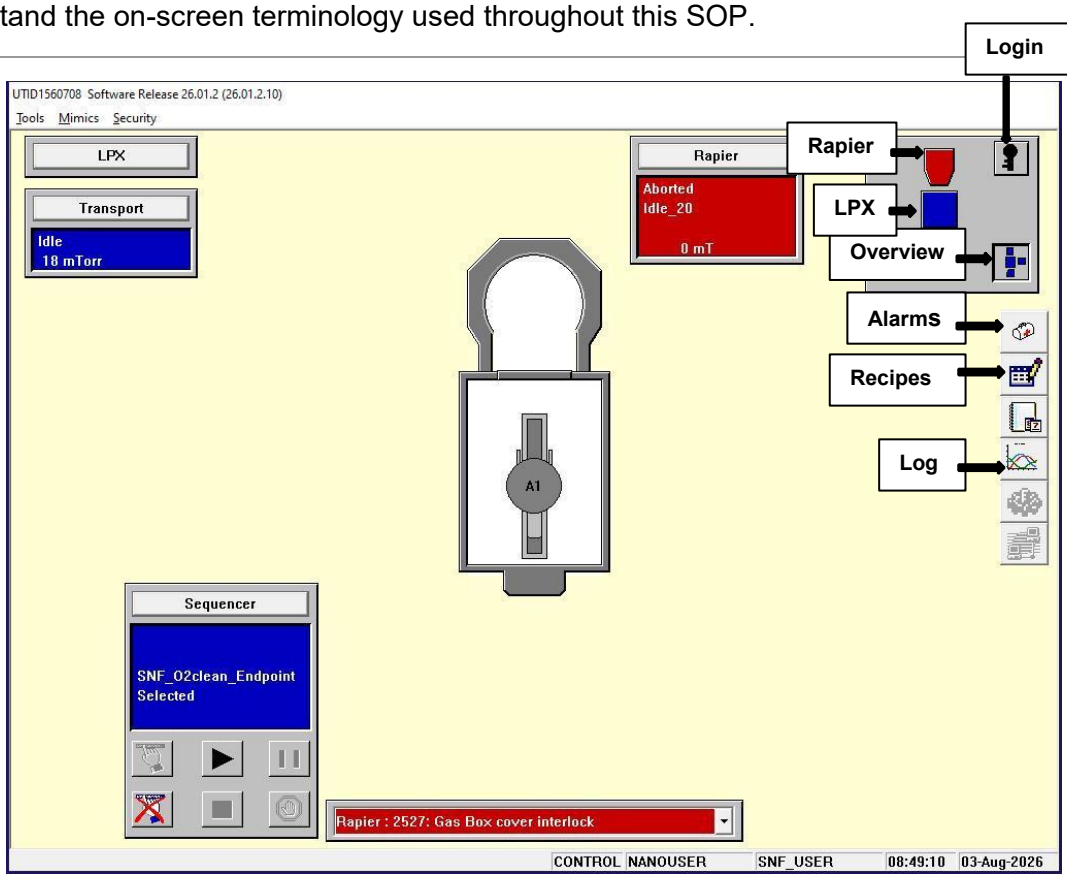



*Fig. 1 — Overview / Control Mimic display, with LPX, Transport, Rapier, and Sequencer status boxes*

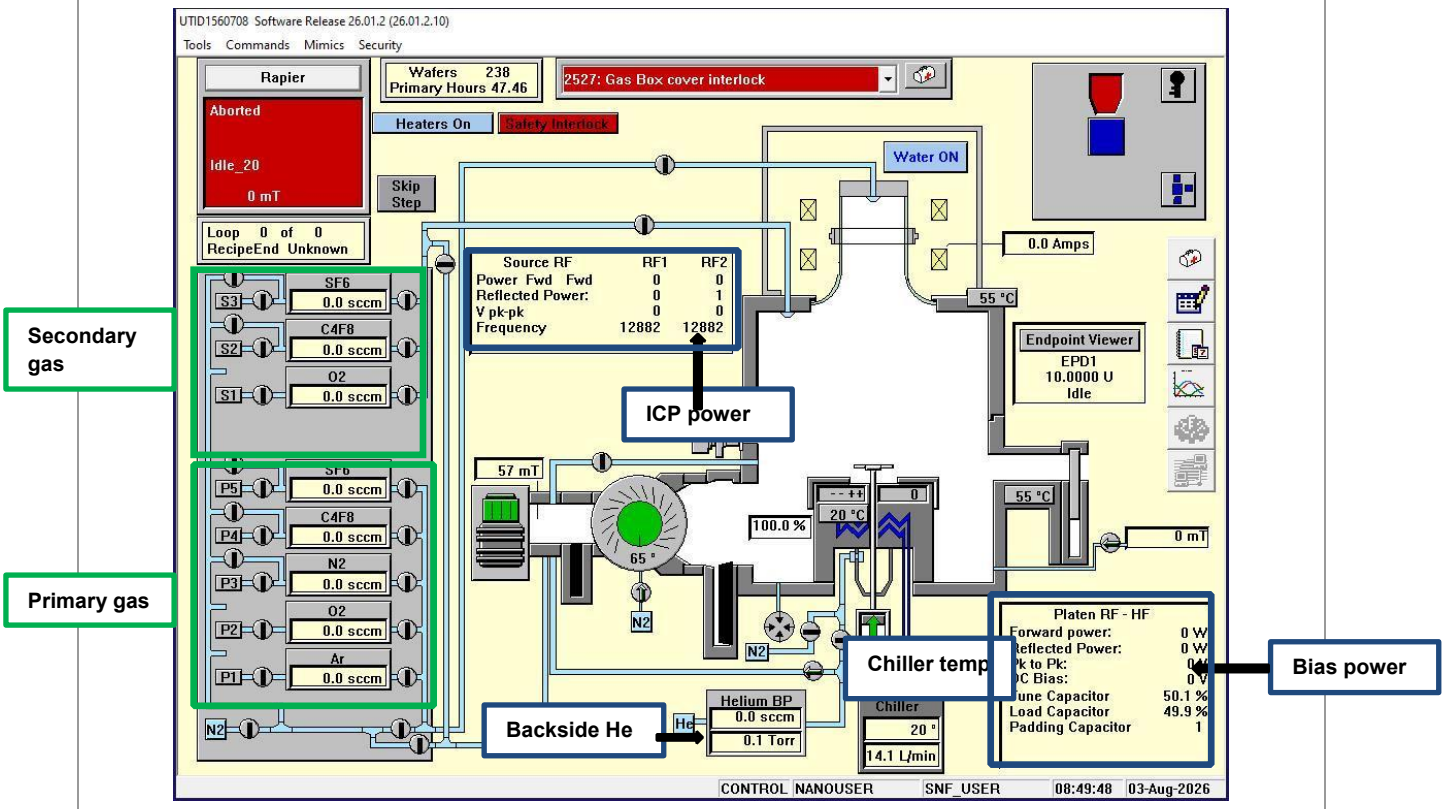



*Fig. 2 — Rapier process mimic display, showing gas panel, Source RF, Platen RF, chiller, and endpoint viewer*

## 2. Equipment Specifications

### 2.1. System Configuration

- KLA-DSE is a single-wafer load lock (LPX) module paired with a dedicated Rapier process chamber for deep silicon etching (Bosch process).
- The load lock integrates vacuum handling and wafer transport functions in a single compact module.
- The process chamber is fitted with dual ICP source (RF1, RF2) and dual platen power (HF, LF), monitored live on the Rapier mimic.
- Process gas panel includes $SF_6$, $C_4F_8$, $O_2$, Ar, and $N_2$ lines, each with independent mass-flow readouts (see Fig. 2).
- The chamber uses an Electrostatic Chuck (ESC) for wafer clamping, with helium backside cooling and a chiller/recirculator for chuck temperature control. Idle setpoints of 0 °C (Idle_0) and 20 °C (Idle_20) are used operationally, along with an Idle_No_Temp state that idles at the current chuck temperature.
- A filter-based endpoint detection viewer (EPD1) is available for monitoring etch and clean steps.

### 2.2. Software Interface and Interface Elements

Tool operation is managed through the same graphical mimic interface used across the Rapier/LPX platform, presenting overview, transport, and process (Rapier) views. The available menu options change depending on which mimic is active — refer to Fig. 1 and Fig. 2 above. Key elements:

- LPX / Transport status box — shows load lock and transport module state and pressure (e.g., Idle, 18 mTorr).
- Rapier status box — shows process module state (e.g., Aborted, Idle_20) and chamber pressure.
- Sequencer panel — hand (select), play, pause, stop, and clear (hand with red cross) icons used to load and run sequence recipes.
- Item toolbar (right-hand column) — quick access to fault response / first aid, the recipe editor, event log, and data viewer.
- Fault message bar — displays active warnings and interlocks (e.g., “Gas Box cover interlock”).
- Gas line displays — real-time flow readouts for $SF_6$, $C_4F_8$, $O_2$, Ar, and $N_2$.
- Source RF / Platen RF (HF) data — forward/reflected power, peak-to-peak voltage, frequency, DC bias, and tune/load/padding capacitor positions.
- Endpoint Viewer (EPD1) — real-time endpoint trace used during clean and etch steps.
- Chiller display — current chuck temperature setpoint and coolant flow rate (L/min).

## 3. Cleanliness Standard

KLA-DSE is designated a CMOS-Clean category tool.

- Wafers processed in flexible (non-CMOS-clean) tools are restricted from use on KLA-DSE.
- The wafer backside must always be clean and free of particles or any residue, including photoresist — no PR is permitted on the backside of the wafer.

## 4. Processing Capabilities

KLA-DSE supports silicon substrate etching within the following limits:

- Only silicon etch with photoresist (SPR or AZ only), $SiO_2$, or SiN masks are allowed. Anything else requires approval from the primary engineer or ProM committee.
- No exposed metals — before or after etch — may be exposed to the plasma.
- No through-wafer etch on full wafers; this can damage the ESC chuck.
- No bonding material is allowed without approval — talk to the primary engineer or ProM committee (this includes Santovac oil).
- Violating these restrictions may lead to a tool ban.

- Not comfortable with these limitations? Use PT-DSE instead.

**No bonding material — including Santovac oil — may be used on KLA-DSE without prior approval.**

Contact the primary engineer or the ProM committee before mounting or bonding any substrate. Unapproved bonding materials, exposed metal, or through-wafer etches on full wafers can damage the ESC chuck and will result in a tool ban.

## 5. Safety

- Certain sections of the equipment carry active RF power during operation. All enclosures where RF energy may be present are labeled, and access panels are equipped with electrical interlocks to prevent accidental exposure.
- The tool operates under vacuum and includes high-voltage electrical components (including the ESC). Do not open or access any internal area without proper authorization and lockout/tagout procedures in place.
- Do not defeat, bypass, or ignore Safety Interlock alarms. If an alarm cannot be cleared using the Reset procedure (Section 6.2), stop and use the first aid box, or contact lab staff.

## 6. Operating Procedure

### 6.1. System Login

1. Enable KLA-DSE in NEMO before proceeding.
2. Open the login dialog on the tool computer.

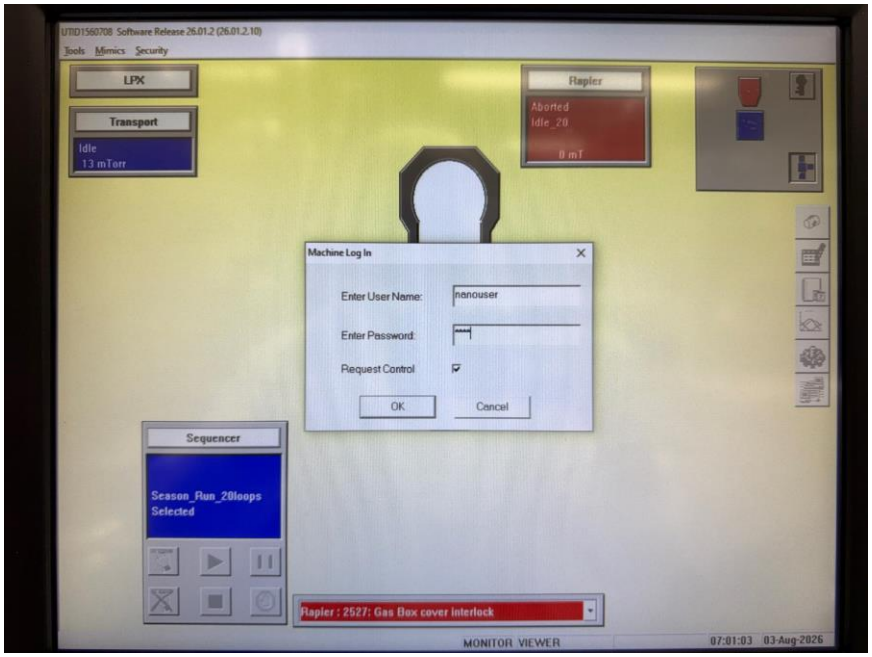



*Fig. 3 — Machine Log In dialog*

3. Enter Username: nanouser and Password: user, then click OK.

## 6.2. Clearing Residual Alarms

4. Go to the Chamber / Rapier diagram.
5. Click on Safety Interlock.

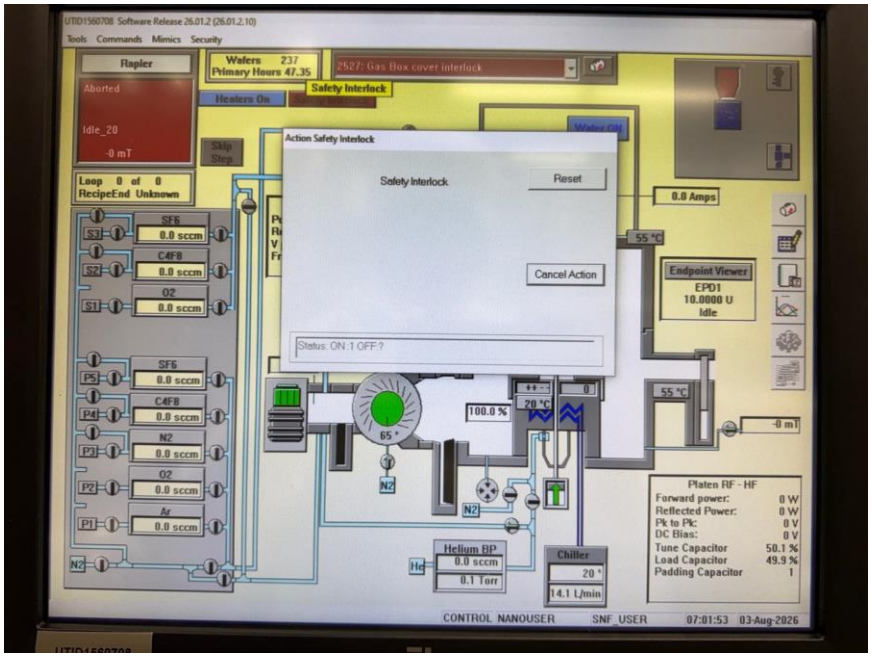



*Fig. 4 — Action Safety Interlock dialog*

6. Click Reset. If all alarms clear, the idle status box turns blue.

**Unable to clear the alarm?**

- Go to the first aid box (item toolbar icon).
- Click on each active alarm.
- Acknowledge them individually.
- Click OK.

### 6.3. Idling at Recipe Temperature

Before venting the load lock, bring the chamber to the correct idle temperature. This time can also be used for chamber cleaning or seasoning steps.

7. Click on the Rapier.
8. Click Idle.

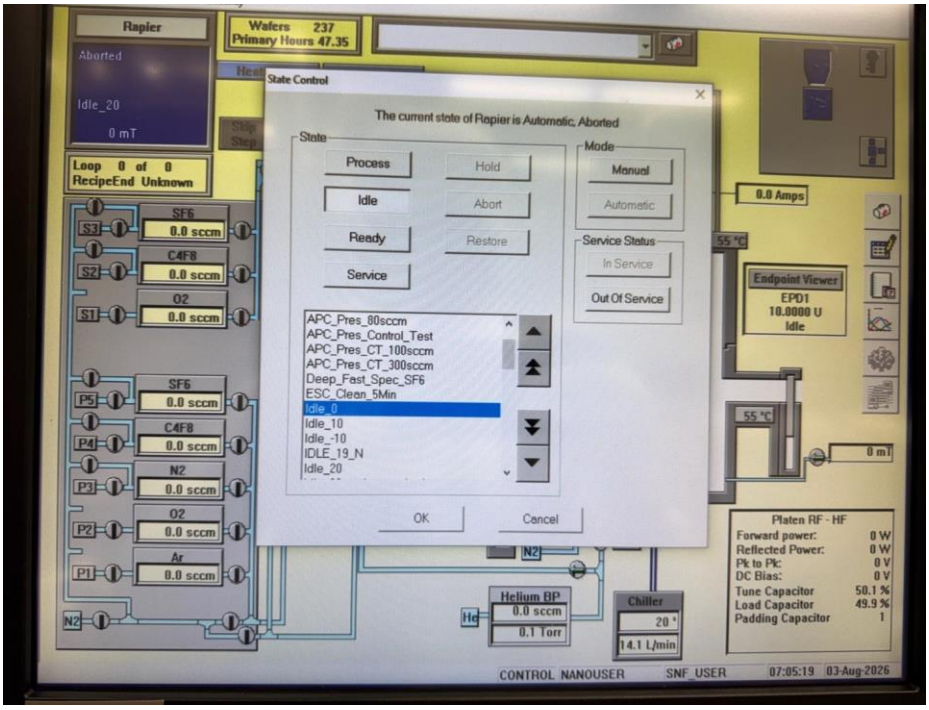



*Fig. 5 — State Control dialog, selecting an Idle recipe*

9. Select Idle_0, then ok. The chiller will start ramping down and takes about 20 minutes to reach 0 °C.
10. Click on the Rapier, then click Abort, then ok.
11. Click on the Rapier, then click Idle, and select Idle_No_Temp, then ok.
12. Wait for the Rapier idle box to turn blue (temperature will continue to ramp down in the background).

## 6.4. Sample Loading

**Vent the load lock / LPX:**

- Go to the overview / Transport diagram.
- Click on Transport, then click Vent.
- Click OK. The idle box turns green while venting and returns to blue once venting is complete.

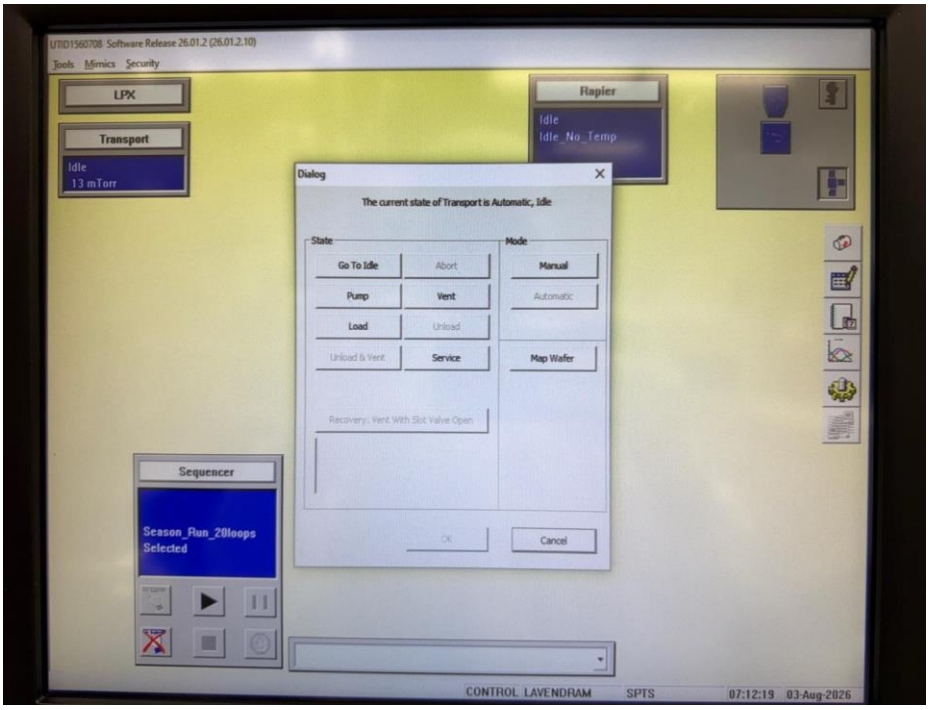



*Fig. 6 — Transport State Control dialog, Vent selected*

**Open the load lock / LPX lid:**

- Unlock the latch (pull up).
- Pull and hold the deadbolt with your other hand.
- Lift the lid and hold it all the way up — do not let go.

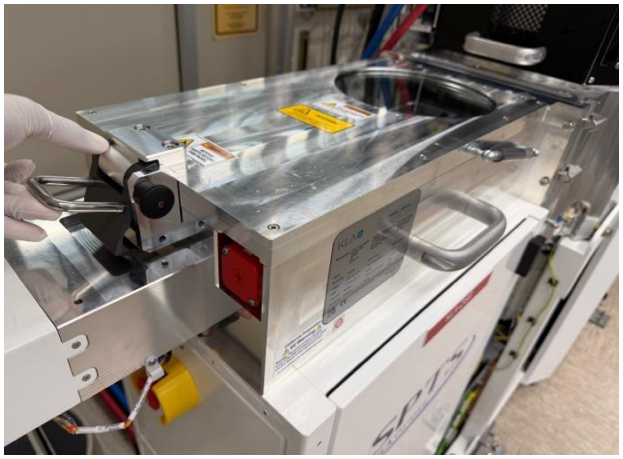


*Fig. 7 — Unlocking the load lock latch*

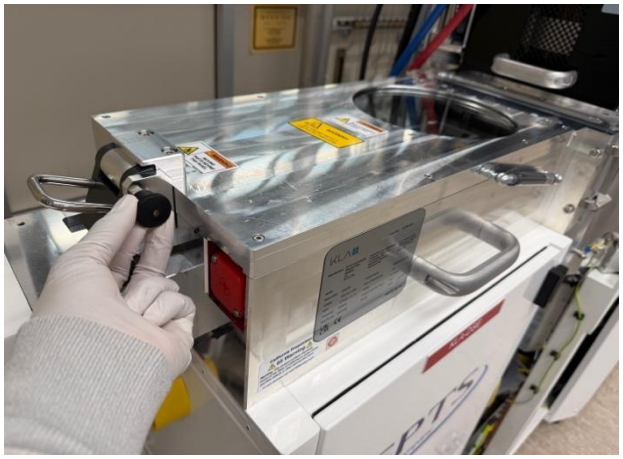


*Fig. 8 — Pulling and holding the deadbolt*

*Fig. 9 — Lid lifted and held open, load lock arm exposed*

**Place the wafer:**

- Place the wafer on the arm / fork with the flat facing toward the chamber and align the flat to the reference line.
- Close the lid and lock the latch (snap down on the latch)

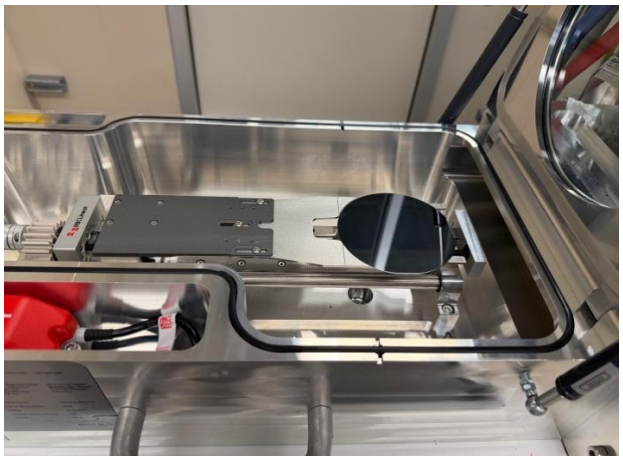


*Fig. 10 — Wafer placed on the load lock arm*

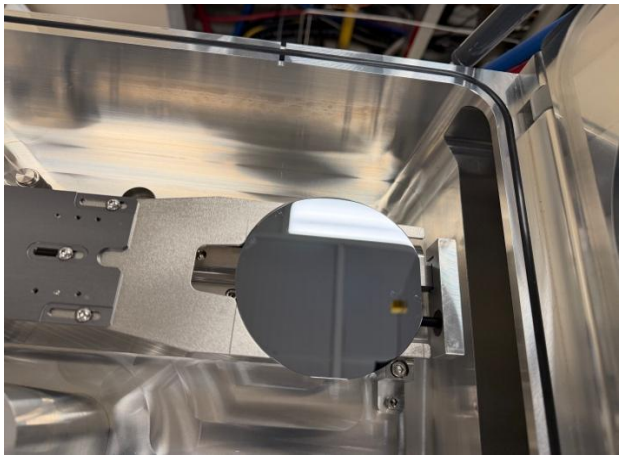


*Fig. 11 — Wafer flat aligned to the reference mark*

### 6.5. Recipe Selection & Sequence Start

13. To replace an existing recipe selection, click the hand icon with the red cross.
14. Click Yes to confirm — the Sequencer box will show no recipe selected, just Idle.
15. Click on the hand icon to open the Select Sequence list.
16. Select the desired recipe from the list.

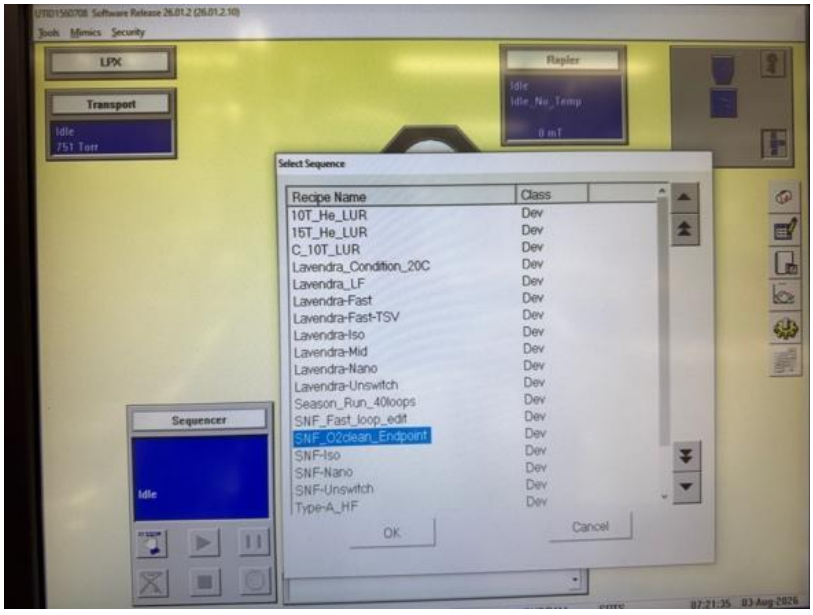



*Fig. 12 — Select Sequence recipe list*

17. Click OK — the desired recipe is now loaded.
18. Click Play.
19. Click OK to start the LPX sequence. Confirm or enter the Wafer ID, leave Wafer Type as Standard, and click OK.

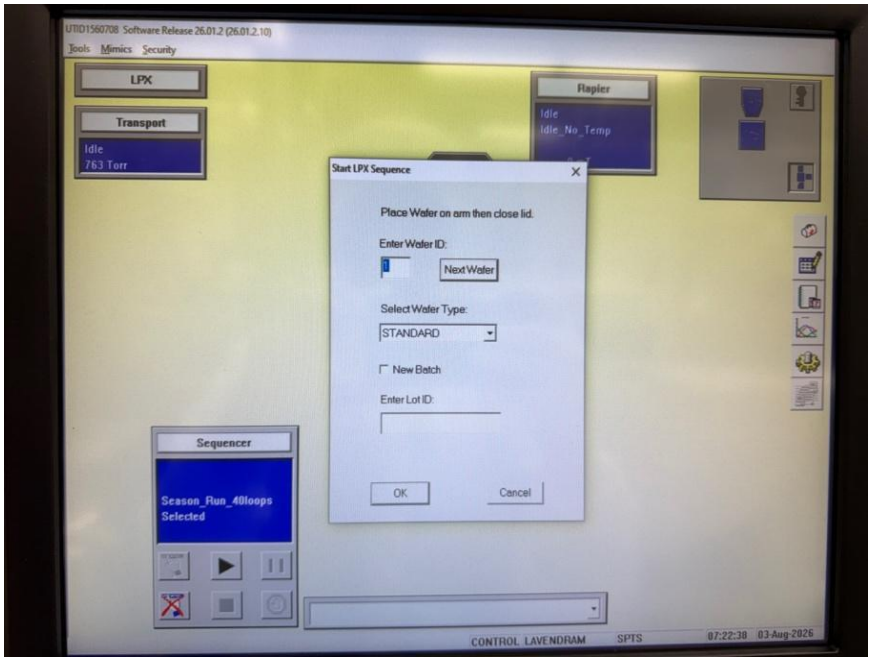



*Fig. 13 — Start LPX Sequence dialog*

20. Click Start to confirm and begin the sequence.

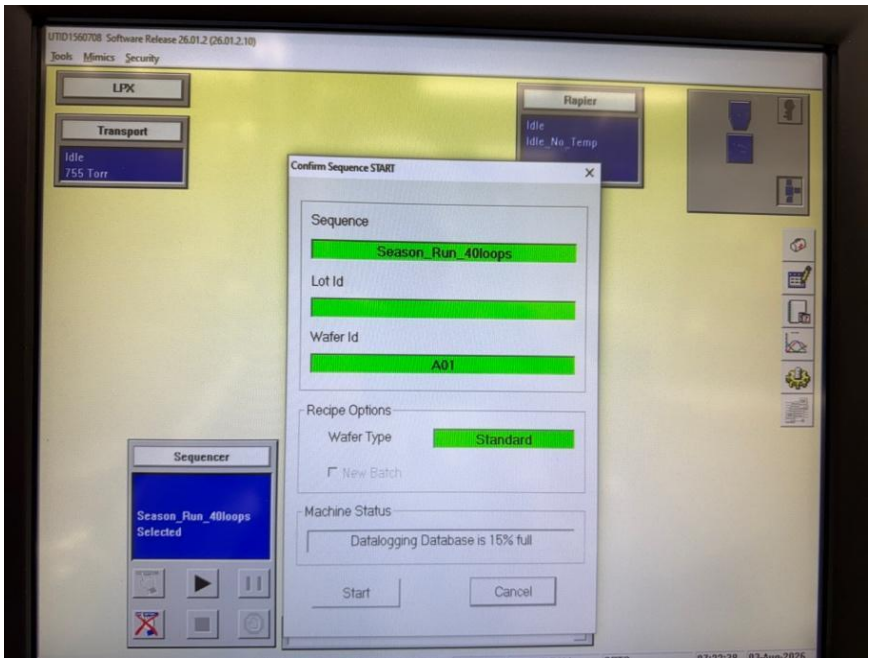



*Fig. 14 — Confirm Sequence START dialog*

## 6.6. Running & Monitoring the Etch Process

The load lock will start pumping; the LPX idle status box turns green and, once it reaches roughly 80 mTorr, the tool initiates the wafer transfer. Go to the Chamber / Rapier diagram and monitor the following during processing:

- Loop status
- Recipe end time
- Temperature
- He backside
- RF stats
- Gas stats

When processing is complete, the wafer is unloaded, the Rapier module returns to Idle, and the load lock begins venting automatically (Automatic mode).

### 6.7. Post-Process Clean & Idle

**After process complete:**

- Load your dummy wafer into the load lock and run the “SNF_O2clean_Endpoint” recipe.
- Leave the chamber at 20 °C — follow the Idle at Room Temperature steps below.

**Idling at room temperature:**

- Click the Rapier status box, then click Abort, then click OK.
- Click the Rapier status box, then click Idle, and select Idle_20.
- Click OK.

### 6.8. Sample Retrieval, Pump Down & Logout

21. Vent and open the load lock lid using the steps above, then remove your processed wafer.
22. Close the load lock lid.
23. Click Transport, then click Pump to pump down the load lock / LPX (if not in Idle, Click Transport, then click Go to Idle).
24. Disable KLA-DSE in NEMO.

### 6.9. Important Notes

- Always run the SNF_O2clean_Endpoint recipe and idle the chamber (Idle_20) before disabling the tool — do not leave the chamber pumping at process temperature unattended.
- Never leave the load lock lid unsupported while open; hold it fully up at all times.
- Review Section 4 (Processing Capabilities) before every run — violations may result in a tool ban.

## 7. Troubleshooting

- If a residual alarm will not clear using Reset (Section 6.2), use the first aid box to acknowledge each fault individually before retrying.
- If the system aborts unexpectedly or you encounter any anomaly during operation, report the issue in NEMO immediately and contact lab staff or the primary engineer.
- Detailed fault-specific troubleshooting steps are still being compiled for this tool (TBA) — contact lab staff for issues not covered above.

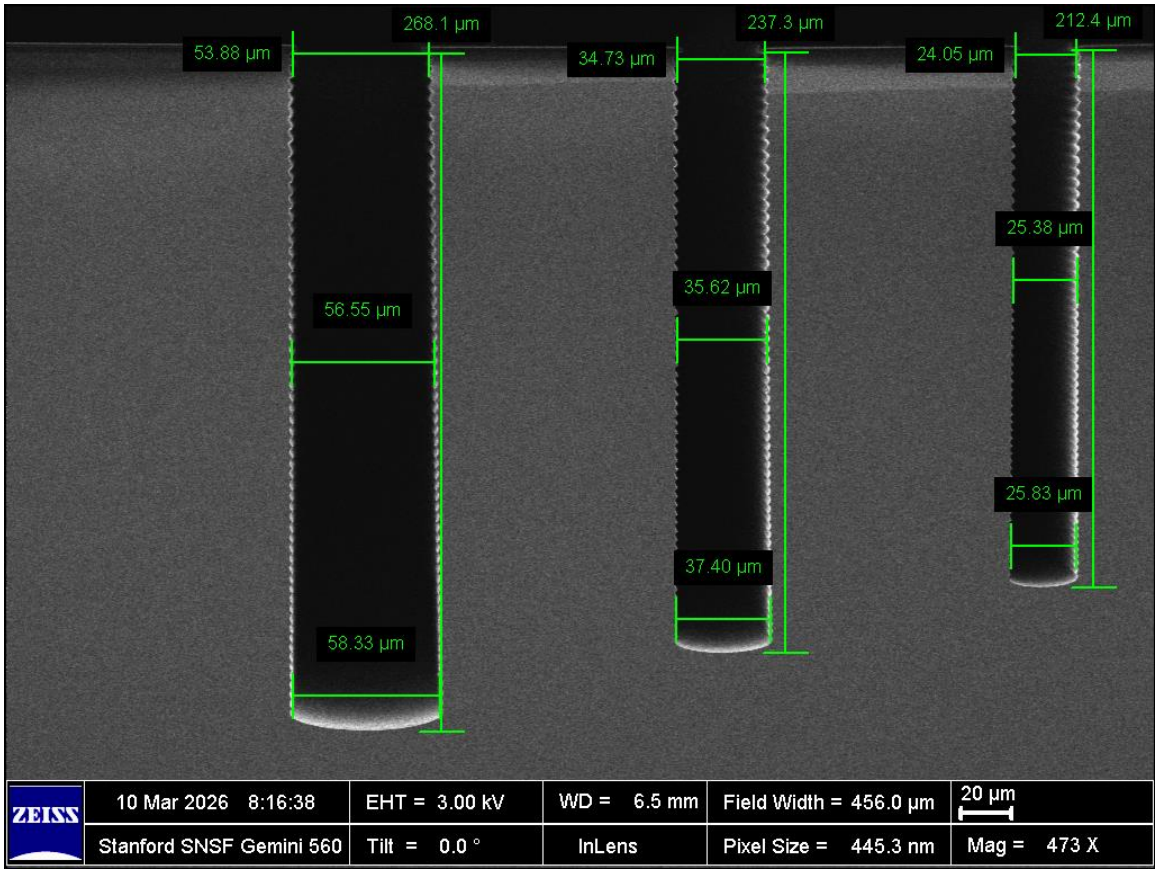
## 8. Recipes and results

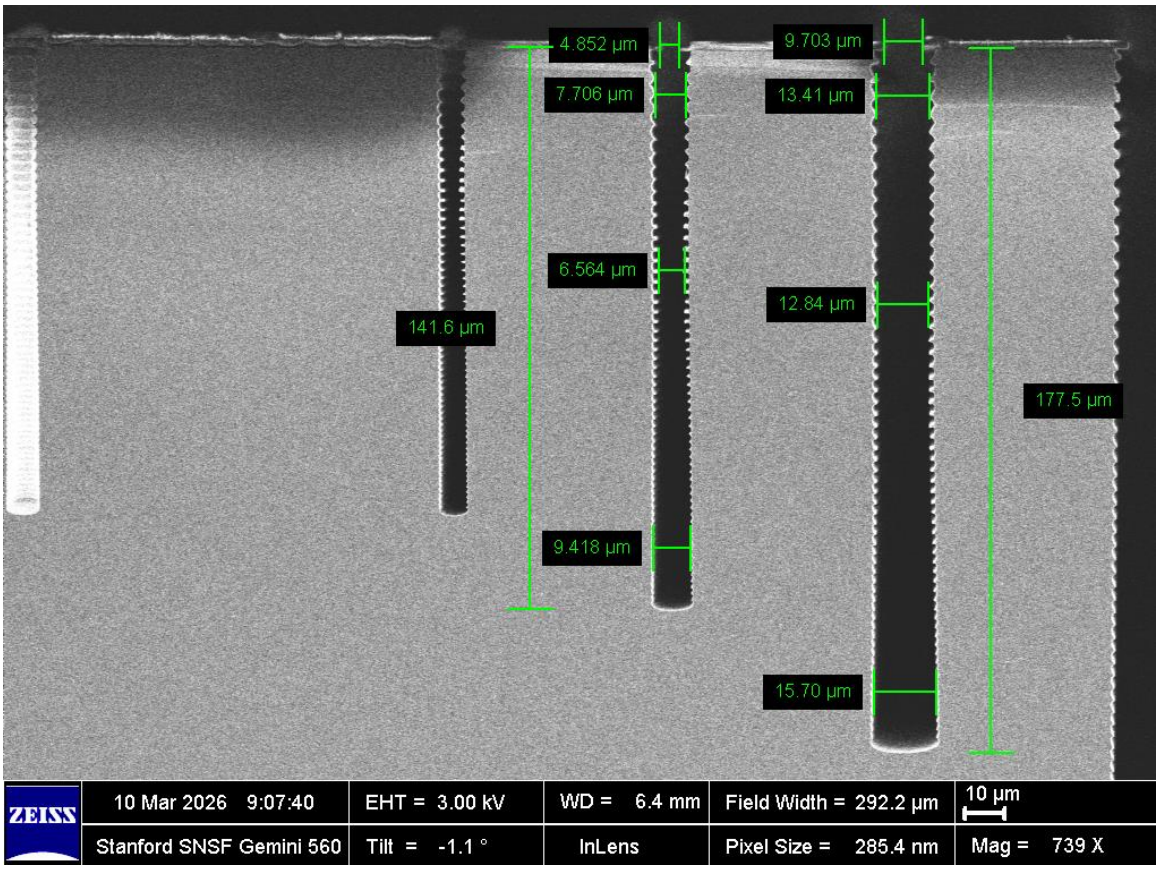
### 8.1. SNF_Fast_loop_Edit

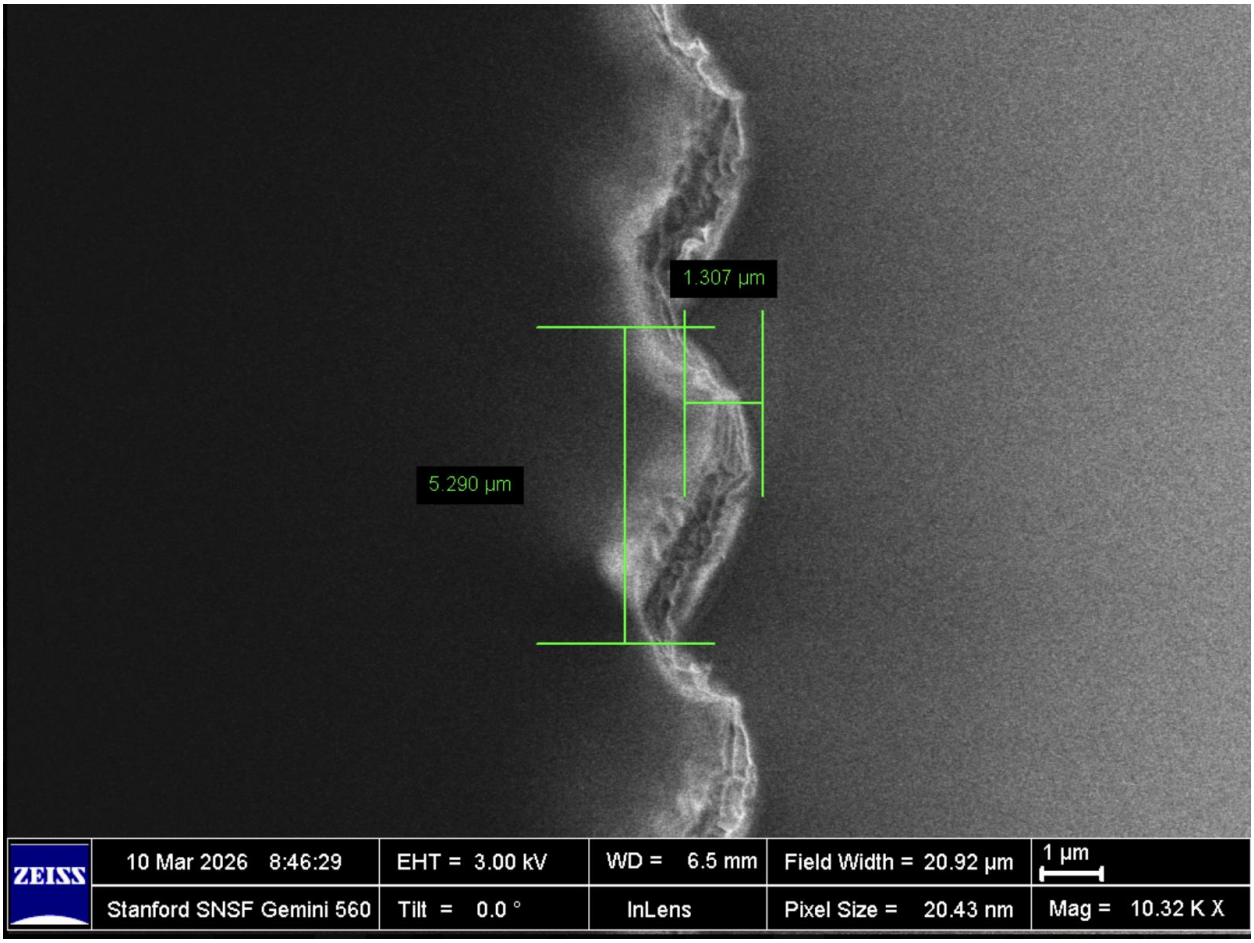
| | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Step Name | | Strike | Dep | E1 | E2 |
| Process Time | Secs | 1.0 | 2.4 | 1.2 1.2 | 6.0 |
| Process Pressure | mTorr | 80.0 ± 0 % | 80.0 ± 20 % | 25.0 25.0 ± 40 % | 200.0 ± 20 % |
| APC Setpoint Position | % | 0.0 | 0.0 | 0.0 | 0.0 |
| APC Mode | | Automatic | Automatic | Automatic | Automatic |
| Source 1 power | Watts | 2500 ± 0 % | 2500 ± 20 % | 2500 2500 ± 20 % | 3500 ± 20 % |
| Source 1 AFT Mode | | Manual | Automatic | Automatic | Automatic |
| Source 1 AFT Frequency | KHz | 13000 | 13560 | 13560 | 13560 |
| Source 1 RF Control Mode | | Load | Load | Load | Load |
| Source 2 power | Watts | 1100 ± 0 % | 1100 ± 20 % | 1100 1100 ± 20 % | 1100 ± 20 % |
| Source 2 AFT Mode | | Manual | Automatic | Automatic | Automatic |
| Source 2 AFT Frequency | KHz | 13100 | 13560 | 13560 | 13560 |
| Source 2 RF Control Mode | | Load | Load | Load | Load |
| Platen Frequency | | Hi Freq | Hi Freq | Hi Freq | Hi Freq |
| Platen HF Power | Watts | 0.0 ± 0 % | 10.0 ± 5 % | 130.0 150.0 ± 40 % | 0.0 ± 40 % |
| Platen HF Capacitor Adjust | | Preset | Automatic | Automatic | Automatic |
| Platen HF Tune Capacitor | % | 13.0 ± 5 % | 13.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen HF Load Capacitor | % | 65.0 ± 5 % | 49.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen HF Padding Capacitor | | 2 | 2 | 2 | 2 |
| Platen HF Control Mode | | Load | Load | Load | Load |
| Platen HF Modulation Enabled | | Enable | Enable | Enable | Enable |
| Platen HF Modulation Frequency | Hz | 150 | 150 | 150 | 150 |
| Platen HF Modulation Duty Cycle | % | 50 | 50 | 50 | 50 |
| Platen LF Power | Watts | 40.0 ± 0 % | 40.0 ± 5 % | 80.0 80.0 ± 20 % | 30.0 ± 20 % |
| Platen LF Control Mode | | Load | Load | Load | Load |
| Platen LF Capacitor Adjust | | Preset | Automatic | Automatic | Automatic |
| Platen LF Tune Capacitor | % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen LF Load Capacitor | % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen LF Padding Capacitor | | 2 | 2 | 2 | 2 |
| Platen LF Max Reflected | Watts | 300 | 300 | 300 | 300 |
| Platen LF Modulation Enabled | | Enable | Enable | Enable | Enable |
| Platen LF Modulation Frequency | Hz | 150 | 150 | 150 | 150 |
| Platen LF Modulation Duty Cycle | % | 10 | 10 | 10 | 10 |
| Platen Temperature | | 0 ± 0 | 0 ± 0 | 0 0 ± 0 | 0 ± 0 |
| Helium pressure | Torr | 15.0 ± 5 % | 15.0 ± 5 % | 15.0 15.0 ± 5 % | 15.0 ± 5 % |
| Helium Flow Warning Level | sccm | 8.0 | 8.0 | 8.0 | 8.0 |
| Helium Flow Fault Level | sccm | 12.0 | 12.0 | 12.0 | 12.0 |
| Coil current | Amps | 10.0 ± 20 % | 10.0 ± 20 % | 10.0 ± 20 % | 10.0 ± 20 % |
| Loop destination | | 0 | 0 | 0 | 2 |
| Number of loops | | 0 | 0 | 0 | 115 |
| Loop Variation Parameter | | 0.0 | 0.0 | 1.0 | 0.0 |
| ESC Voltage | Volts | 5000 ± 10 % | 5000 ± 10 % | 5000 ± 10 % | 5000 ± 10 % |
| Gas Line Config | | Flow | Flow | Flow | Flow |
| P1 Ar | sccm | 200.0 ± 20 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| P2 O2 | sccm | 0.0 ± 5 % | 1.0 ± 0 % | 130.0 130.0 ± 5 % | 0.0 ± 5 % |
| P3 N2 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| P4 C4F8 | sccm | 200.0 ± 20 % | 500.0 ± 20 % | 1.0 1.0 ± 0 % | 1.0 ± 0 % |
| P5 SF6 | sccm | 1.0 ± 0 % | 1.0 ± 0 % | 1.0 1.0 ± 0 % | 800.0 ± 20 % |
| S1 O2 | sccm | 0.0 ± 5 % | 1.0 ± 0 % | 70.0 70.0 ± 20 % | 0.0 ± 5 % |
| S2 C4F8 | sccm | 120.0 ± 5 % | 160.0 ± 20 % | 1.0 1.0 ± 0 % | 1.0 ± 0 % |
| S3 SF6 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |

Platen temp @ 0°C

| **Loops: #60** | CD:50um | CD:30um | CD:20um | CD:10um | CD:5um |
|---|---|---|---|---|---|
| Etch depth | 268um | 237um | 212 | 177 | 141 |
| Etch/cycle | 4.4um | 3.9um | 3.5um | 2.9um | 2.3um |
| Scallops | 1.3um | | | | |
| PR Selectivity | 290:1 @50um CD | | | | |
| SiO2 Selctivity | 1000:1 @50um CD | | | | |


268.1 µm
53.88 µm
237.3 µm
34.73 µm
212.4 µm
24.05 µm
25.38 µm
56.55 µm
35.62 µm
25.83 µm
37.40 µm
58.33 µm
ZEISS
10 Mar 2026 8:16:38
EHT = 3.00 kV
WD = 6.5 mm
Field Width = 456.0 µm
20 µm
Stanford SNSF Gemini 560
Tilt = 0.0 °
InLens
Pixel Size = 445.3 nm
Mag = 473 X


4.852 µm
9.703 µm
7.706 µm
13.41 µm
6.564 µm
12.84 µm
141.6 µm
177.5 µm
9.418 µm
15.70 µm
ZEISS
10 Mar 2026 9:07:40
EHT = 3.00 kV
WD = 6.4 mm
Field Width = 292.2 µm
10 µm
Stanford SNSF Gemini 560
Tilt = -1.1 °
InLens
Pixel Size = 285.4 nm
Mag = 739 X

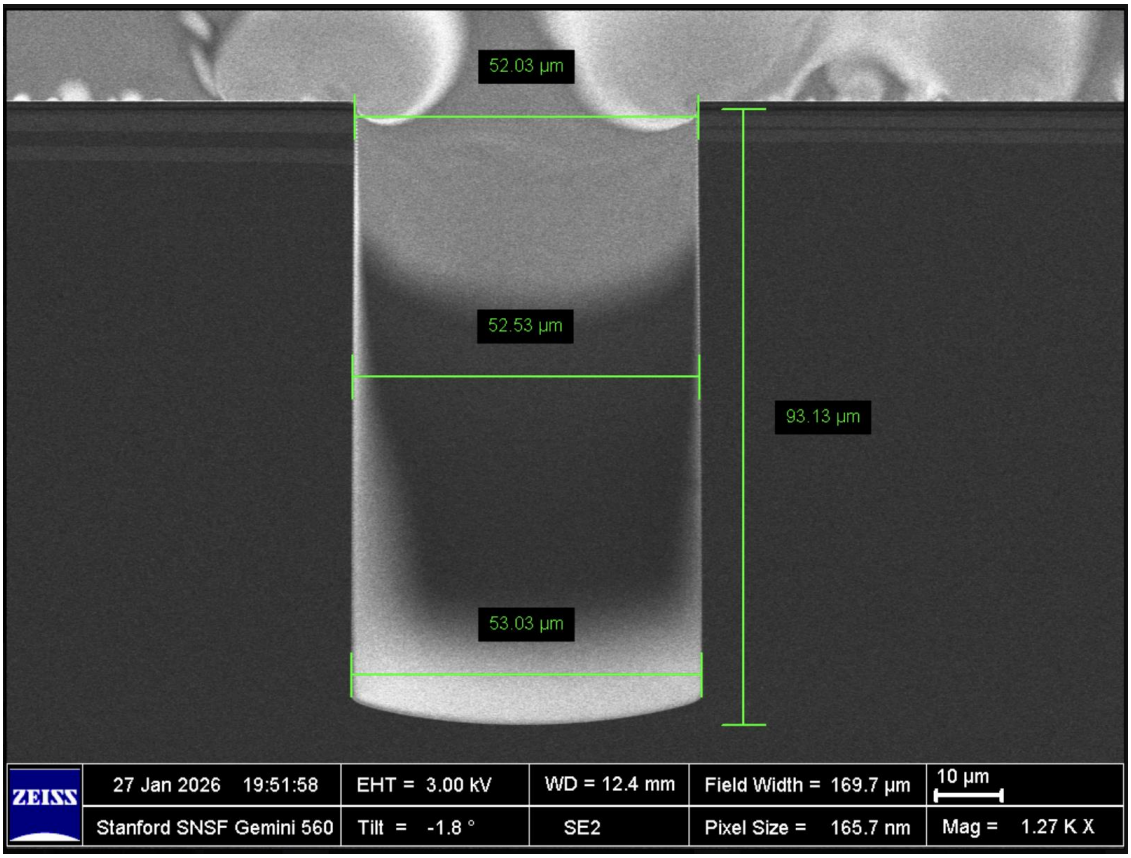

1.307 µm
5.290 µm
ZEISS
10 Mar 2026 8:46:29
EHT = 3.00 kV
WD = 6.5 mm
Field Width = 20.92 µm
1 µm
Stanford SNSF Gemini 560
Tilt = 0.0 °
InLens
Pixel Size = 20.43 nm
Mag = 10.32 K X

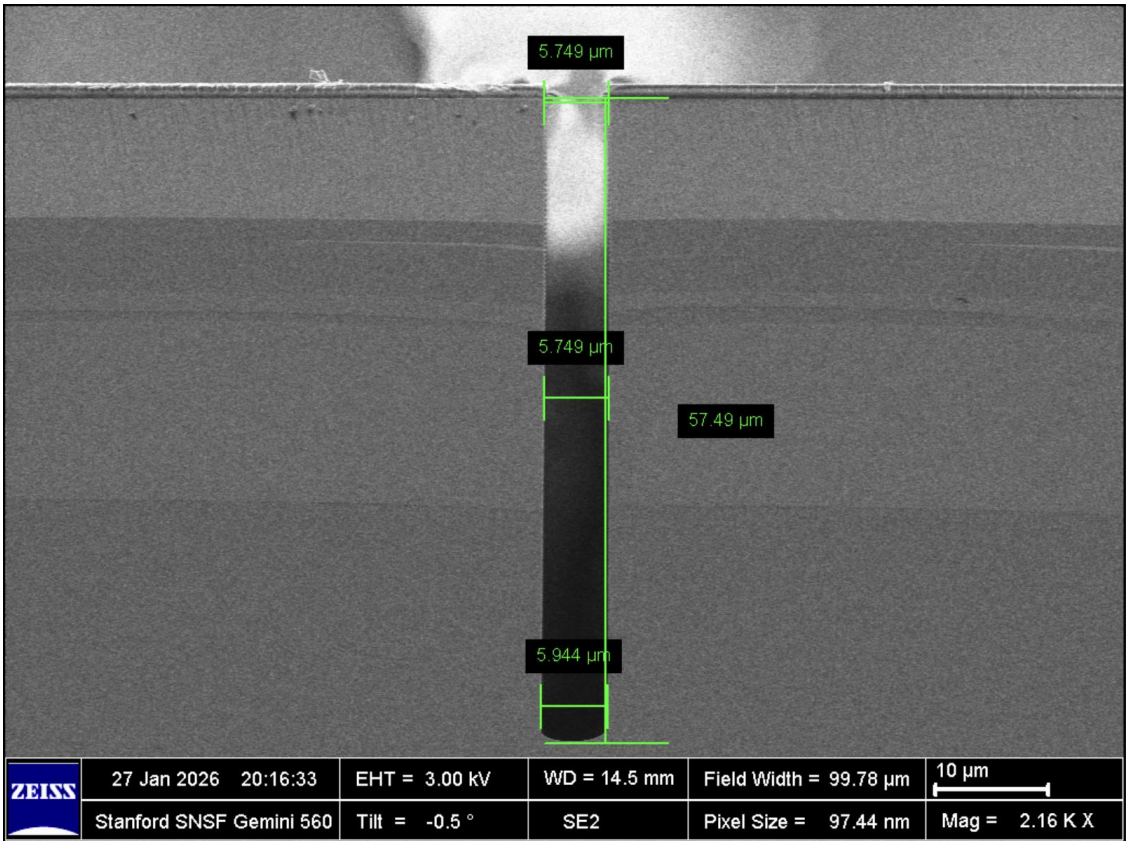
## 8.2. SNF_Slow_loop Edit

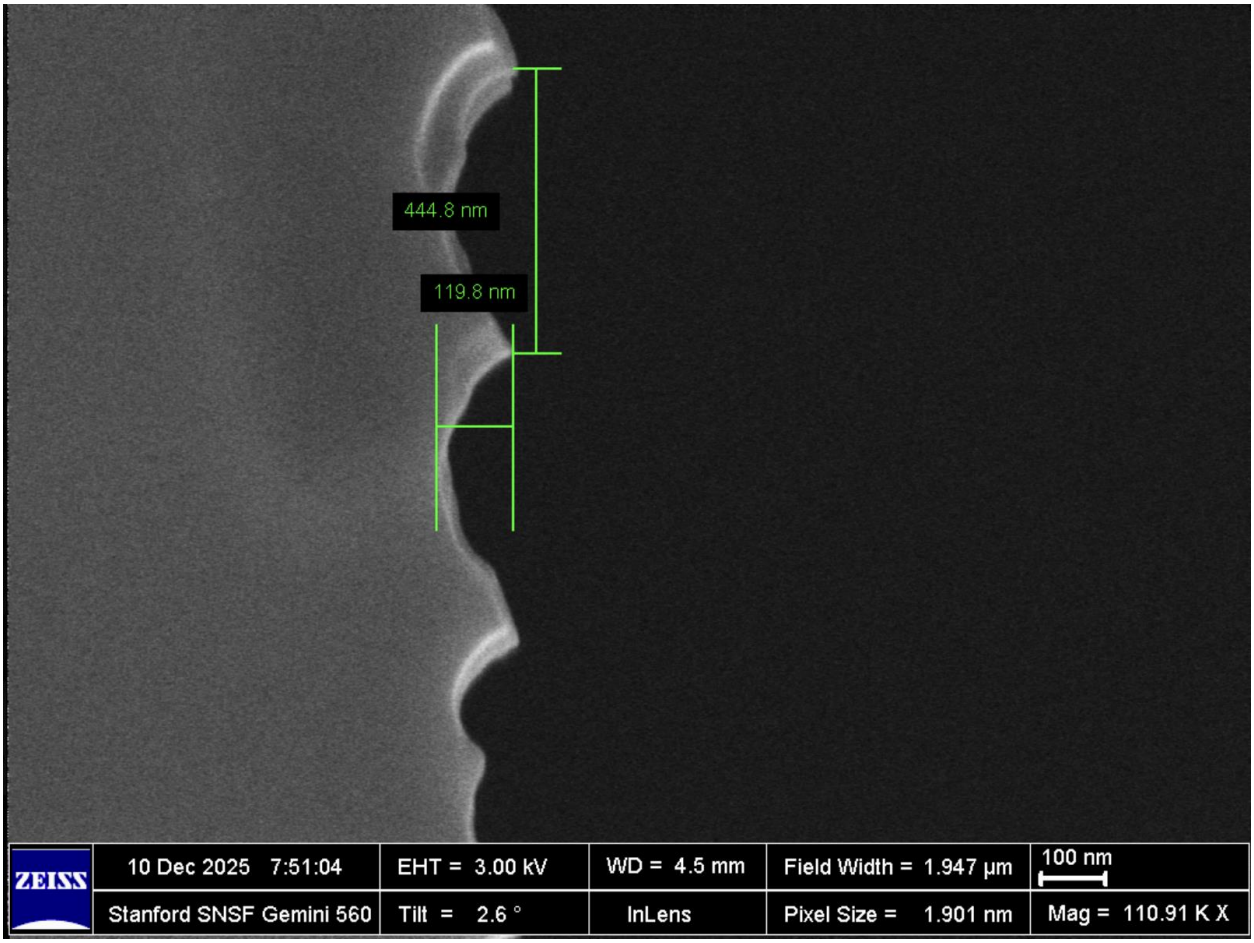
| | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Step Name | | Strike | Dep | E1 | E2 |
| Process Time | Secs | 1.0 | 1.4 | 1.5 1.5 | 1.9 |
| Process Pressure | mTorr | 40.0 ± 0 % | 45.0 ± 40 % | 25.0 25.0 ± 40 % | 40.0 ± 40 % |
| APC Setpoint Position | % | 0.0 | 0.0 | 0.0 | 0.0 |
| APC Mode | | Automatic | Automatic | Automatic | Automatic |
| Source 1 power | Watts | 2500 ± 0 % | 2500 ± 20 % | 2500 2500 ± 20 % | 2500 ± 20 % |
| Source 1 AFT Mode | | Manual | Automatic | Automatic | Automatic |
| Source 1 AFT Frequency | KHz | 12950 | 13560 | 13560 | 13560 |
| Source 1 RF Control Mode | | Load | Load | Load | Load |
| Source 2 power | Watts | 1000 ± 0 % | 1000 ± 20 % | 1000 1000 ± 20 % | 1000 ± 20 % |
| Source 2 AFT Mode | | Manual | Automatic | Automatic | Automatic |
| Source 2 AFT Frequency | KHz | 13600 | 13560 | 13560 | 13560 |
| Source 2 RF Control Mode | | Load | Load | Load | Load |
| Platen HF Power | Watts | 0.0 ± 0 % | 0.0 ± 5 % | 50.0 75.0 ± 40 % | 23.0 ± 40 % |
| Platen HF Capacitor Adjust | | Preset | Automatic | Automatic | Automatic |
| Platen HF Tune Capacitor | % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen HF Load Capacitor | % | 50.0 ± 5 % | 55.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen HF Padding Capacitor | | 2 | 2 | 2 | 2 |
| Platen HF Control Mode | | Load | Load | Load | Load |
| Platen HF Modulation Enabled | | Enable | Enable | Enable | Enable |
| Platen HF Modulation Frequency | Hz | 150 | 150 | 150 | 150 |
| Platen HF Modulation Duty Cycle | % | 20 | 20 | 20 | 20 |
| Helium pressure | Torr | 15.0 ± 20 % | 15.0 ± 20 % | 15.0 15.0 ± 20 % | 15.0 ± 20 % |
| Helium Flow Warning Level | sccm | 8.0 | 8.0 | 8.0 | 8.0 |
| Helium Flow Fault Level | sccm | 12.0 | 12.0 | 12.0 | 12.0 |
| Coil current | Amps | 10.0 ± 0 % | 10.0 ± 20 % | 10.0 ± 20 % | 10.0 ± 20 % |
| Loop destination | | 0 | 0 | 0 | 2 |
| Number of loops | | 0 | 0 | 0 | 167 |
| Loop Variation Parameter | | 0.0 | 0.0 | 1.0 | 0.0 |
| ESC Voltage | Volts | 5000 ± 10 % | 5000 ± 10 % | 5000 ± 10 % | 5000 ± 10 % |
| Gas Line Config | | Flow | Flow | Flow | Flow |
| P1 Ar | sccm | 200.0 ± 20 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| P2 O2 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| P3 N2 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| P4 C4F8 | sccm | 200.0 ± 20 % | 360.0 ± 20 % | 1.0 1.0 ± 0 % | 1.0 ± 0 % |
| P5 SF6 | sccm | 0.0 ± 5 % | 1.0 ± 0 % | 300.0 300.0 ± 20 % | 400.0 ± 20 % |
| S1 O2 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| S2 C4F8 | sccm | 100.0 ± 20 % | 95.0 ± 20 % | 1.0 1.0 ± 0 % | 1.0 ± 0 % |
| S3 SF6 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |

Platen temp @ 19°C

| **Loops: #167** | CD:50um | CD:5um |
|---|---|---|
| Etch depth | 92um | 56um |
| Etch/cycle | 550nm | 330nm |
| Scallops | 120nm | |
| PR Selectivity | 57:1 @50um CD | |
| SiO2 Selectivity | | |


52.03 µm
52.53 µm
93.13 µm
53.03 µm
ZEISS
27 Jan 2026 19:51:58
EHT = 3.00 kV
WD = 12.4 mm
Field Width = 169.7 µm
10 µm
Stanford SNSF Gemini 560
Tilt = -1.8 °
SE2
Pixel Size = 165.7 nm
Mag = 1.27 K X


5.749 µm
5.749 µm
57.49 µm
5.944 µm
ZEISS
27 Jan 2026 20:16:33
EHT = 3.00 kV
WD = 14.5 mm
Field Width = 99.78 µm
10 µm
Stanford SNSF Gemini 560
Tilt = -0.5 °
SE2
Pixel Size = 97.44 nm
Mag = 2.16 K X


444.8 nm
119.8 nm
ZEISS
10 Dec 2025 7:51:04
EHT = 3.00 kV
WD = 4.5 mm
Field Width = 1.947 µm
100 nm
Stanford SNSF Gemini 560
Tilt = 2.6 °
InLens
Pixel Size = 1.901 nm
Mag = 110.91 K X

## 8.3. SNF_Nano

| | | 1 | | 2 | | 3 | | 4 | |
|---|---|---|---|---|---|---|---|---|---|
| Step Name | | Strike | | Dep | | E1 | | E2 | |
| Process Time | Secs | 1.0 | | 1.2 1.0 | | 1.0 1.1 | | 0.8 0.9 | |
| Process Pressure | mTorr | 40.0 | ± 0 % | 45.0 45.0 | ± 80 % | 25.0 25.0 | ± 80 % | 28.0 29.0 | ± 80 % |
| APC Setpoint Position | % | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| APC Mode | | Automatic | | Automatic | | Automatic | | Automatic | |
| Source 1 power | Watts | 2500 | ± 0 % | 2500 2500 | ± 20 % | 2500 2500 | ± 20 % | 2700 2700 | ± 20 % |
| Source 1 AFT Mode | | Manual | | Automatic | | Automatic | | Automatic | |
| Source 1 AFT Frequency | KHz | 13000 | | 13000 | | 13000 | | 13000 | |
| Source 1 RF Control Mode | | Load | | Load | | Load | | Load | |
| Source 2 power | Watts | 0 | ± 0 % | 0 0 | ± 20 % | 0 0 | ± 20 % | 0 0 | ± 20 % |
| Source 2 AFT Mode | | Manual | | Automatic | | Automatic | | Automatic | |
| Source 2 AFT Frequency | KHz | 13100 | | 13100 | | 13100 | | 13100 | |
| Source 2 RF Control Mode | | Load | | Load | | Load | | Load | |
| Platen Frequency | | Hi Freq | | Hi Freq | | Hi Freq | | Hi Freq | |
| Platen HF Power | Watts | 0.0 | ± 0 % | 0.0 0.0 | ± 5 % | 77.0 97.0 | ± 40 % | 0.0 0.0 | ± 40 % |
| Platen HF Capacitor Adjust | | Preset | | Automatic | | Automatic | | Automatic | |
| Platen HF Tune Capacitor | % | 18.0 | ± 5 % | 50.0 | ± 5 % | 50.0 | ± 5 % | 50.0 | ± 5 % |
| Platen HF Load Capacitor | % | 50.0 | ± 5 % | 50.0 | ± 5 % | 50.0 | ± 5 % | 50.0 | ± 5 % |
| Platen HF Padding Capacitor | | 2 | | 2 | | 2 | | 2 | |
| Platen HF Control Mode | | Load | | Load | | Load | | Load | |
| Platen HF Modulation Enabled | | Enable | | Enable | | Enable | | Enable | |
| Platen HF Modulation Frequency | Hz | 150 | | 150 | | 150 | | 150 | |
| Platen HF Modulation Duty Cycle | % | 40 | | 40 | | 40 | | 20 | |
| Platen LF Power | Watts | 0.0 | ± 0 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 20 % | 0.0 0.0 | ± 20 % |
| Platen LF Control Mode | | Load | | Load | | Load | | Load | |
| Platen LF Capacitor Adjust | | Preset | | Automatic | | Automatic | | Automatic | |
| Platen LF Tune Capacitor | % | 50.0 | ± 5 % | 50.0 | ± 5 % | 50.0 | ± 5 % | 50.0 | ± 5 % |
| Platen LF Load Capacitor | % | 50.0 | ± 5 % | 50.0 | ± 5 % | 50.0 | ± 5 % | 50.0 | ± 5 % |
| Platen LF Padding Capacitor | | 2 | | 2 | | 2 | | 2 | |
| Platen LF Max Reflected | Watts | 300 | | 300 | | 300 | | 300 | |
| Platen LF Modulation Enabled | | Enable | | Enable | | Enable | | Enable | |
| Platen LF Modulation Frequency | Hz | 150 | | 150 | | 150 | | 150 | |
| Platen LF Modulation Duty Cycle | % | 10 | | 10 | | 10 | | 10 | |
| Platen Temperature | | 0 | ± 0 | 0 0 | ± 0 | 0 0 | ± 0 | 0 0 | ± 0 |
| Helium pressure | Torr | 15.0 | ± 5 % | 15.0 15.0 | ± 5 % | 15.0 15.0 | ± 5 % | 15.0 15.0 | ± 5 % |
| Helium Flow Warning Level | sccm | 5.0 | | 5.0 | | 5.0 | | 5.0 | |
| Helium Flow Fault Level | sccm | 5.0 | | 5.0 | | 5.0 | | 5.0 | |
| Coil current | Amps | 10.0 | ± 20 % | 10.0 | ± 20 % | 10.0 | ± 20 % | 10.0 | ± 20 % |
| Loop destination | | 0 | | 0 | | 0 | | 2 | |
| Number of loops | | 0 | | 0 | | 0 | | 60 | |
| Loop Variation Parameter | | 0.0 | | 1.0 | | 1.0 | | 1.0 | |
| ESC Voltage | Volts | 5000 | ± 10 % | 5000 | ± 10 % | 5000 | ± 10 % | 5000 | ± 10 % |
| Gas Line Config | | Flow | | Flow | | Flow | | Flow | |
| P1 Ar | sccm | 400.0 | ± 20 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % |
| P2 O2 | sccm | 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % |
| P3 N2 | sccm | 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % |
| P4 C4F8 | sccm | 300.0 | ± 20 % | 300.0 300.0 | ± 20 % | 1.0 1.0 | ± 0 % | 1.0 1.0 | ± 0 % |
| P5 SF6 | sccm | 1.0 | ± 0 % | 1.0 1.0 | ± 0 % | 275.0 275.0 | ± 20 % | 285.0 285.0 | ± 20 % |
| S1 O2 | sccm | 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % |
| S2 C4F8 | sccm | 0.0 | ± 5 % | 0.0 0.0 | ± 20 % | 0.0 0.0 | ± 0 % | 0.0 0.0 | ± 0 % |
| S3 SF6 | sccm | 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % | 0.0 0.0 | ± 5 % |

Platen temp @ 20°C

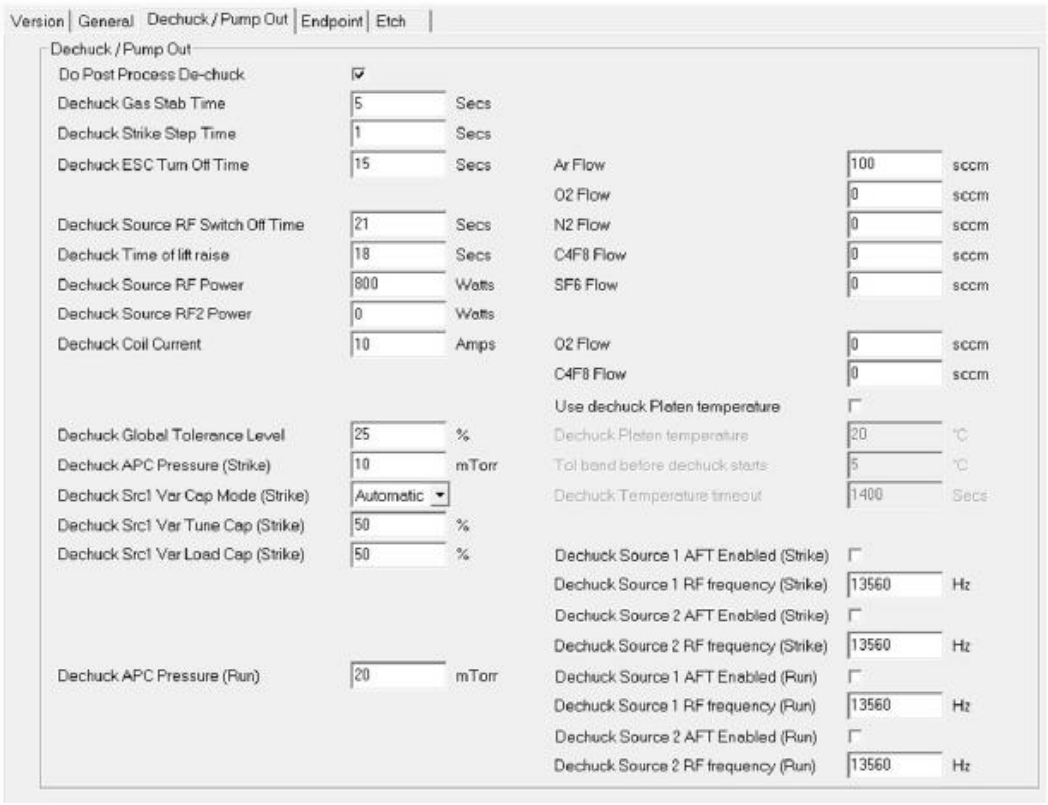
| | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Step Name | | Strike | Clean1 | Transit | Clean2 |
| Process Time | Secs | 2.0 | 600.0 | 5.0 5.0 | 120.0 |
| Process Pressure | mTorr | 35.0 ± 0 % | 20.0 ± 50 % | 35.0 35.0 ± 20 % | 35.0 ± 20 % |
| APC Setpoint Position | % | 0.0 | 0.0 | 0.0 | 0.0 |
| APC Mode | | Automatic | Automatic | Automatic | Automatic |
| Source 1 power | Watts | 2500 ± 0 % | 2500 ± 30 % | 2500 2500 ± 30 % | 2500 ± 20 % |
| Source 1 AFT Mode | | Manual | Automatic | Automatic | Automatic |
| Source 1 AFT Frequency | KHz | 13560 | 13560 | 13560 | 13560 |
| Source 1 RF Control Mode | | Load | Load | Load | Load |
| Source 2 power | Watts | 1500 ± 0 % | 1500 ± 20 % | 1500 1500 ± 20 % | 1500 ± 20 % |
| Source 2 AFT Mode | | Manual | Automatic | Automatic | Automatic |
| Source 2 AFT Frequency | KHz | 13560 | 13560 | 13560 | 13560 |
| Source 2 RF Control Mode | | Load | Load | Load | Load |
| Platen Frequency | | Hi Freq | Hi Freq | Hi Freq | Hi Freq |
| Platen HF Power | Watts | 30.0 ± 0 % | 30.0 ± 50 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| Platen HF Capacitor Adjust | | Preset | Automatic | Automatic | Automatic |
| Platen HF Tune Capacitor | % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen HF Load Capacitor | % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen HF Padding Capacitor | | 2 | 2 | 2 | 2 |
| Platen HF Control Mode | | Load | Load | Load | Load |
| Platen HF Modulation Enabled | | Disable | Disable | Disable | Disable |
| Platen HF Modulation Frequency | Hz | 1000 | 1000 | 1000 | 1000 |
| Platen HF Modulation Duty Cycle | % | 50 | 50 | 50 | 50 |
| Platen LF Power | Watts | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| Platen LF Control Mode | | Forward | Forward | Forward | Forward |
| Platen LF Capacitor Adjust | | Preset | Automatic | Automatic | Automatic |
| Platen LF Tune Capacitor | % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen LF Load Capacitor | % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % | 50.0 ± 5 % |
| Platen LF Padding Capacitor | | 1 | 1 | 1 | 1 |
| Platen LF Max Reflected | Watts | 200 | 200 | 200 | 200 |
| Platen LF Modulation Enabled | | Disable | Disable | Disable | Disable |
| Platen LF Modulation Frequency | Hz | 100 | 100 | 100 | 100 |
| Platen LF Modulation Duty Cycle | % | 50 | 50 | 50 | 50 |
| Platen Temperature | | 20 ± 5 | 20 ± 5 | 20 20 ± 5 | 20 ± 5 |
| Helium pressure | Torr | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| Helium Flow Warning Level | sccm | 0.0 | 0.0 | 0.0 | 0.0 |
| Helium Flow Fault Level | sccm | 0.0 | 0.0 | 0.0 | 0.0 |
| Coil current | Amps | 10.0 ± 0 % | 10.0 ± 20 % | 10.0 ± 20 % | 10.0 ± 20 % |
| Loop destination | | 0 | 0 | 0 | 0 |
| Number of loops | | 0 | 0 | 0 | 0 |
| Loop Variation Parameter | | 0.0 | 0.0 | 1.0 | 0.0 |
| ESC Voltage | Volts | 5000 ± 10 % | 5000 ± 10 % | 5000 ± 10 % | 5000 ± 10 % |
| Gas Line Config | | Flow | Flow | Flow | Flow |
| P1 Ar | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| P2 O2 | sccm | 500.0 ± 20 % | 500.0 ± 20 % | 500.0 200.0 ± 20 % | 200.0 ± 5 % |
| P3 N2 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| P4 C4F8 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| P5 SF6 | sccm | 1.0 ± 0 % | 1.0 ± 0 % | 50.0 350.0 ± 20 % | 350.0 ± 20 % |
| S1 O2 | sccm | 200.0 ± 20 % | 200.0 ± 20 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| S2 C4F8 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |
| S3 SF6 | sccm | 0.0 ± 5 % | 0.0 ± 5 % | 0.0 0.0 ± 5 % | 0.0 ± 5 % |

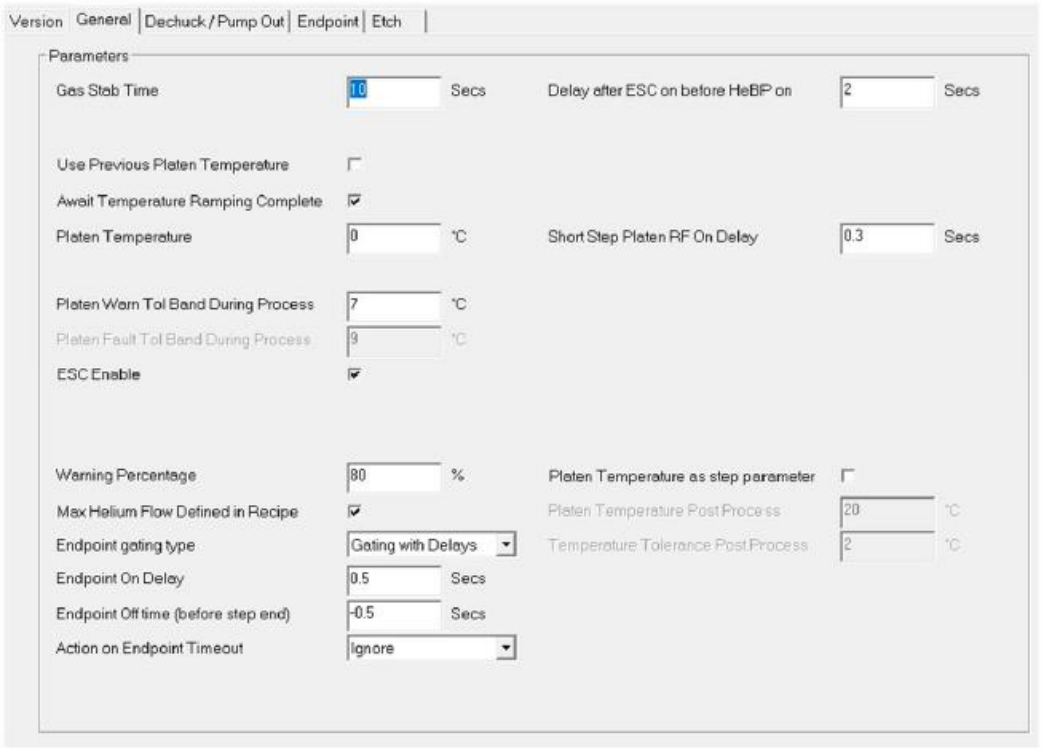
## 8.4. SNF_Clean_endpoint

Endpoint algorithm

| | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Step Name | | Strike | Clean1 | Transit | Clean2 |
| Endpoint Type | | Disabled | Standard v2.0 | Disabled | Disabled |
| Delay | Secs | 10.0 | 5.0 | 0.0 | 10.0 |
| Average | Secs/L | 1.0 | 1.0 | 1.0 | 1.0 |
| Normalisation Time | Secs | 0.0 | 0.0 | 0.0 | 0.0 |
| Threshold 1 Type | | Direct | Direct | Direct | Direct |
| Threshold 1 Diff Window | Secs/L | 5.0 | 5.0 | 5.0 | 5.0 |
| Threshold 1 Edge | | Falling | Falling | Falling | Falling |
| Threshold 1 Level Mode | | Absolute | Percentage Change | Percentage Change | Absolute |
| Threshold 1 Level | Unit/P | 50.0000 | 50.0000 | 50.0000 | 50.0000 |
| Threshold 2 Type | | None | None | None | None |
| Threshold 2 Diff Window | Secs/L | 5.0 | 5.0 | 5.0 | 5.0 |
| Threshold 2 Edge | | Falling | Falling | Falling | Falling |
| Threshold 2 Level Mode | | Absolute | Absolute | Absolute | Absolute |
| Threshold 2 Level | Unit/P | 50.0000 | 50.0000 | 50.0000 | 50.0000 |
| Over Etch Mode | | Percent | Percent | Percent | Percent |
| Over Etch | Secs/% | 10.0 | 150.0 | 20.0 | 10.0 |
| Signal Source | | EPD1 | EPD1 | EPD1 | EPD1 |
| EPD Monitor Source | | EPD1 | EPD1 | EPD1 | EPD1 |
| EPD Monitor Source Faults | | Ignore | Ignore | Ignore | Ignore |
| Filter Gain | | 0 | 0 | 0 | 0 |
| Min Expected T1 | Secs | 0.0 | 0.0 | 0.0 | 0.0 |
| Max Expected T1 | Secs | 0.0 | 0.0 | 0.0 | 0.0 |
| Action on Early T1 | | Ignore | Ignore | Ignore | Ignore |
| Action on Late T1 | | Ignore | Ignore | Ignore | Ignore |
| Min Expected T2 | Secs | 0.0 | 0.0 | 0.0 | 0.0 |
| Max Expected T2 | Secs | 0.0 | 0.0 | 0.0 | 0.0 |
| Action on Early T2 | | Ignore | Ignore | Ignore | Ignore |
| Action on Late T2 | | Ignore | Ignore | Ignore | Ignore |

## 8.5. General and Dechuck




## 9. Revision Block

| Revision | Date | Description of Change | Author |
|---|---|---|---|
| 1 | **8/4/26** | **KLA-DSE Standard Operating Procedure_V1** | Lavendra M |
| 2 | **8/10/26** | **KLA-DSE Standard Operating Procedure_V2** | Lavendra M |