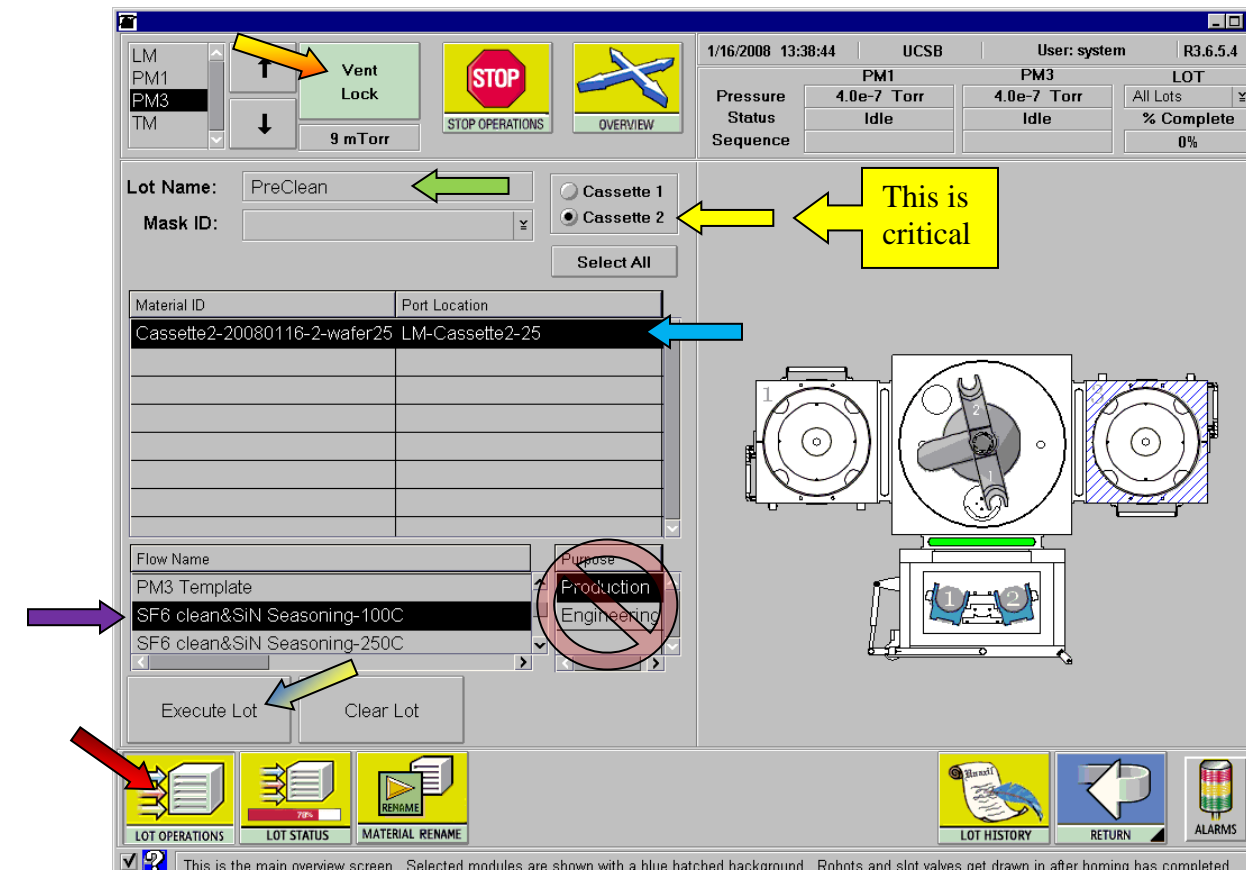


## Operation of Unaxis ICP-PECVD Deposition

1. Reference **Figure 1** for arrows within this procedure.
2. Vent the Load Lock via the "Vent Lock" icon. ←
3. **Load your sample(s)** and a pre-clean substrate into **Cassette 2** (the cassette on the right). Ensure the major flat is parallel to and facing the back of the cassette. The system will automatically map the cassettes when you close the door.
4. **Pump the Load Lock** via the "Pump Lock" icon. The icon will change to "Pump Lock" when the "Vent Lock" process is complete. ←
5. **Edit Deposition Time** and navigate to the "Operations" screen.
6. From the "Lot Operations" screen follow steps a-g for "**Pre-Deposition Clean & Seasoning**" and then your substrates: ←
  - a. Select **Cassette 2**. ←
  - b. Enter a "Lot Name". ←
  - c. From the "Material ID/ Port Location" list select the substrate that you wish to process. ←
  - d. From the "Flow Name" list select the flow file that you wish to run (i.e. "SiO<sub>2</sub> LDR 100C (100%SiH<sub>4</sub>)"). ←
  - e. Select "Execute Lot". ←
  - f. The selected wafer will now be removed from the "Material ID/ Port Location" menu list. ←
  - g. Once the chuck temperature has reached process set-point the system will begin running. If the actual temperature is different than your required process temperature it may take a while attain your desired temperature so please be patient.
7. When the system has completed processing it will prompt you with an audible indicator and the Signal Tower will flash yellow.
8. Repeat steps 5-7 until all of your substrates have finished processing.
9. Vent the Load Lock, via the "Vent Lock" icon. ←
10. Remove your substrate(s), insert an AlN cleaning wafer into the cassette and run the "**PM3 Post-Dep Clean**".



(Figure 1)

### Load Sample(s):

1. Reference **Figure 1** for arrows within this procedure.
2. Remove **Cassette #2** (the cassette on the right).
3. Place your sample(s) onto a carrier wafer at the center.
4. Hold the carrier wafer at the edge opposite the major flat using tweezers, and insert the carrier wafer all of the way to the back of the slot (otherwise, the carrier wafer will be broken). The major flat should be parallel to the back of the cassette (The side without pins).
5. Put the cassette back to the holding position (the side of the cassette with steel pins protruding should be facing away from you).
6. Close the door gently and click on the "Pump Lock" icon. ←

**Edit Deposition Time:**

- From main screen, click on "EDITORS" icon.
- Focus on PM3 and select "Edit Step".
- Select the appropriate "Category Filter", i.e. "Low-stress SiN Process(100% SiH4)". See list below for other options.
- Select the appropriate step from the "Directory of Process Steps". i.e. "SiN Dep 100C(100% SiH4)".
- Edit the "process Time" using the deposition rates on the paper posted on the right side of the system for your calculation and select "SAVE STEP". Select the "Return" icon.

**Category Filter**

**Step**

- SiN Process(2%SiH4-No-Ar)
  - "Low Stress No Ar"
    - SiN 50C-120W-2%SiH4 No Ar
    - SiN 100C-120W-2%SiH4 No Ar
    - SiN 250C-120W-2%SiH4 No Ar
  - "Medium Stress No Ar"
    - SiN 50C-50W-2%SiH4 No Ar
    - SiN 100C-50W-2%SiH4 No Ar
    - SiN 250C-50W-2%SiH4 No Ar
  - "High Stress No Ar"
    - SiN 50C-5W-2%SiH4 No Ar
    - SiN 100C-5W-2%SiH4 No Ar
    - SiN 250C-5W-2%SiH4 No Ar

**Low-stress SiN Process(100%SiH4)**

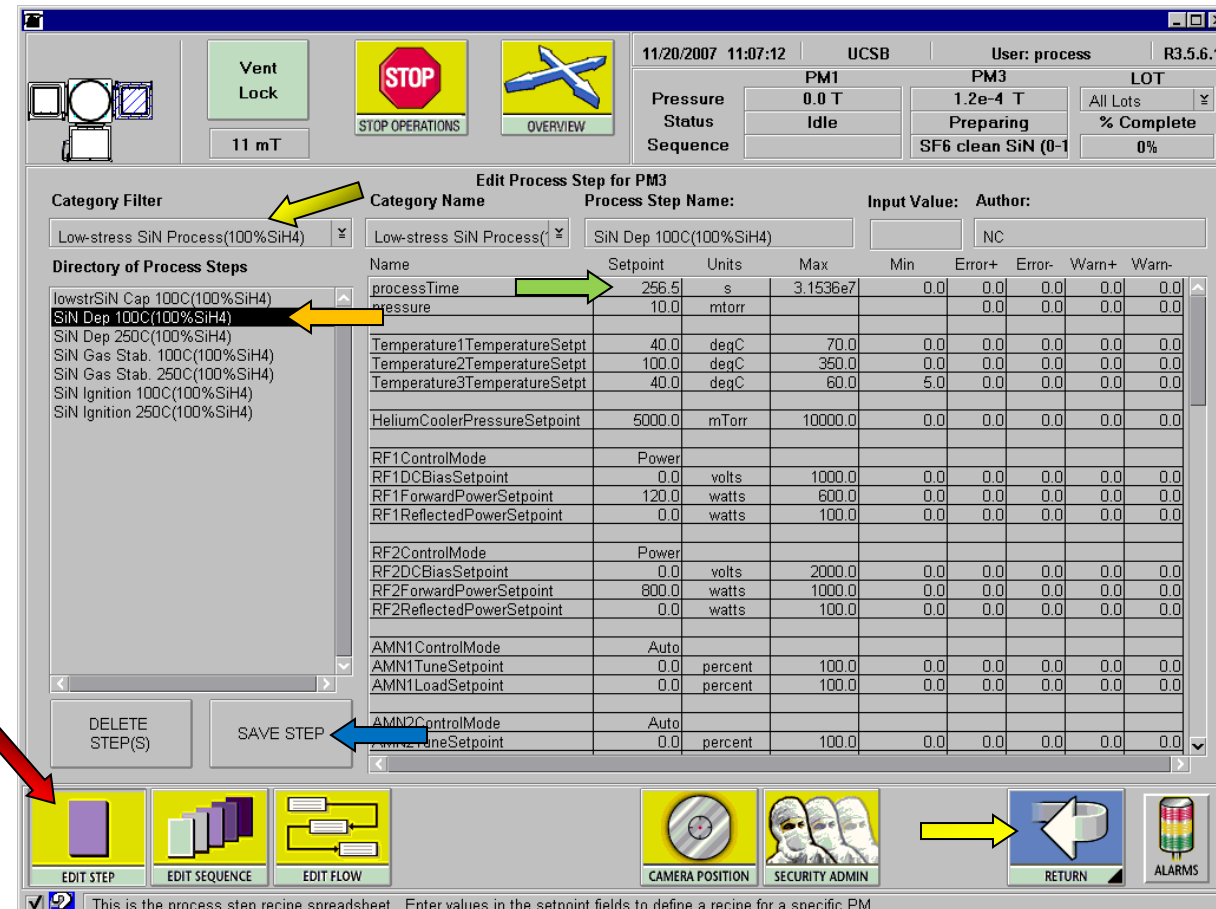
- SiN Low Stress 50C (100%SiH4)
- SiN Low Stress 100C (100%SiH4)
- SiN Low Stress 250C (100%SiH4)

**medium-stress SiN Process(100%SiH4)**

- SiN Medium Stress 50C (100%SiH4)
- SiN Medium Stress 100C (100%SiH4)
- SiN Medium Stress 250C (100%SiH4)

**SiO2 Process (100%SiH4)**

- "Low Dep Rate"
  - SiO2 LDR 50C (100%SiH4)
  - SiO2 LDR 100C (100%SiH4)
  - SiO2 LDR 250C (100%SiH4)
- "High Dep Rate"
  - SiO2 HDR 50C (100%SiH4)
  - SiO2 HDR 100C (100%SiH4)
  - SiO2 HDR 250C (100%SiH4)



(Figure 2)

## SiNx and SiO2 with Argon Rate Table

### SiNx (Low Stress) 100%SiH4

Flows: SiN Low Stress (50C,100C,250C) (100%SiH4)

Category: Low-stress SiN Process(100%SiH4)

Step: SiN Low Stress (50C,100C,250C) (100%SiH4)

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	0	310	344
<u>Seconds/1000Å</u>	0	194	175

### SiNx (Medium Stress) 100%SiH4

Flows: SiN Medium Stress (50C,100C,250C) (100%SiH4)

Category: medium-stress SiN Process(100%SiH4)

Step: SiN Medium Stress (50C,100C,250C) (100%SiH4)

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	0	412	397
<u>Seconds/1000Å</u>	0	146	151

### SiO2 (LDR) - Low Dep Rate

Flows: SiO2 LDR (50C,100C,250C) (100%SiH4)

Category: SiO2 Process (100% SiH4)

Step: SiO2 LDR (50C,100C,250C) (100%SiH4)

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	375	382	383
<u>Seconds/1000Å</u>	160	157	157

### SiO2 (HDR) - High Dep Rate

Flows: SiO2 HDR (50C,100C,250C) (100%SiH4)

Category: SiO2 Process (100% SiH4)

Step: SiO2 HDR (50C,100C,250C) (100%SiH4)

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	1145	1137	1044
<u>Seconds/1000Å</u>	53	53	58

### SiO2 (2%SiH4)

Flows: SiO2 (100C,50C, 250C) 5W (2%SiH4)

Category: SiO2 Process(2%SiH4)

Steps: SiO2 (100C,50C, 250C) 5W (2%SiH4)

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	360	337	302
<u>Seconds/1000Å</u>	167	178	199

## SiNx and SiO2 with He Rate Table

### SiNx (Low Stress 2%SiH4 No Ar)

Flows: SiN (50C,100C,250C)-120W-2%SiH4 No Ar

Category: SiN Process (2%SiH4-No-Ar)

Step: SiN (100C, 50C, 250C)-120W-2%SiH4 No Ar

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	249	170	159
<u>Seconds/1000Å</u>	241	353	377

### SiNx (Medium Stress 2%SiH4 No Ar)

Flows: SiN (50C,100C,250C)-50W-2%SiH4 No Ar

Category: SiN Process (2%SiH4-No-Ar)

Steps: SiN (100C, 50C, 250C)-50W-2%SiH4 No Ar

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	289	219	212
<u>Seconds/1000Å</u>	207	274	283

### SiNx (High Stress 2%SiH4 No Ar)

Flows: SiN (50C,100C,250C)-5W-2%SiH4 No Ar

Category: SiN Process (2%SiH4-No-Ar)

Steps: SiN (50C,100C,250C)-5W-2%SiH4 No Ar

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	300	237	209
<u>Seconds/1000Å</u>	200	253	287

### SiO2 (2%SiH4 No Ar)

Flows: SiO2 (100C,50C, 250C)-5W-2%SiH4-No Ar

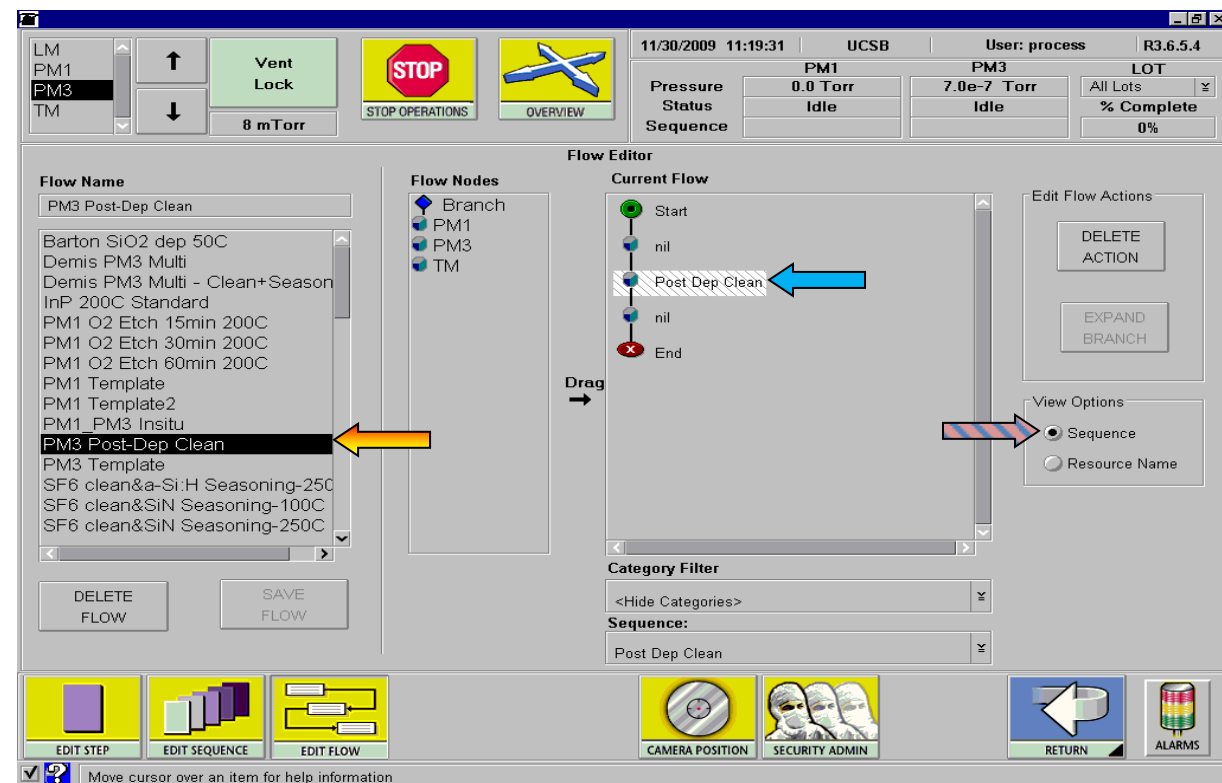
Category: SiO2 Process(No-Ar-2%SiH4)

Steps: SiO2 (100C,50C, 250C)-5W-2%SiH4-No Ar

<u>Substrate Temperature</u>	<u>50C</u>	<u>100C</u>	<u>250C</u>
<u>Dep Rate (Å/min)</u>	335	323	278
<u>Seconds/1000Å</u>	179	185	216

## Pre-Deposition Clean & Seasoning:

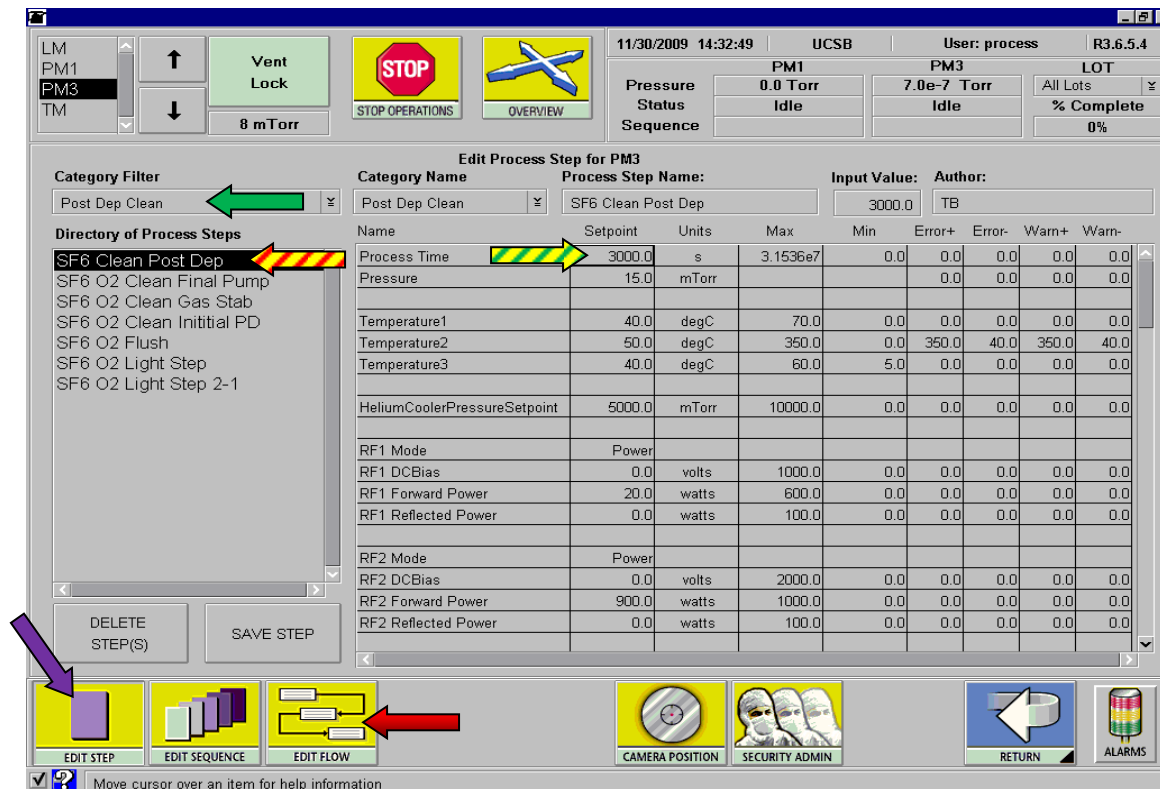
1. From the "Lot Operations" screen select one of the clean & seasoning "Flows" below, and follow steps 6-7 of the "[Operation of Unaxis ICP-PECVD Deposition](#)" procedure. "Figure 3" below does not apply to these instructions.
2. To prepare for SiNx film at 250 °C, select "SF6 clean & SiN seasoning-250C".
3. To prepare for SiNx film at 100 °C, select "SF6 clean & SiN seasoning-100C".
4. To prepare for SiO2 film at 250 °C, select "SF6 clean & SiO2 seasoning-250C".
5. To prepare for SiO2 film at 100 °C, select "SF6 clean SiNx & SiO2 seasoning-100C".
6. Click on "Execute Sequence".



(Figure 3)

## PM3 Post-Dep Clean:

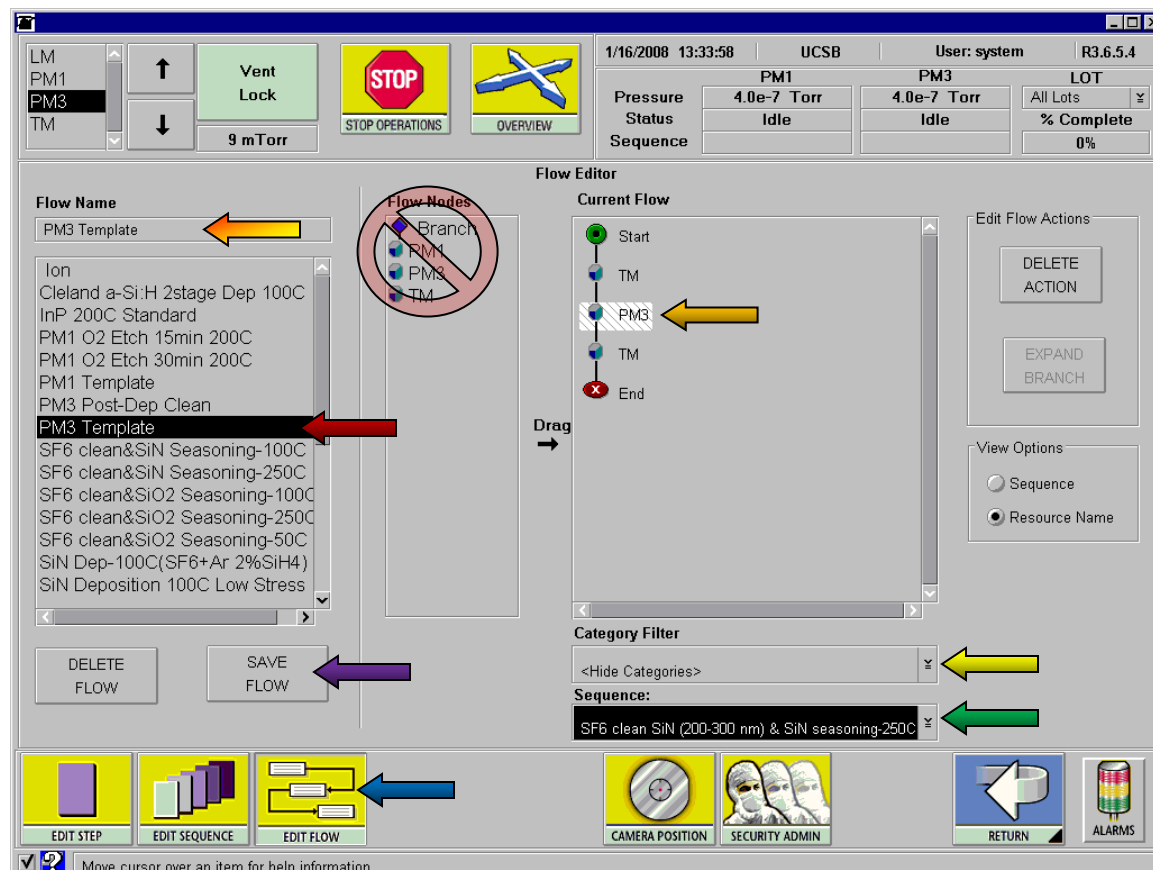
1. Reference "Figure 3" on the previous page and "Figure 4" on this page for colored arrows within this procedure.
2. From the "Edit Flow" screen ← edit the "PM3 Post-Dep Clean" flow ← and verify the Sequence "Post Dep Clean" is loaded into PM3 in the "Current Flow" list. ← "Sequence" under "View Options" must be selected. ←
3. From the "Edit Step" screen ← select "Post Dep Clean" from the "Category Filter" list. ← Select the step "SF6 Clean Post Dep" ← and edit the "Process Time" ← so the amount of material etched will equal your cumulative deposition thickness. SiNx etches at 20nm/min and SiO2 etches at 40nm/min.
4. From the "Lot Operations" screen follow steps 6-7 of the "[Operation of Unaxis ICP-PECVD Deposition](#)" procedure using the flow "PM3 Post-Dep Clean".



(Figure 4)

## Editing a Flow:

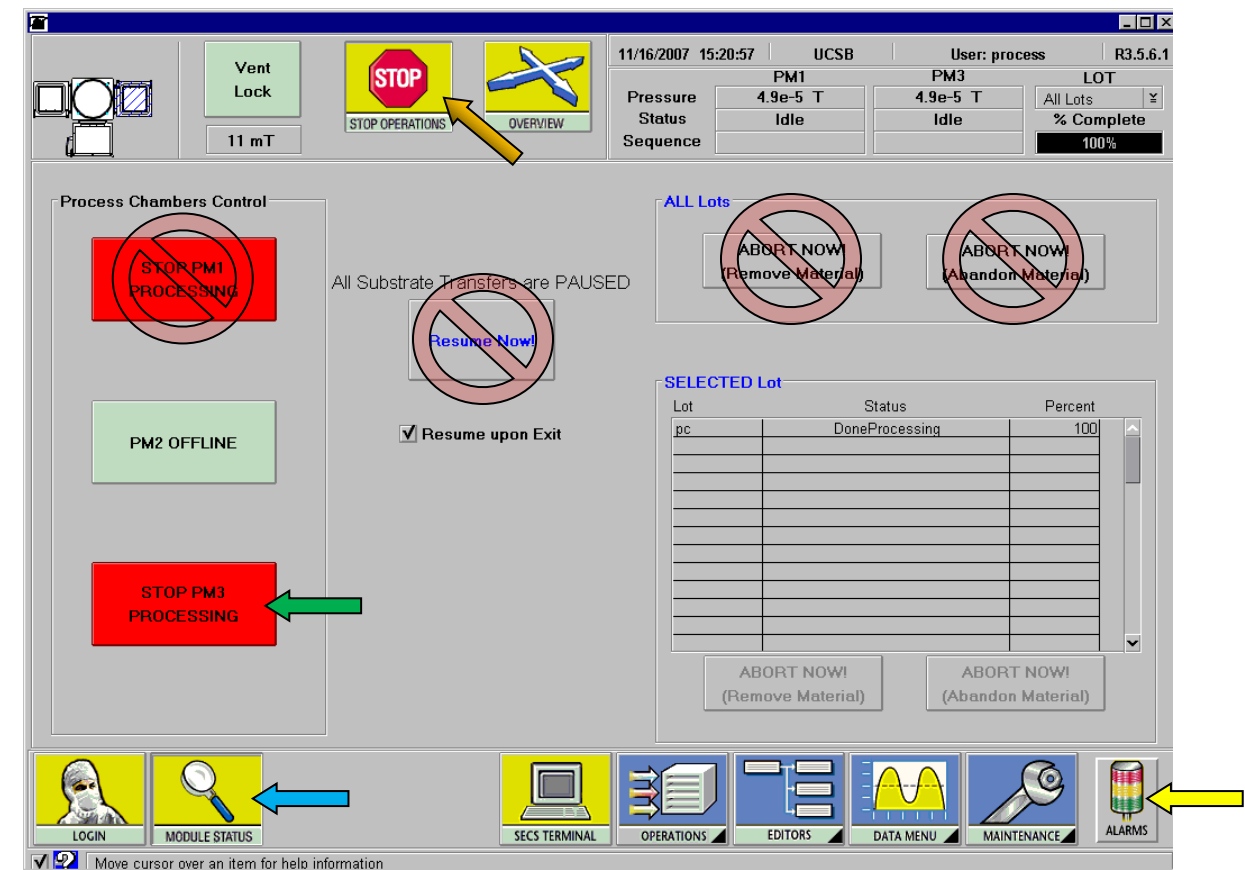
1. Navigate to the "Editors" screen.
2. Select "Edit Flow" at the bottom of the screen. ←
3. Select the "Flow" to be edited from the flow list. ←
4. Click on "PM3" in the "Current Flow" field. ←
5. Select the appropriate "Category Filter". ←
6. Select the desired "Sequence" from the sequence list. ←
7. If you are saving a custom flow make sure to rename the flow in the "Flow Name" field. ←
8. "Save" the new flow. If you are saving a standard flow like "PM3 Post-Dep Clean" then do not rename it. ←



(Figure 5)

## Aborting the run:

1. Wait until the wafer has loaded into the process chamber.
2. Select the "Stop Operations" icon. ←
3. Select the "STOP PM3 PROCESSING" button. ←
4. The "ALARMS" button will turn red, when it does select it. ←
5. Select "Next Step" then click on the "Recover" button.
6. Repeat steps 3-5 until the sequence reaches the "Final Pump Down" step.
7. Click on the "ALARMS" button to close the "ALARMS" screen. ←
8. Select the "MODULE STATUS" icon to return to the process status screen. ←



(Figure 6)