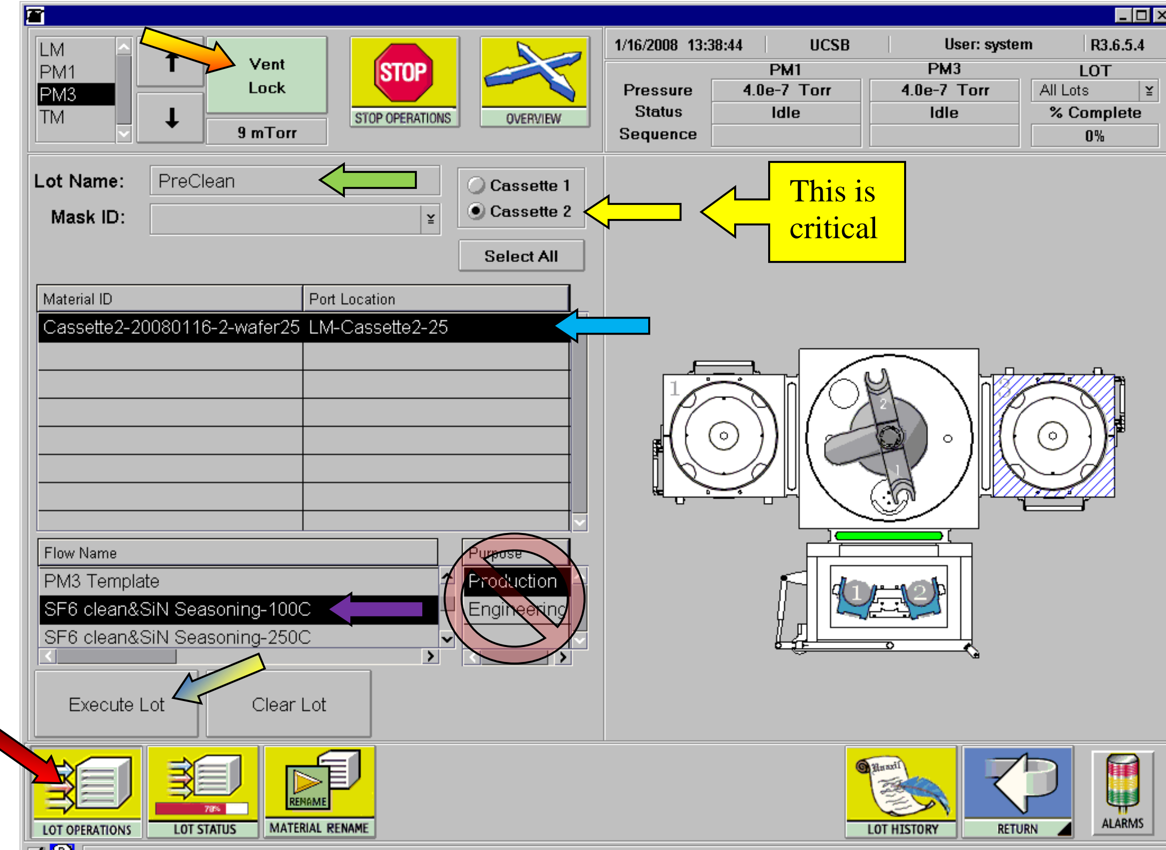
Operation of Unaxis ICP-PECVD Deposition

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. "**LDR SiO2 100C**").
   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".



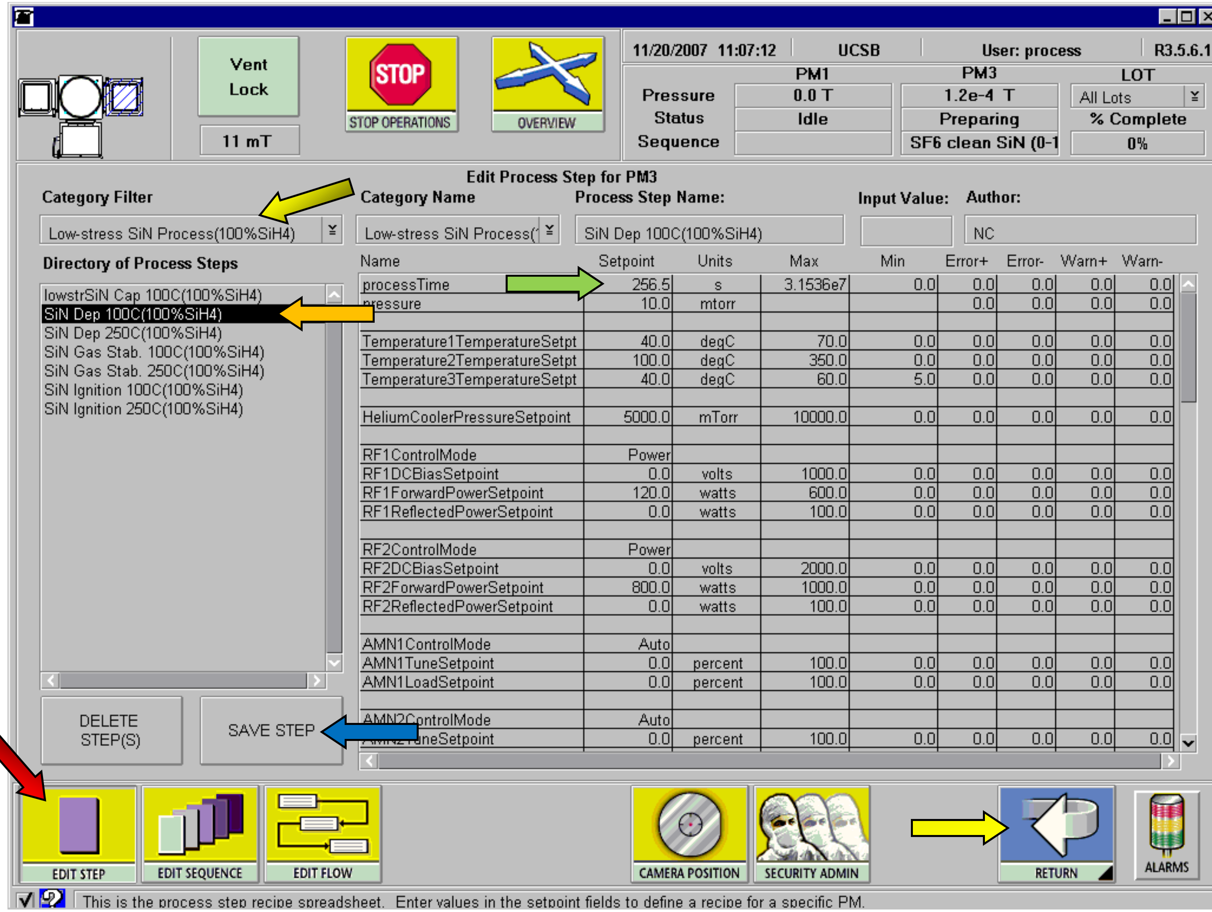
(Figure 1)

Load Sample(s):

- Reference **Figure 1** for arrows within this procedure.
- Remove **Cassette #2** (the cassette on the right).
- Place your sample(s) onto a carrier wafer at the center.
- Hold the carrier wafer at the edge opposite the major flat using tweezers, and insert the carrier wafer <u>all of the way to the back of the slot</u> (**otherwise, the carrier wafer will be broken inside of the process module**). The major flat should be parallel to the cassette side without the pins.
- Put the cassette back to the holding position (<u>the pin side of the cassette should be facing the LM chamber</u>).
- 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.



(Figure 2)

Category Filter		**Step**
SiN process(2%SiH4-No-Ar)	"Low Stress No Ar"	SiN Deposit 50C-120W(No Ar)
		SiN Deposit 100C-120W(No Ar)
		SiN Deposit 250C-120W(NoAr)
	"Medium Stress No Ar"	SiN Deposition50C-50W(NoAr)
		SiN Deposition100C-50W(NoAr)
		SiN Deposition50C-50W(NoAr)
	"High Stress No Ar"	SiN Deposition50C-5W(NoAr)
		SiN Deposition100C-5W(NoAr)
		SiN Deposition50C-5W(NoAr)
medium-stress SiN Process(100%SiH4)		SiN Dep 50C(100%SiH4)-50W
		SiN Dep 100C(100%SiH4)-50W
		SiN Dep 250C(100%SiH4)-50W
Low-stress SiN Process(100%SiH4)		SiN Dep 50C(100%SiH4)
		SiN Dep 100C(100%SiH4)
		SiN Dep 250C(100%SiH4)
SiO2 Process (100%SiH4)	"Low Dep Rate"	LDRSiO2 Dep 50C
		LDR SiO2 Dep 100C
		LDRSiO2 Dep 250C
	"High Dep Rate"	HDRSiO2 Dep 50C
		HDR SiO2 Dep 100C
		HDRSiO2 Dep 250C

SiNx and SiO2 with Argon Rate Table

SiNx (Low Stress)

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

SiNx (Medium Stress)

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

SiO2 (LDR) - Low Dep Rate

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

SiO2 (HDR) - High Dep Rate

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

SiNx and SiO2 with He Rate Table

SiNx (Low Stress 2%SiH4 No Ar)

Flows: SiN-120W-100C(250C) (2%SiH4)
Category: SiN process (2%SiH4) **Step**: SiN deposition100C(50C, 250C)-120W

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

SiNx (Medium Stress 2%SiH4 No Ar)

Flows: SiN-50W-100C(250C) (2%SiH4)
Category: SiN process (2%SiH4) **Steps:** SiN deposition 100C(50C,250C)-50W

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

SiNx (High Stress 2%SiH4 No Ar)

Flows: SiN-5W-100C(250C) (2%SiH4)
Category: SiN process (2%SiH4) **Steps:** SiN deposition 100C(50C,250C)-5W

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

SiO2 (2%SiH4 with He)

Flows: SiO2-5W-100C(50C, 250C) (2%SiH4)
Category: SiO2 process (2% SiH4) **Steps:** SiO2 deposition 100C(50C, 250C)

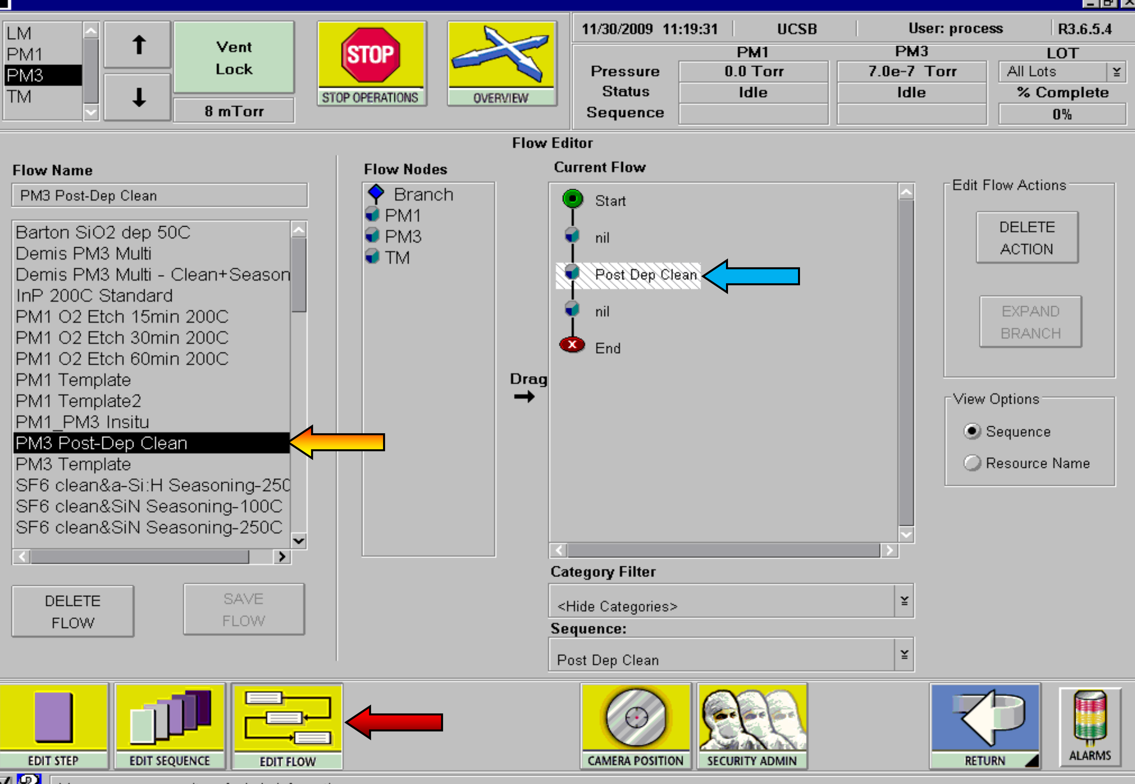
Substrate Temperature	50C	100C	250C
Dep Rate (Å/min)	303	336	319
Seconds/1000Å	198	179	188

Pre-Deposition Clean & Seasoning:

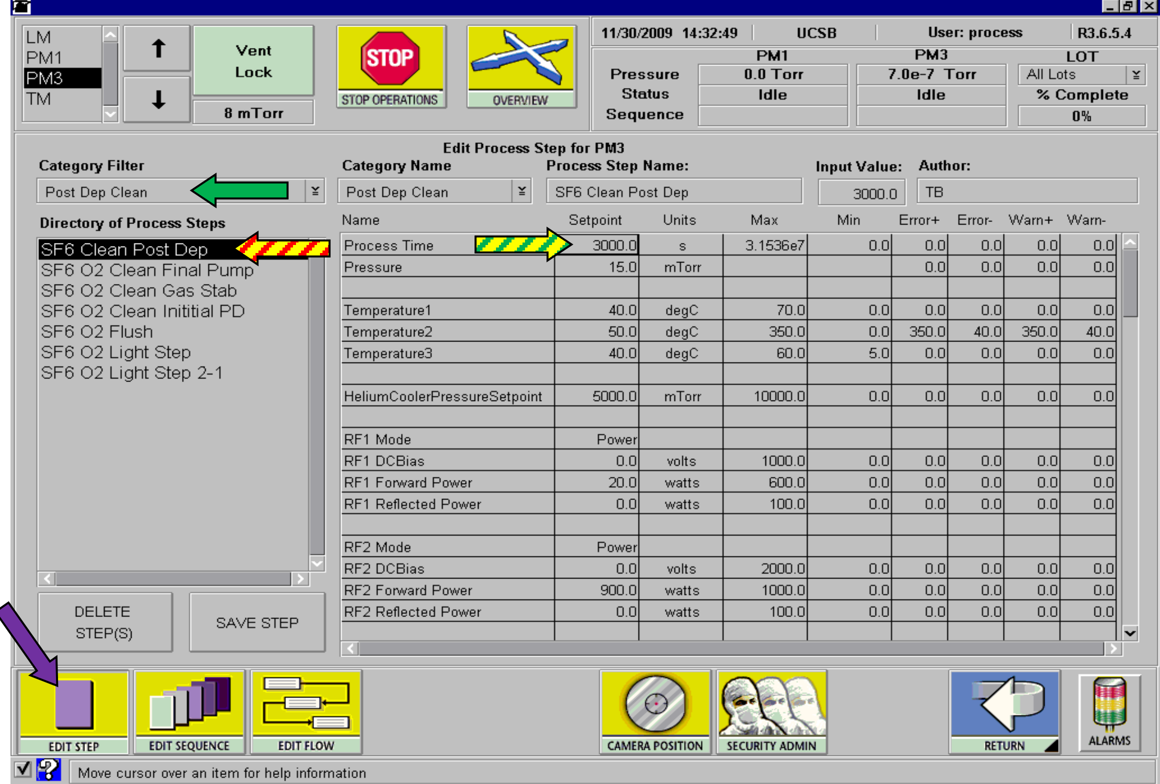
- From the "**Lot Operations**" screen select one of the clean & seasoning flows, and follow steps 6-7 of the "Operation of Unaxis ICP-PECVD Deposition" procedure using one of the following "**Flows**".
- To prepare for SiNx film at 250 ^{0}C, select "**SF6 clean & SiN seasoning-250C**".
- To prepare for SiNx film at 100 ^{0}C, select "**SF6 clean & SiN seasoning-100C**".
- To prepare for SiO2 film at 250 ^{0}C, select **"SF6 clean & SiO2 seasoning-250C"**.
- To prepare for SiO2 film at 100 ^{0}C, select **"SF6 clean SiNx & SiO2 seasoning-100C"**.
- Click on "**Execute Sequence**".

PM3 Post-Dep Clean:

- Reference "**Figure 4**" and "**Figure 5**" on the next page for colored arrows within this procedure.
- 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.
- 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.
- 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**".



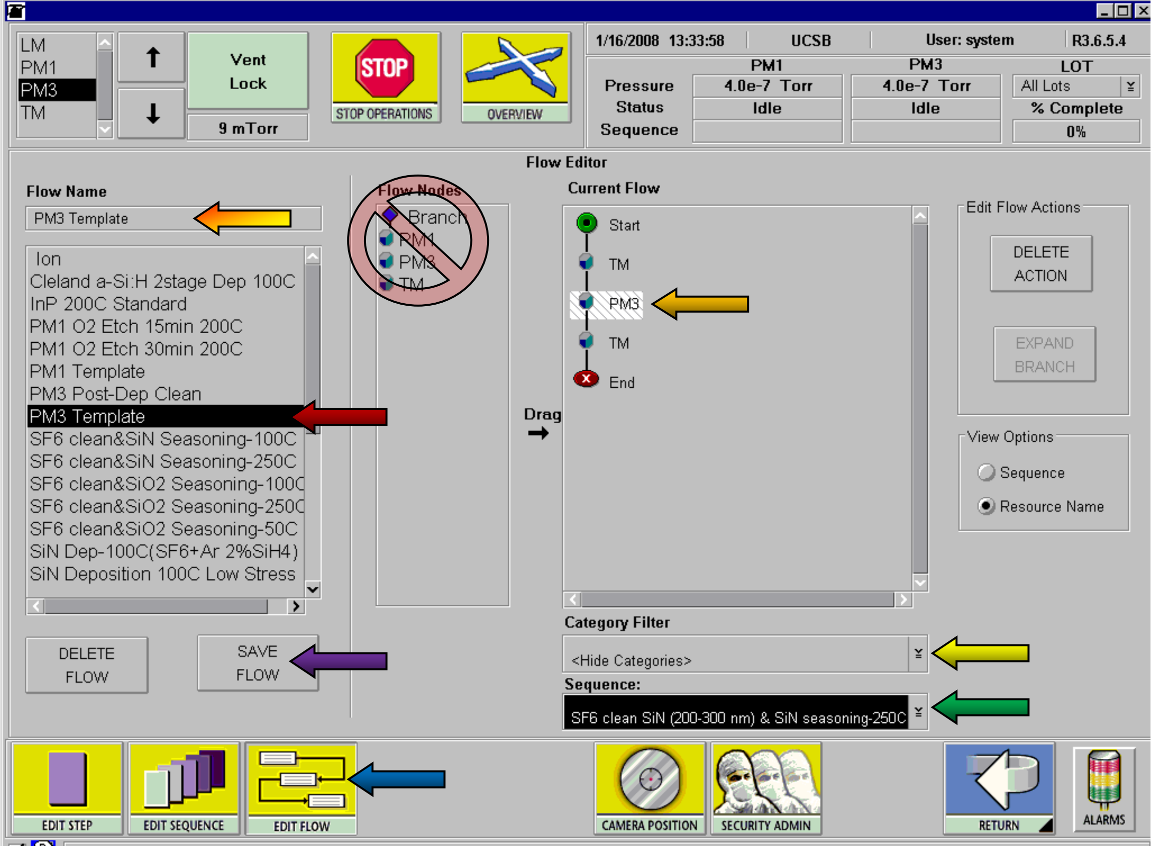
(Figure 4)



(Figure 5)

Editing a Flow:

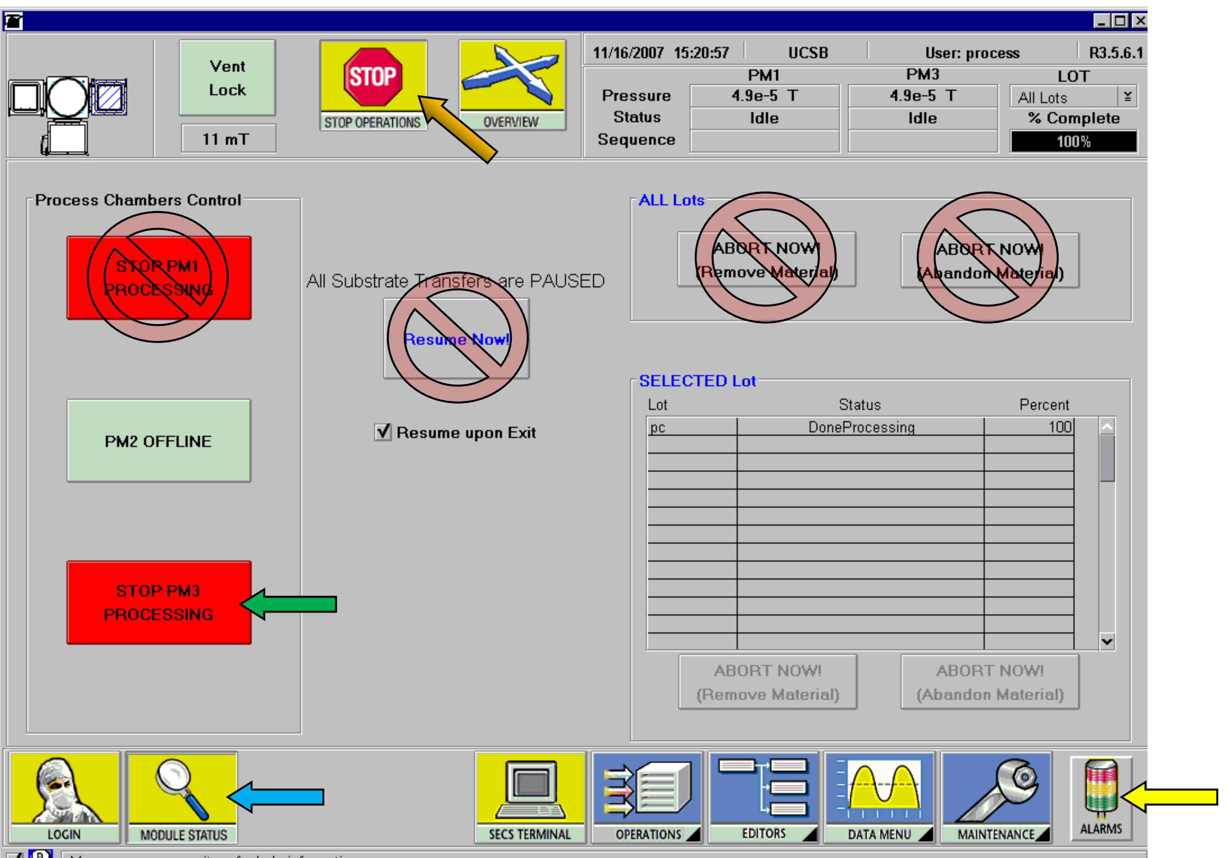
- Navigate to the "**Editors**" screen.
- Select "**Edit Flow**" at the bottom of the screen.
- Select the "**Flow**" to be edited from the flow list.
- Click on "**PM3**" in the "**Current Flow**" field.
- Select the appropriate "**Category Filter**".
- Select the desired "**Sequence**" from the sequence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



(Figure 3)

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)