

## 1.0 Plasma Enhanced Chemical Vapor Deposition System - STS LpX CVD



Figure 1: STS LpX CVD

### 1.1 Introduction

STS LpX CVD is for the deposition of silicon dioxide ( $\text{SiO}_2$ ), silicon nitride ( $\text{Si}_3\text{N}_4$ ), and amorphous silicon. Please contact staff for approved substrate materials.

Only trained and approved (qualified) users may use this tool.

### 1.2 Features and Specifications

- Wafer size: 100 mm
- Gases: 2%  $\text{SiH}_4$  (balance  $\text{N}_2$ ),  $\text{NH}_3$ ,  $\text{N}_2\text{O}$ ,  $\text{N}_2$ , Ar,  $\text{C}_4\text{F}_8$ , and  $\text{O}_2$ .

### 1.3 Applicable Documents

STS LpX CVD installation, operation, and maintenance manuals are available.

### 1.4 Safety

- High electrical power sources including RF power sources are present. Do not open any panels or defeat interlocks.
- Do not open the gas cabinet or the system chamber; **hazardous gases are present**. Read MSDS before using.
- Pay attention to safety symbols on the equipment.
- Press EMO button (Figure 1) if there is an immediate danger to personnel or the equipment and inform the staff.

## 1.5 Precautions

- Do not scratch or put any metallic objects on the vacuum seal surfaces.
- Only clean samples that do not outgas are allowed in this system.

## 1.6 Operating Procedure

### 1.6.1 System Start Up

- Activate the equipment in FOM.
- Switch on the pump under loadlock.

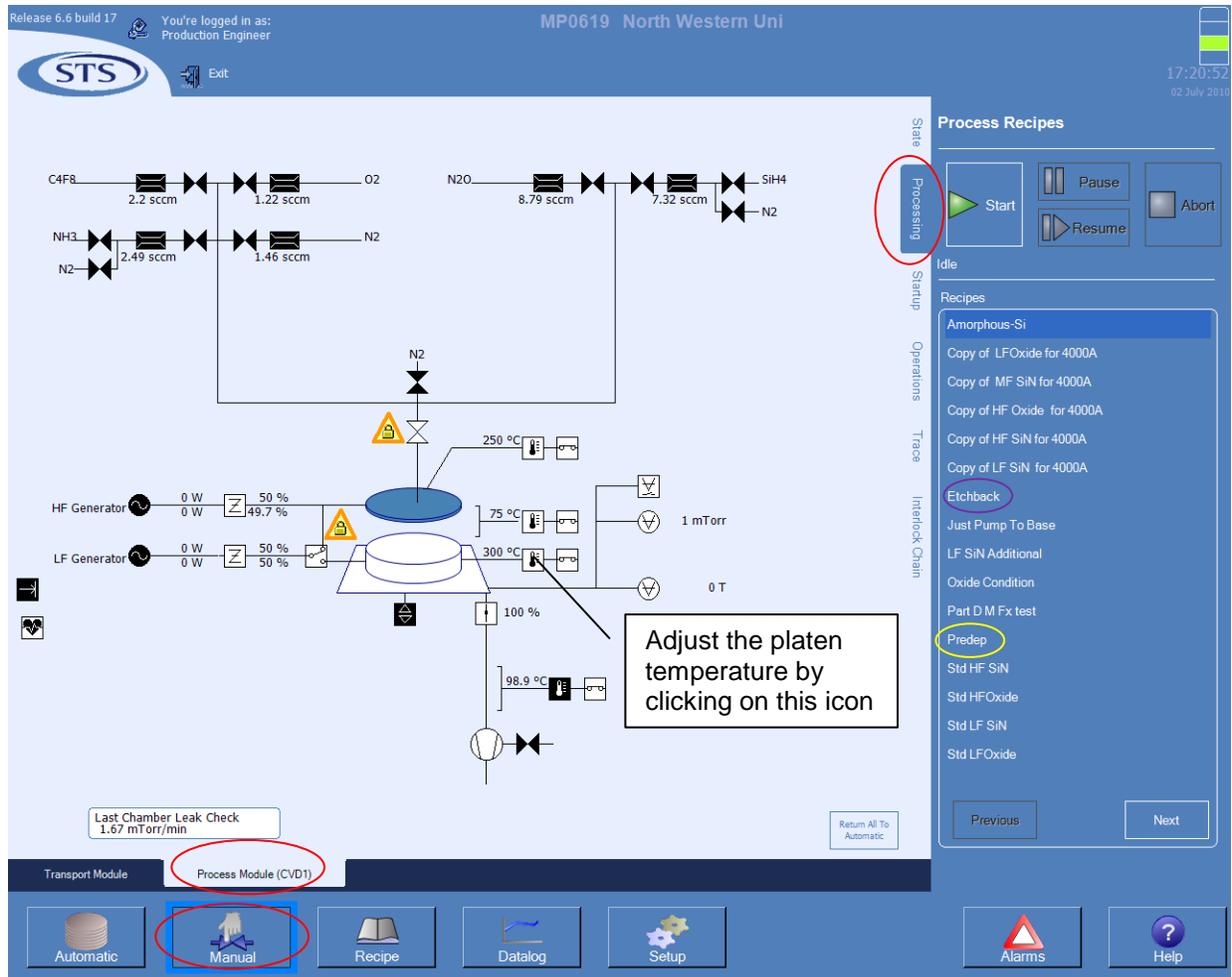


Figure 2: Running a process recipe.

### 1.6.2 Chamber Conditioning - Predep

Chamber conditioning must be performed before the first deposition. Then subsequent depositions can be carried on up to a total of 2  $\mu\text{m}$  thickness. After that 'etchback' followed by chamber conditioning is needed before more depositions can be done.

- To display the screen shown in Figure 2 on the operation computer, select 'Manual', 'Process Module (CVD)', and 'Processing' tabs in this order. These are circled in red.
- Adjust the platen temperature to the desired temperature for your depositions. To adjust, click on the heater icon (Figure 2) and enter the new value in the menu that shows up on the right side of the screen. Most commonly used temperature is 300°C.
- Wait until the platen temperature reaches the set point value.

- d) Select 'Processing' tab. Select 'Predep' (circled in yellow) from the recipes and click 'Start' (green triangle). This will start deposition of SiO<sub>2</sub> on chamber walls. Note that this must be done with no wafer in the chamber.
- e) The green start triangle will light up when this process finishes.

### 1.6.3 Loading a Sample

Make sure the sample is approved for this system and is clean (do not touched by bare hands). Only 4" silicon wafers can be loaded.

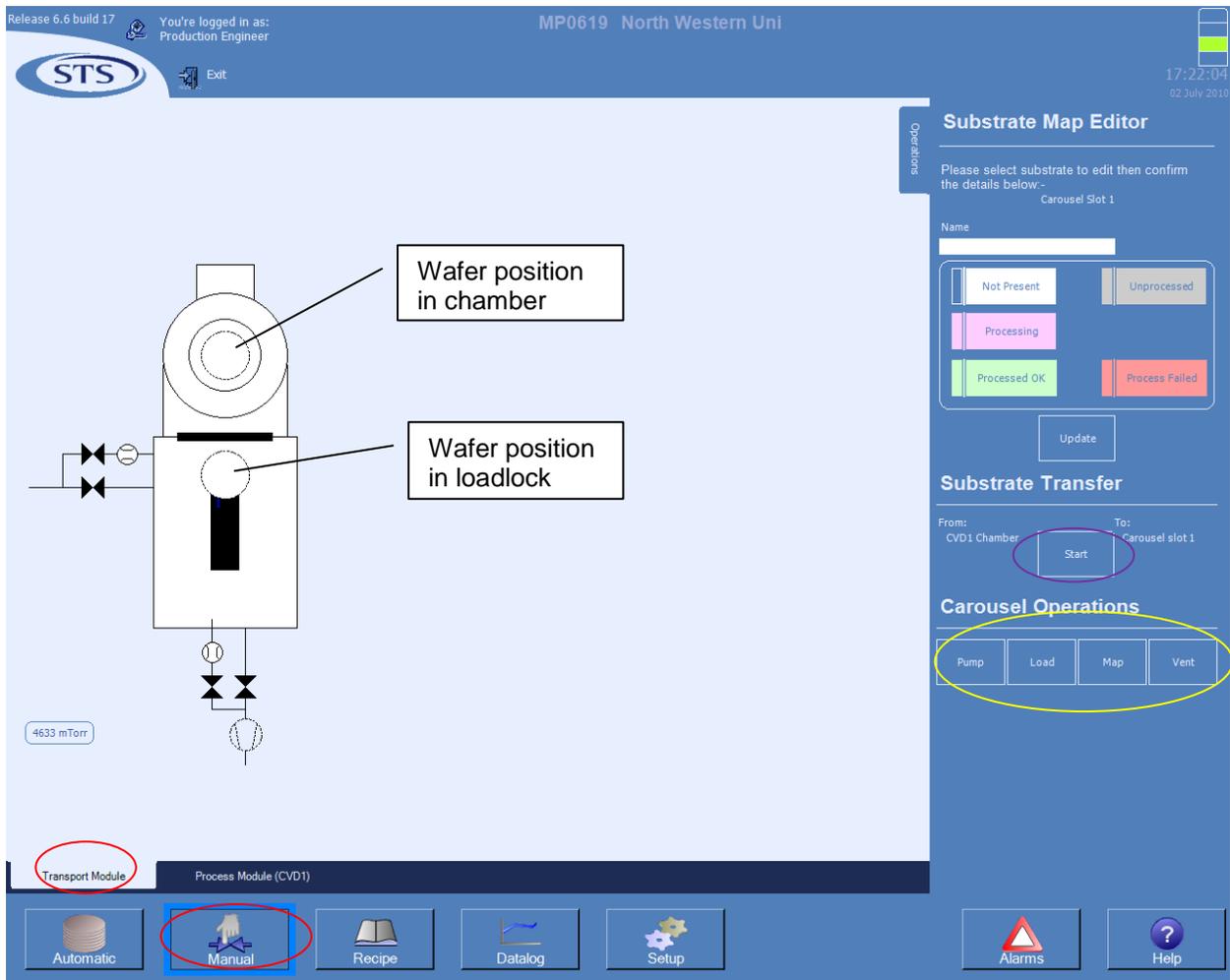


Figure 3: Loading/unloading a wafer.

- a) Go to the loading/unloading screen shown in Figure 3 by selecting Manual and then Transport Module (circled in red).
- b) Click on Vent button (in yellow circle). This will purge the loadlock and then vent it. It will take a few minutes and Vent button will be grayed out during this operation.
- c) Open the loadlock door and place your wafer on the loading arm with wafer flat facing to the front of the machine and aligned as shown in Figure 4. Always make sure the wafer is clean and free of particles and use tweezers to handle it.
- d) Close the loadlock door.
- e) Click on Load button in yellow circle. This will pump down the loadlock and will place a wafer on the loading arm on the computer screen (computer now knows that there is a wafer on the loading arm).

- f) After this operation completes, click on the wafer on the loading arm (Figure 3) followed by its position in the chamber. Then click Start button (circled in purple). This will transfer the wafer from the loadlock to the chamber.
- g) Wait until this operation is complete.

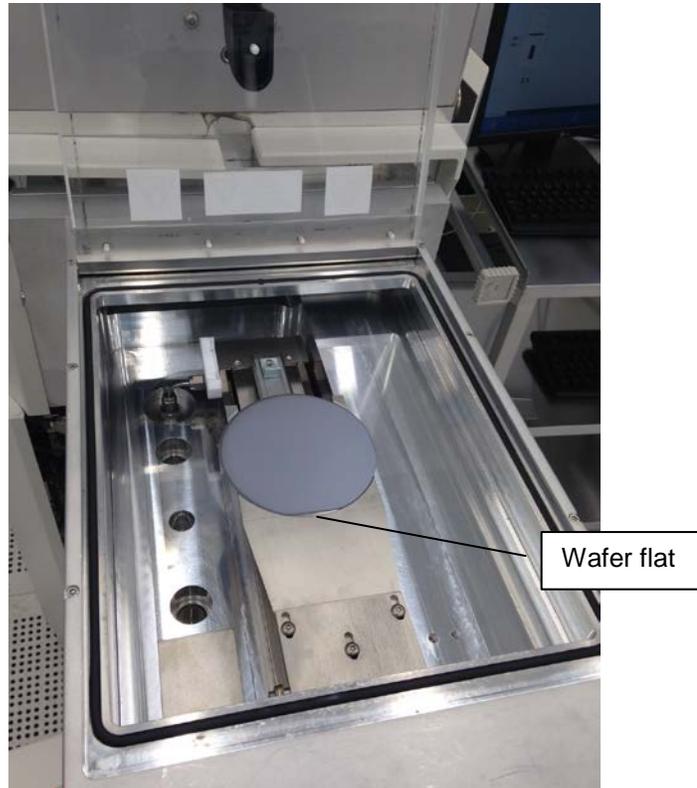


Figure 4: Wafer in the loadlock with its flat aligned to the loading arm.

#### 1.6.4 Depositing the Film

- a) Go to the screen shown in Figure 2 (Manual, Process Module, Processing).
- b) Select the recipe that you want to run. See Sec. 1.6.7 for editing recipes.
- c) Click on Start button (green triangle). While the process is running, its status can be observed on top of light blue area of the screen. Also, the valves', gases', and generators' status can be observed on the diagram. During the process Start button will be grayed out and will be activated after it is finished.

#### 1.6.5 Unloading the Sample

- a) Go to the screen shown in Figure 3 by selecting Transport Module.
- b) Click on the wafer in chamber and its position in loadlock.
- c) Click on the start button (circled purple). This will bring the wafer in loadlock.
- d) Click on Vent (in yellow circle). This will purge the loadlock first and then bring it to atmosphere.
- e) Open the loadlock door and remove the wafer.
- f) If another deposition needs to be done, load another wafer following the procedure in Sec. 1.6.3. Otherwise, close the door.
- g) Click on Pump button (in yellow circle). This will pump the loadlock but will not show the wafer on the arm which is consistent since now there is no wafer in the loadlock.

### 1.6.6 Chamber Conditioning – Etchback

Etchback cleans the chamber by removing deposited materials. It must be run after each deposition session or when total deposition reaches 2 $\mu\text{m}$  (whichever comes first). So, every user must run it before logging out from the system. It must be run with no wafer in the chamber. Do not change platen temperature or any other chamber temperatures after deposition and before Etchback.

- Go to the screen shown in Figure 2 (Manual, Process Module, Processing).
- Select Etchback under Recipes (circled in purple).
- Click on Start button (green triangle). The process is terminated by the EPD computer after all the deposited material has been removed. The EPD computer screen will show the trace as in Figure 5.

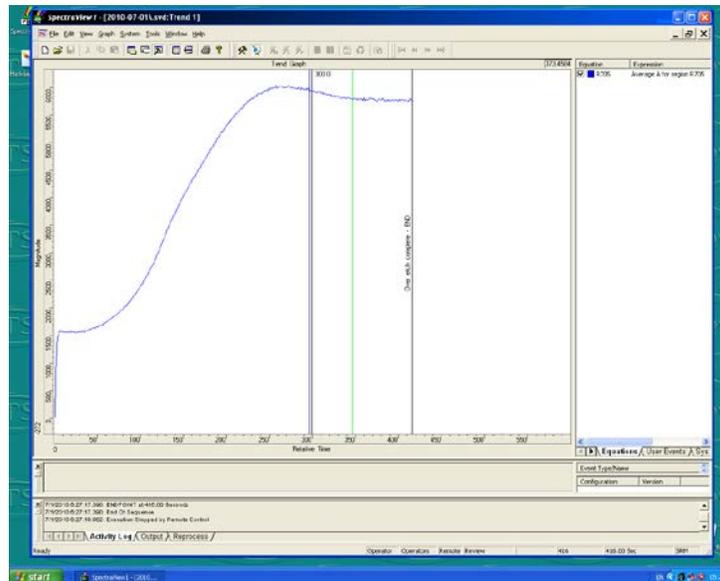


Figure 5: EPD Computer screen.

### 1.6.6 System Logout

- Logout from the system in FOM.
- Switch off the pump under loadlock.

### 1.6.7 Editing Process Recipes

Please do not delete or make changes to any existing recipes. To keep number of recipes manageable, do not make multiple recipes if only difference is the process time. Process time can be readily adjusted before running the recipe.

- Go to the screen shown in Figure 6 by clicking on Recipe button (circled in red).
- Select CVD1 > Process Module. All the process recipes are saved under this folder.
- To copy any recipe, select the recipe by clicking on it. Click on copy button (circled in yellow). Then click Process Module folder to select it. Click on paste button (circled in purple) and then Apply (circled in orange) button. Your recipe will be saved as Copy of (original recipe name). Now you can modify this recipe and change its name.
- Click on + to expand the recipe. Here you can change its name on the first line. Under Description you can enter deposition rate, film properties, etc. All changes are saved by clicking Apply button.
- Recipes contain several modules. Make sure you only make changes in the main etch step. For the recipe shown in Figure 6, the main etch step is called Standard Material Process (circled in blue).
- Clicking on Standard Material Process will open the screen shown in Figure 7. Here, the only thing that you want to change is process time (circled in red, Figure 7).

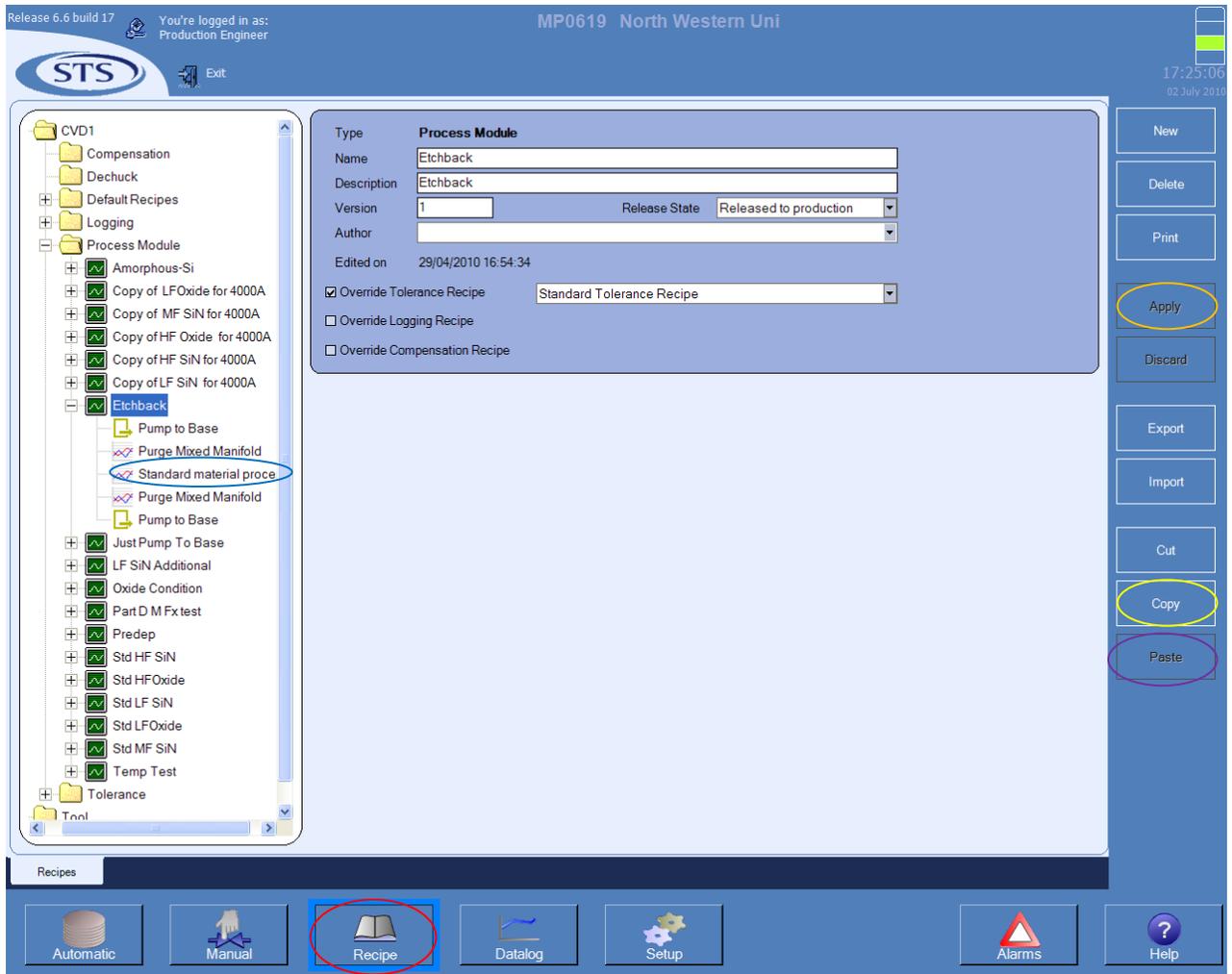


Figure 6: Recipe editing I.

- g) Now by clicking on Pressure, Gases, and Generators tabs (circled in blue), you can adjust pressure, select gases and their flows, and select generator and the power. Make sure to save the changes by clicking Apply button.
- h) Now you can go back to the screen shown in Figure 2 and you will find your recipe listed with other recipes. You can select it and run it if desired.

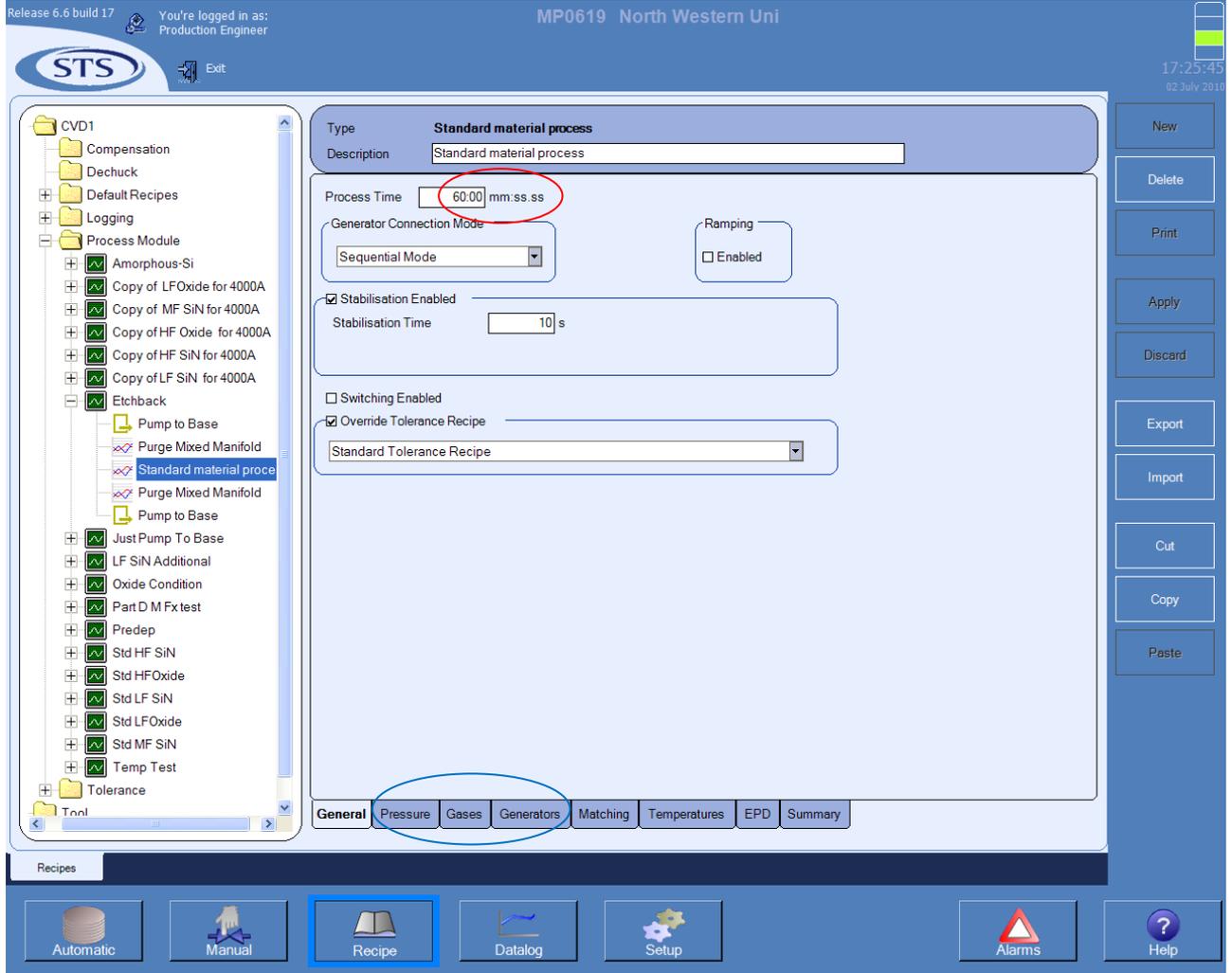


Figure 7: Recipe editing II.