CORAL Name: CoatDevelop-picoTrack

Location: Bay L8
Tool Category: Lithography
Contact: Scott Poesse

Contents

Introduction 1
Safety 2
User Qualifications and Responsibilities 3
Operating Procedures 3
Appendices 7
Syringe Dispense Option 9
Operating Procedures for the Syringe Dispense System 9



Introduction

The **CoatDevelop-picoTrack** is a fully automated coater and developer track system with integrated vapor prime ovens, hotplates, and chill plates. The system allows for the spin coating of photoresist, as well as spray developing, and puddle developing of 6" and 8" wafers. Two standard photoresists are available (AZ 3312 and AZ nLOF2020) through integrated pumps, and additional resists may be dispensed with a syringe pump system

in smaller quantities. Two standard developers are available (AZ 726 and AZ 435), each with spray, stream or puddle recipes on the develop side of the system.

The coater track and developer track operate independently and can be run simultaneously. Both tracks have redundant hotplate stacks for improved throughput. Recipe creation is controlled by MIT.nano Staff to ensure standard recipes do not get inadvertently changed. Several standard recipes exist for a variety of thicknesses, but MIT.nano Staff can create custom recipes for users upon request.

Safety

Read and understand this SOP before use. Only trained personnel may operate this system. You must have an approved PTC process. This tool utilizes robot handling systems which can become pinch points; the handler also uses a low power laser to map the cassettes. Liquid chemical hazards exist inside this tool, users should be familiar with the chemicals used in the tools and know where to find the appropriate SDS for these chemicals.

Chemical	GHS Hazards	SDS	Chemical Components
AZ 3312 Positive Photoresist	Flammable, Irritant, Harmful	AZ 3312	2-Methoxy-1-methylethyl acetate, Ethyl lactate, Diazonaphthoquinonesulfonic ester, Aromatic hydroxy compound, 2-Methoxypropul acetate-1
AZ nLof 2020 Negative Liftoff Photoresist	Flammable, Harmful	AZ nLof 2020	2-Methoxy-1-methylethyl acetate, Phenolic compound, 2-Methoxypropyl acetate-1
AZ 726 MIF Developer	Acutely Toxic, Corrosive, Health Hazard	AZ 726 MIF	Tetramethylammonium hydroxide, water
AZ 435 MIF Developer	Acutely Toxic, Corrosive, Health Hazard	AZ 435 MIF	Tetramethylammonium hydroxide, water
AZ EBR 70/30 Edge Bead Remover	Flammable, Harmful	AZ EBR 70/30	1-Methoxy-2-propanol, 1-Methoxy-2-propanol acetate, 2-Methoxypropyl acetate
HMDS (Hexamethyldisilazane)	Flammable, Toxic, Corrosive/Irritant	HMDS	Hexamethyldisilazane

TABLE: Chemicals with broad hazard classification.

The hotplate stacks have high temperature hotplates at various temperatures up to 250C, users should not attempt to access the hotplates. Please observe the following safety protocols:

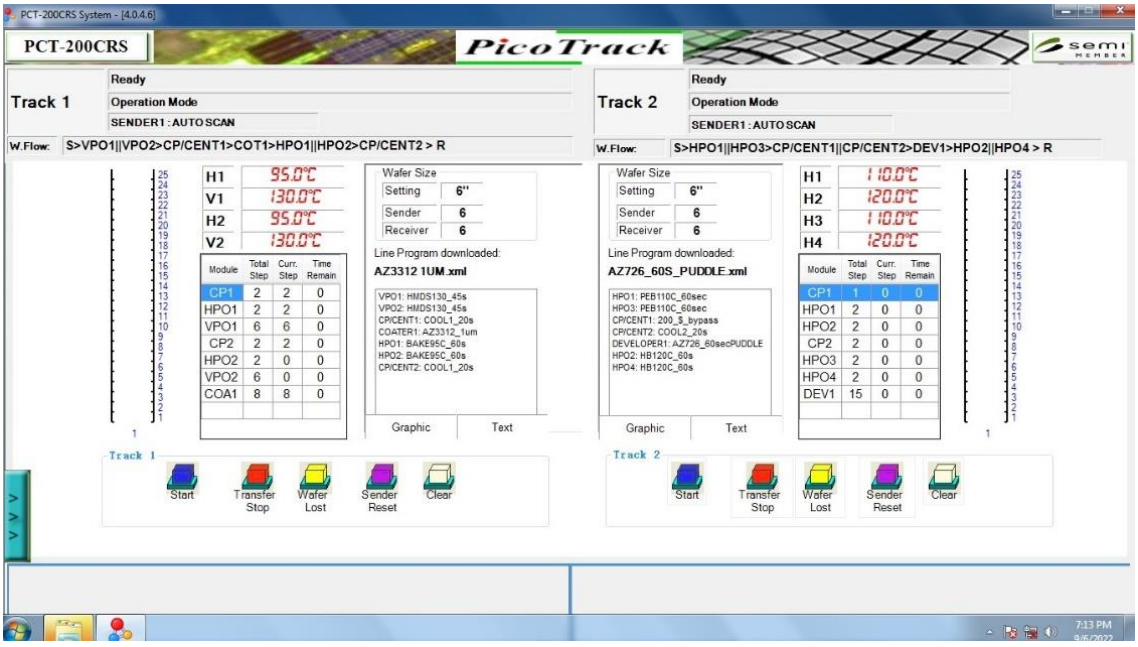
- Do not open the tool enclosure doors while the tool is in operation, with the exception of the send/receive cassette doors.
- Do not remove or open the enclosure panels on the lower part of the tool.
- Do not place your hand or other object in the path of the tool's robot handler, and do not manipulate the handler or transfer arm.
- Do not attempt to recover wafers from the system without talking to staff.
- Wear nitrile gloves when working directly with solvents and developers.

User Qualifications and Responsibilities

- Users must have an approved PTC process prior to training.
- User-supplied resists for the syringe dispense option must be approved through the Personal Chemical Request Form.
- Report all problems, including stuck wafers in CORAL.
- Coordinate with staff to modify or create new recipes.

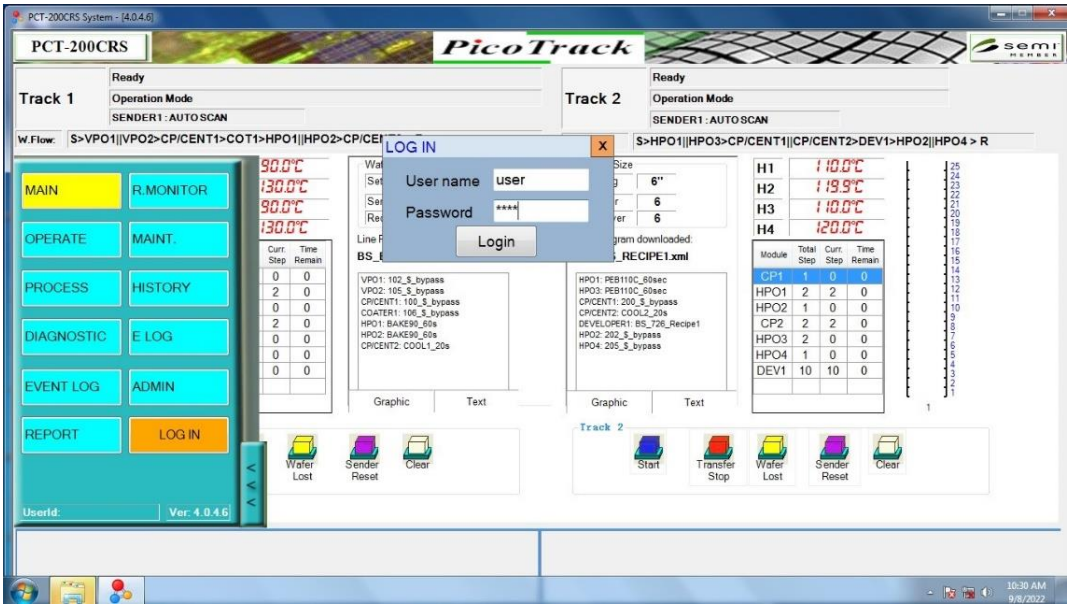
Operating Procedures

1. Check reservations in CORAL to ensure you have reserved the correct machine at the correct time. Engage the tool in CORAL.
2. The MAIN screen is shown below.

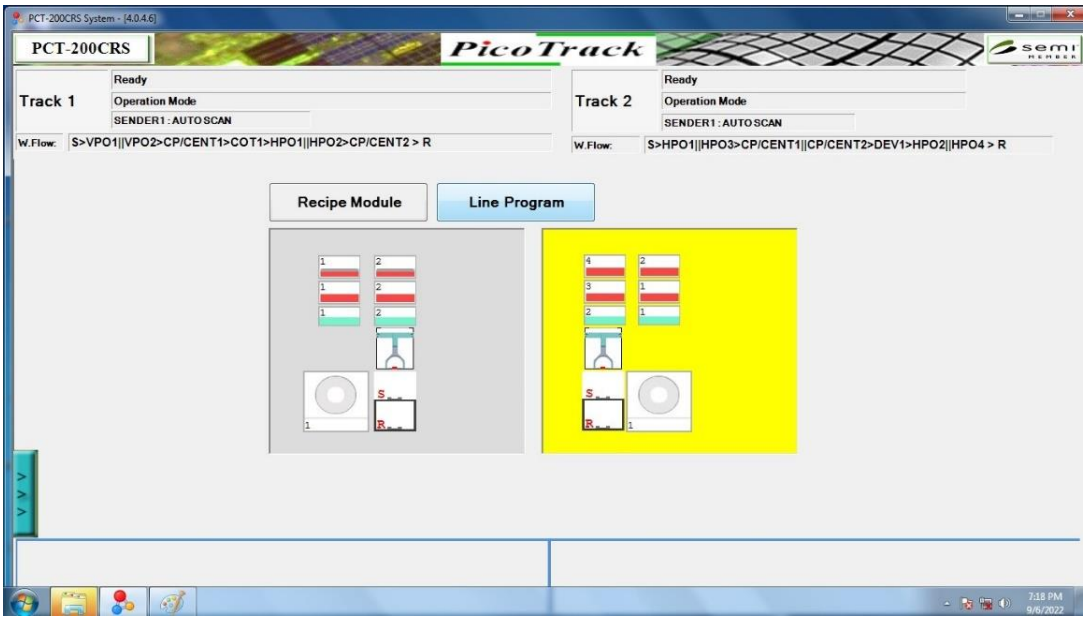


3. Touch the small blue rectangle with arrows on the lower left side of the screen to access the menu selector.

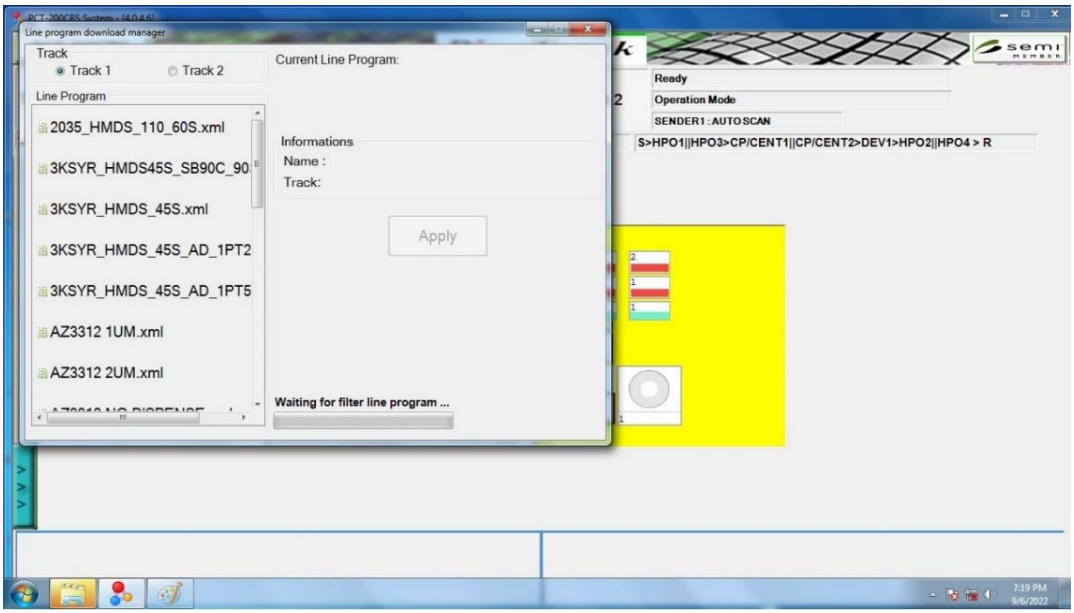
4. Select LOG IN. The User name is “user” and the Password is “user”.



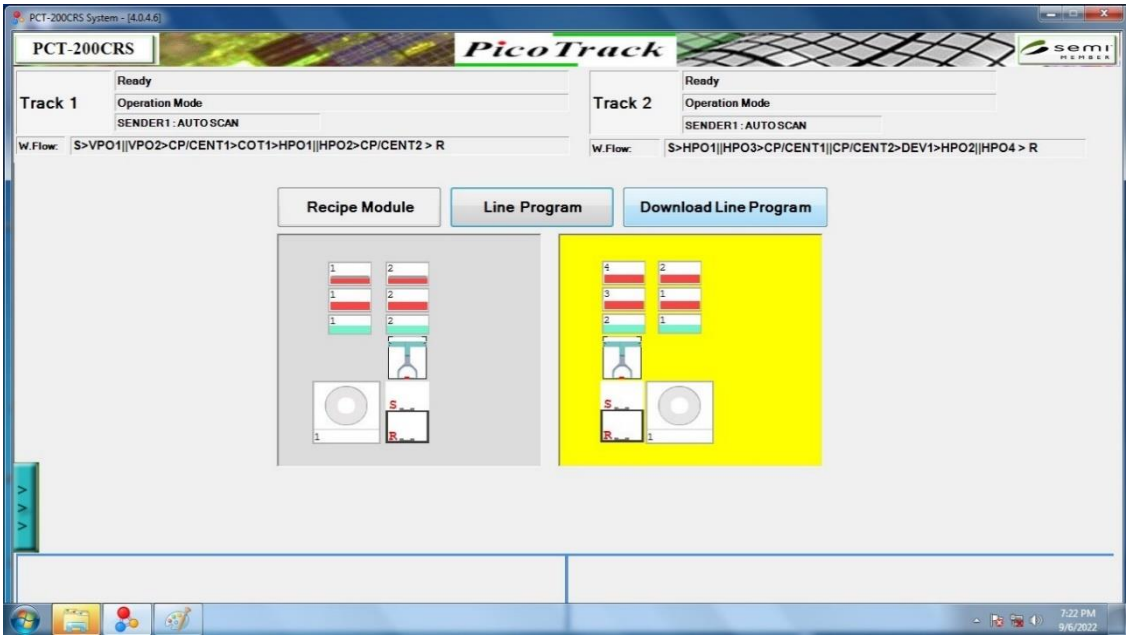
5. After logging in you will be brought back to the MAIN page. From there you will select OPERATE.



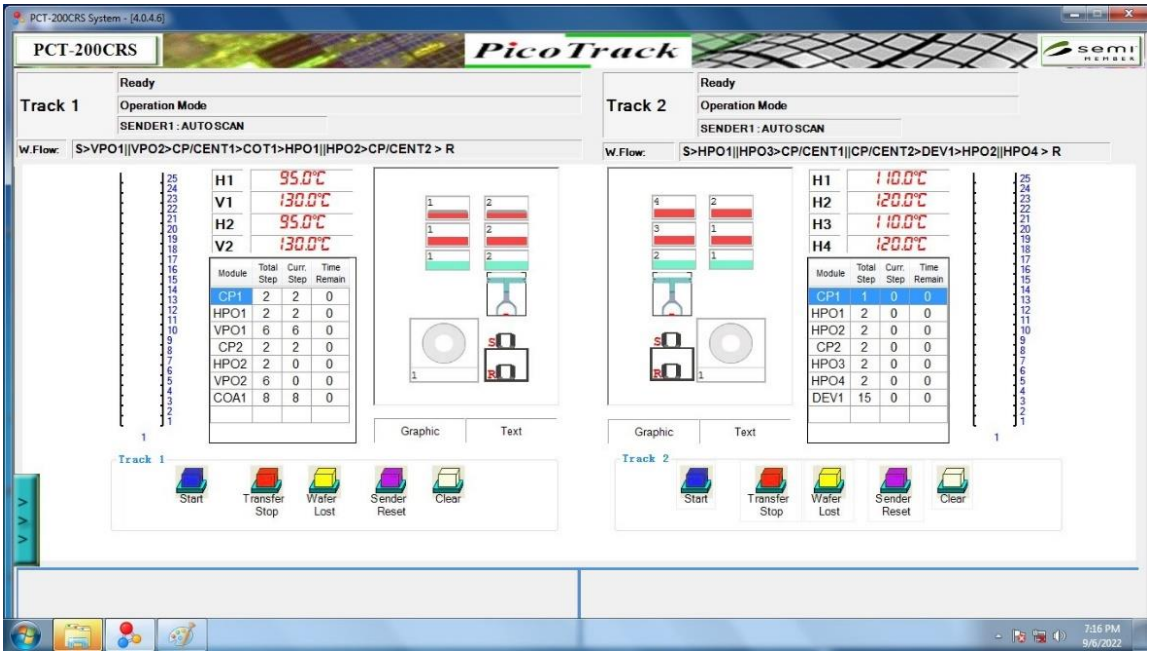
6. Select LINE PROGRAM and you will be brought to the following screen.



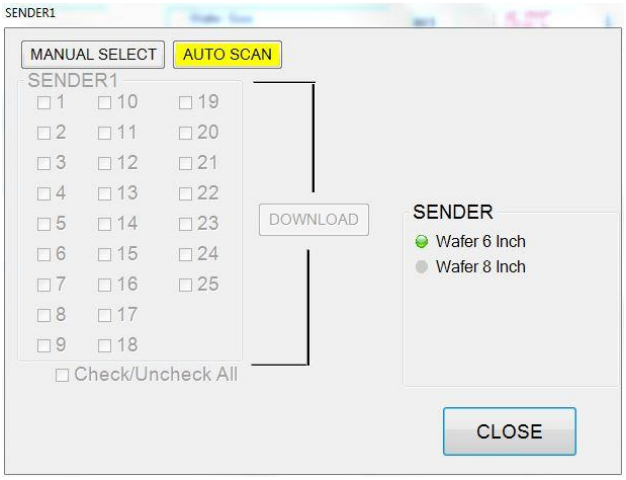
7. Select “Track1” for coater recipes or “Track 2” for developer recipes. Double tap the recipe you wish to use and hit “Apply”. That will take you to the next screen shown below.



8. Select “Download Line Program” and you will be brought to the MAIN page.



9. Load your wafers into the SEND (top) cassette for the track that you wish to run (COAT or DEVELOP). Load an empty RECEIVE (bottom) cassette in the same side. Make sure when the cassette is place onto the indexer that it lies flat and fits into the appropriate slots for a 6” cassette; failure to do so may result in the transfer arm crashing into wafers or wafer breakage.
10. Touch the S for Send Cassette. The following menu will be displayed.



If you choose MANUAL SELECT you must enter the wafer numbers and slots you wish to be processed. Press download. If you choose AUTO SCAN, the robot will scan the cassette and all wafers will be processed.

11. When you are ready to run click START or press the START button to begin processing the wafers. The sequence will run automatically, when the process is complete the system will beep and the green light will flash on the RECEIVE indexer; remove the RECEIVE cassette to silence and reset the system.

a. NOTE: Once a wafer has entered into the sequence, it must be processed through completion. Do not attempt to remove a wafer from the robot during the process. If you wish to abort the process for any wafers remaining in the SEND cassette, then click or press the SEND RESET button.
b. If the system alarms during the process and you are able to correct the problem (within your training), press CLEAR to acknowledge the alarm and press START again to resume the process.
c. When your process is complete, remove your wafers from the cassette. Log out of the user account, then disengage in CORAL. Be sure to enter the correct run data in the CORAL window.



Appendices

Appendix 1 – Menu Tab Descriptions

- MAIN: Default screen, monitor wafers and process, software control panel.
- OPERATE: Select and load various processes for Track 1 and Track 2.
- PROCESS: Create and edit module recipes and sequences (STAFF ONLY).
- DIAGNOSTIC: Status for sensors and solenoids.
- EVENT LOG: List of commands from all users that occur on the tool.
- REPORT: Report of wafer scan, wafer complete and lot complete.
- R.MONITOR: Monitor the individual modules & recipe progress (temperature, time, spin speed) in detail.
- MAINT.: Service mode for maintenance and calibrations (STAFF ONLY).
- HISTORY: Alarm and recipe download history log.
- E LOG: Customizable user log to track maintenance and recipe history.
- ADMIN: Manage user accounts (STAFF ONLY).

Appendix 2 – Standard Recipe Sequences

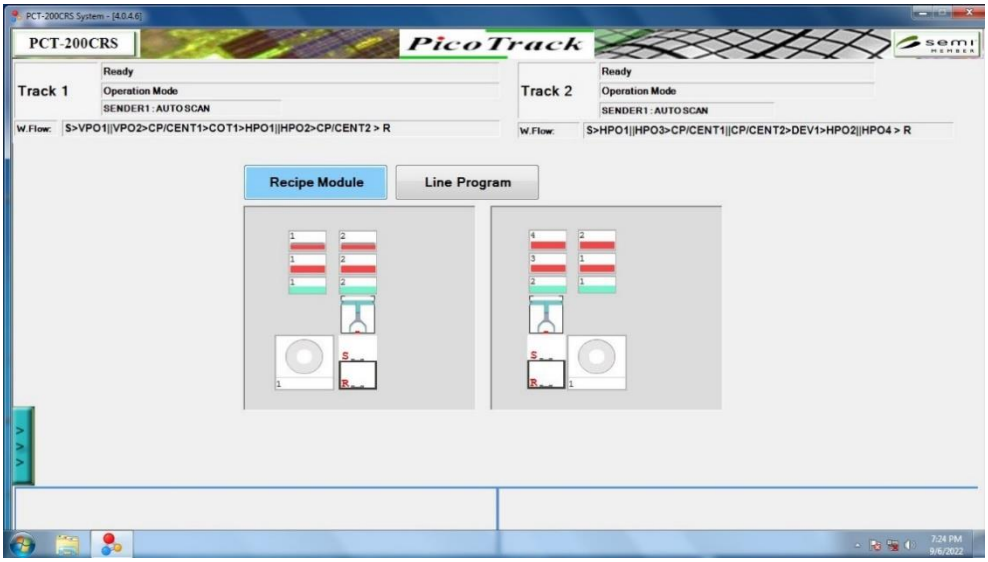
Track#1
AZ3312_1um Positive photoresist, 1um
AZ3312_2um Positive photoresist, 2um
AZNloff2020_2um Negative Liftoff photoresist, 2um

Track#2
AZ726_puddle_60_sec Standard puddle develop recipe for thin photoresist
AZ726_spray_60_sec Standard spray develop recipe for thin photoresist
AZ726_stream_60_sec Standard stream develop recipe for thin photoresist
AZ726_puddle_300_sec Puddle develop recipe for thick photoresist

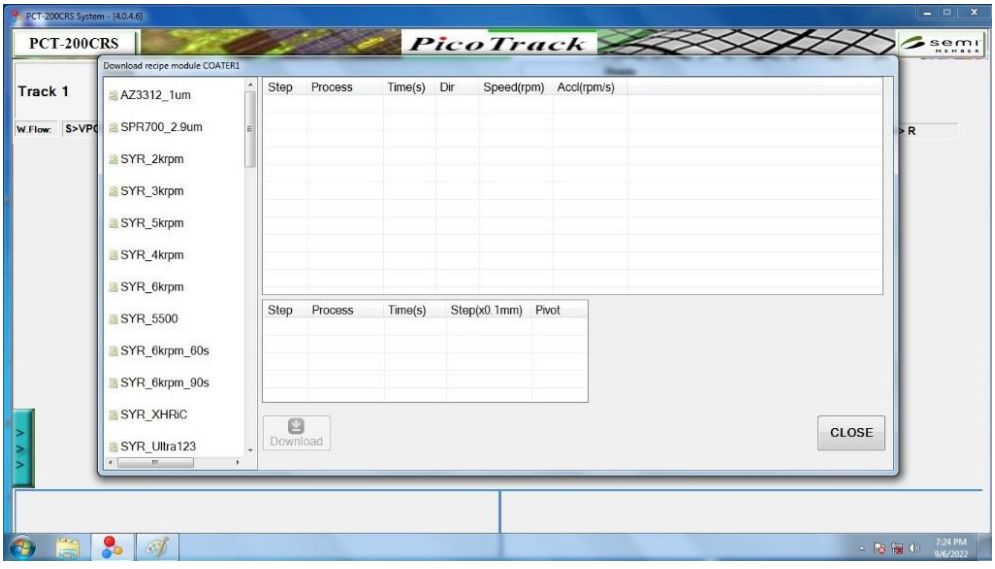
Appendix 3

Additional Procedures

1. All Module recipes can be either changed or bypassed. To do so, chose Operate from the main menu, and then press Recipe Module.



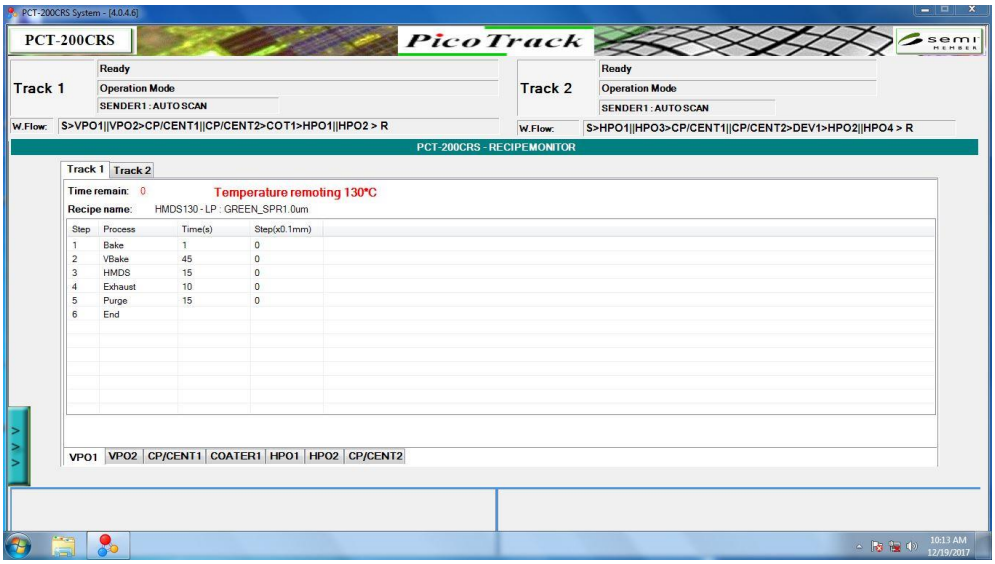
2. On the Recipe Module screen red modules are hotplates, blue modules are chill plates and the coater and developer modules are grey circles. In this example we will choose to bypass the coater module however we could also easily change the coater recipe if we wanted to as well. Once you touch the module the following screen will appear.



3. Scroll down until you see BYPASS. Double click and then click “Download”. Close window. You have now bypassed the coater module. Again, this can be done to any module.

Appendix 4

The R MONITOR tab allows users to view the status of individual modules as wafers are being processed. Hotplate temperatures, spin speeds, and step times can be monitored from this screen.



Appendix 5

Syringe Dispense Option

This section details the procedure for using the ptrack's integrated syringe dispense option for dispensing non-standard photoresists.

The PicoTrack Coater module includes an option for manual photoresist coating via a syringe dispense system. The syringe dispense system utilizes an air driven syringe pump to dispense photoresists from 55 mL syringe vials through the system's nozzle dispense arm. It allows users to dispense non-standard photoresists with improved speed and uniformity from the manual coaters. Process development may be required. Non-standard must be reviewed and approved by MIT.nano staff, requests are submitted on the Personal Chemical Request Form.

Syringes are prepped in hood Liftoff-L08, located in the same bay as the CoatDevelop-picoTrack. Syringes should be transported from the hood to the system with a chemical cart or secondary containment bucket. Be sure all connections between the syringe and tool are tight to prevent leaks. Please clean any chemicals (photoresist or edge bead remover) that are spilled during the transfer process. The user is responsible for returning the syringe system to standby state at the end of tool use.

Operating Procedures for the Syringe Dispense System

1. Filling the syringe: to be completed in **L8**(**Liftoff-L08**)
    - Obtain and clean a 55 mL syringe, screw a blue cap onto the twist-lock end of the syringe.
    - Using a pipette or funnel, transfer photoresist into the syringe so that the vial is 75% full.

- Push a white syringe piston into the syringe until there is very little headspace (air) between the piston and the top of the photoresist.
- Secure the syringe with a blue transport cap on the open end of the syringe.
- Place the syringe into tube rack and transfer to machine in secondary containment.

2. Empty the syringe dispense line:
   - Check the CoatDevelop-picoTrack coater track is in Idle and not operating.
   - Open the side doors on the system' coat module and remove the slide-in glass panel.
   - Remove the air-driven syringe cap, then remove the white syringe piston from the syringe vial, then replace the air-driven syringe cap.
   - Press the dispense pedal to empty the syringe vial and the syringe dispense line. Watch in the coater bowl until the line is empty, then release the pedal.

3. Connect the syringe and prime the dispense line:
   - Remove the air-driven syringe cap, then remove the dispense line from the twist-lock end of the syringe. Place the syringe in the tube rack in the **Liftoff-L8** hood until the end of the process.
   - Tipping the photoresist (PR) syringe upside down, using a fab wipe to catch any drips, remove the twist lock cap and carefully releases any remaining air.. At this time connect a twist-lock filter if using. Connect the dispense line to the twist-lock end of the PR syringe (or filter), then turn the syringe upright and place it into the vial holder on the side of the coater bowl.
   - Transfer contaminated fab wipe to *Solid Waste Container* in **Liftoff-L8**. Add your photoresist chemicals to the hazardous waste tag, if not already included in the list.
   - Remove the blue transport cap from the open end of the PR syringe. Connect the air-driven syringe cap.
   - Watching inside the coater bowl, press the dispense pedal for 1-2 second bursts until you see the photoresist reach the dispense nozzle tip. System is now primed.

4. Load recipe and coat wafers:
   - Using the procedure outlined in the CoatDevelop-picoTrack SOP, load the appropriate line code for your syringe dispense process. This will typically be "SYR-XXXX"; these processes include standard vapor prime and pre-bake steps.
     - Contact staff to create alternative line code recipes.
   - If desired, select a different spin speed recipe using the procedure outlined in the SOP under "Additional Procedures".
   - Follow procedures for loading wafers into the system and start the recipe. Note a single 55 mL vial can coat up to 10 wafers, but the actual number of wafers will depend on the volume of resist dispensed and viscosity of the resist.
   - Each syringe dispense recipe has the following steps:
     - Move nozzle to dispense position
     - 10 sec (two separate 5 sec steps) at 0 rpm for static dispense
     - 5 sec spin at 500 rpm for spread or dynamic dispense
     - 30 sec spin at X rpm
     - Backside EBR and "dry" steps
   - When the wafer is moved to the coater chuck, watch for the arm to move into place. Dispense the resist with the pedal if you do not have a dispense time in your program.
     - Do not allow photoresist run over the edge of the wafers during static dispense. Backside EBR can remove some spill-over but not all, this can foul the pre-bake hotplate.
   - Repeat for remaining wafers. Finish the batch as per the standard SOP.

5. Cleanup and disposal.
    - Upon completion, press the dispense pedal until all the resist is dispensed.
    - Add your photoresist chemicals to the carboy hazardous waste tag that is posted on the wall near the tool, if not already included in the list.
    - Remove the air-driven syringe cap. Using a fabwipe, carefully remove the dispense line from the PR syringe (or filter). Holding the dispense line above the level of the nozzle, reconnect the standby syringe and place it back in the vial holder.
        - Used filters and fabwipes are disposed in *Solid Waste Container* **Liftoff-L8**.
        - Re-cap the syringe at both ends and transport back to **Liftoff-L8** for cleaning or disposal.
        - Used syringe vials can be cleaned in **Liftoff-L8** and re-used. Clean syringe by rinsing with Acetone. Collect waste in the *Liquid Waste Container* in **Liftoff-L08**.
    - Using the funnel or acetone squirt bottle, fill the rinse syringe at **Liftoff-L8**. Return to **CoatDevelop-picoTrack** and replace the air-driven syringe cap and press the pedal until the dispense line is purged with acetone. When the syringe is empty and a small bit of air has entered the dispense line, release the pedal. Remove the air-driven syringe cap.
    - Repeat step c for a second full-vial purge
    - Repeat with empty syringe to flush line with air.
    - Replace the slide-in glass panel.
    - Close doors.