

Ion Miller

Standard Operating Procedure

Revision: 1.0 — Last Updated: March 23 / 2015. Revised by Li Yang

Overview

This document will provide a detailed operation procedure of the Fischione Model 1010 Ion Miller. Formal Training is required for all users prior to using the system.

Revision History

#	Revised by:	Date	Modification
1	Li Yang	March 23	First release
2			
3			
4			
5			

Document No. 4DSOP000X



Table of Contents

General Information	3
Operation	4
Preparation	4
Milling	11
Shutdown Procedure	12
References and Files	13
Contact Information	13

General Information

E.A. Fischione's Model 1010 is a compact, tabletop precision Ar ion milling/polishing system. It is fully programmable for consistently producing high-quality samples to be observed in Scanning Transmission Electron Microscope (STEM) with large electron transparent areas.

- Two independent adjustable Hollow Anode Discharge (HAD) ion sources permit either rapid milling, or more gradual specimen polishing to different materials with various combinations of conditions:
 - a. Milling angle range: 0 to 45°
 - b. Extractor voltage range: 0.5kV to 6.0kV
 - c. Beam Current: 3mA to 8mA
- The choice of single or dual ion source operation allows milling from either one or both sides of the specimen.
- Total ion milling time is typically less than 2 hours depending on the specimen material and its initial thickness.
- A sample can be milled while actively being cooled to temperatures approaching to that of liquid nitrogen.
- The mill process can be stopped with laser control.

This SOP is an operation guide, not including cool stage and laser control. User need to contact Li Yang for further training on using the functions.

Cautions:

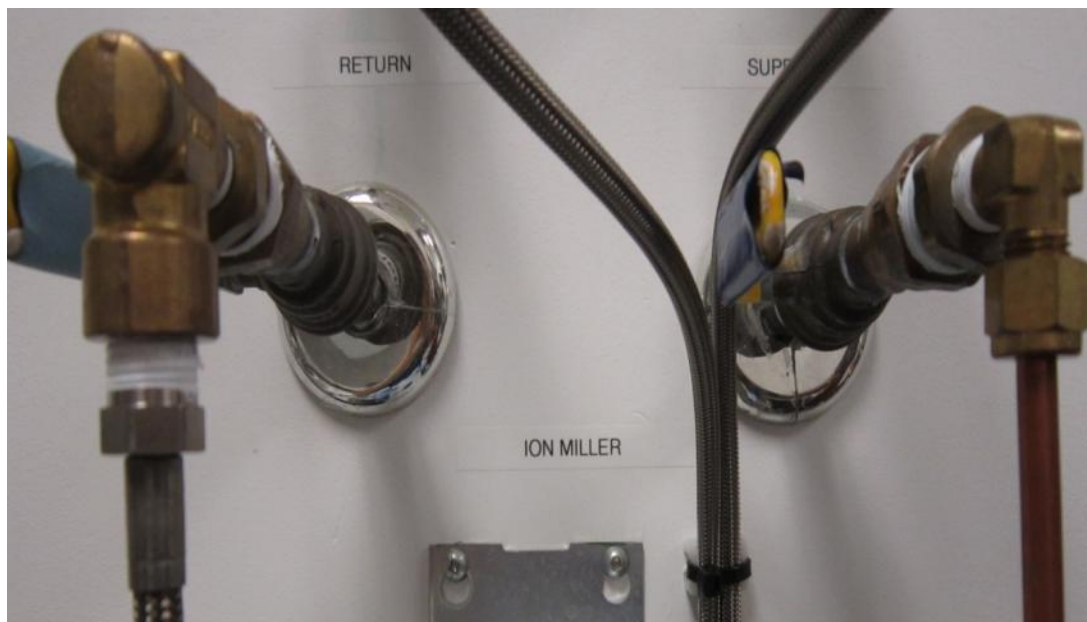
- a. Installing other program onto the Ion Mill computer will interfere with the instrument control and is prohibited.**
- b. Never attempt to force open the chamber insert. To switch a sample, the chamber must be vented and the stage must be warmed to a temperature >10°C.**



Operation

Preparation

1. Verify that the ION MILL is supplied with electricity, Ar gas, and water.

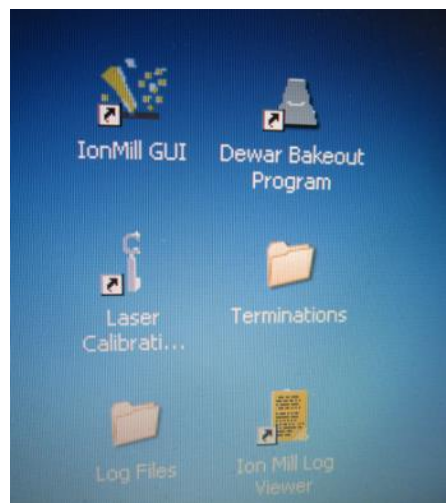


2. Turn on the ION Mill by pressing the switch in the lower rear right corner of the machine.



3. Boot up the computer by pressing the power button. A user identification dialog box will appear.

4. Click 'OK' in the identification dialog box.



The desktop screen will appear with icons for Model 1010 programs. IonMill GUI is the user interface. Others are applications if the functions are chosen.

5. Click 'IonMill GUI' to get the user interface initialized. The interface window is divided into three general

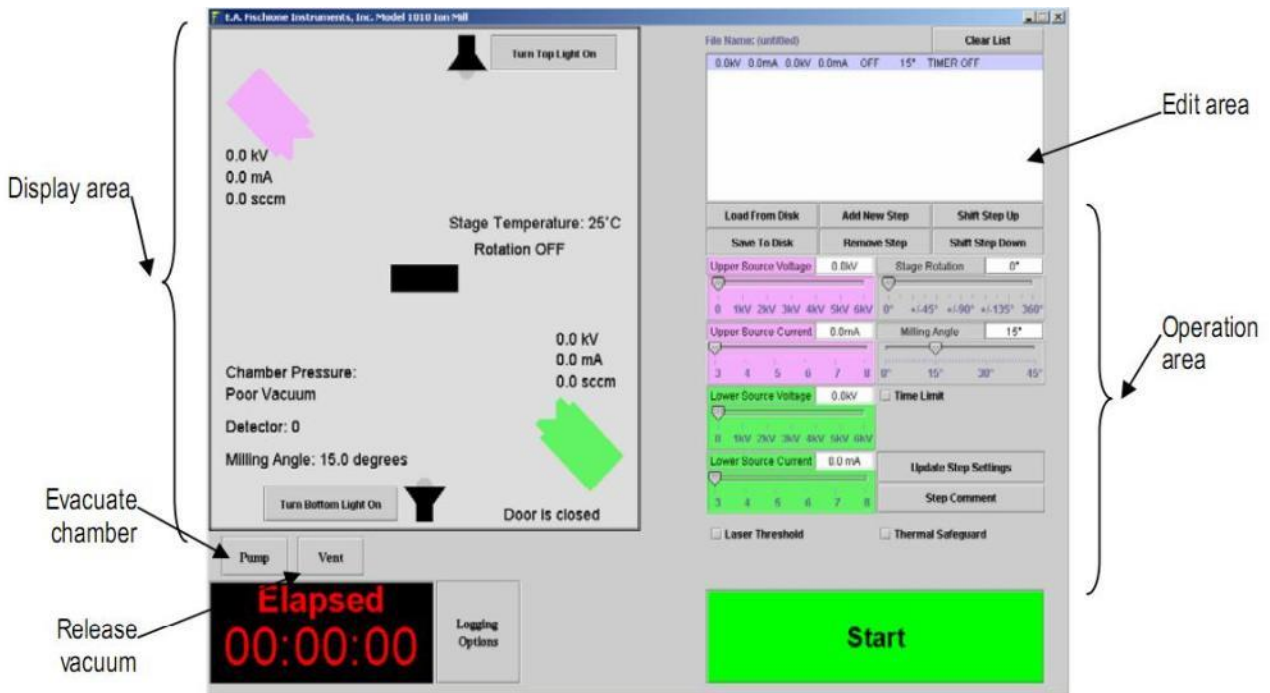
areas:

Display area: Real time monitors of the ion milling parameters.

Click on the Buttons in it will turn the lights on for checking the specimen.

Edit area: For building the ion milling program steps.

Operation area: For entering the milling parameters and editing a given step.



It will take a little while for the program to go through several initialization procedures including checking the tilt of the stage, making sure the stepper motor is engaged, checking the pressure and temperature, and calculating some behind-the-scenes calibrations. When the initialization phase is complete, A Start button will appear at the bottom of the window.

6. Click Vent to release the vacuum. The chamber door will be opened easily.

7. Load the Specimens

Note: Specimen thickness <math>< 150 \mu\text{m}</math>.

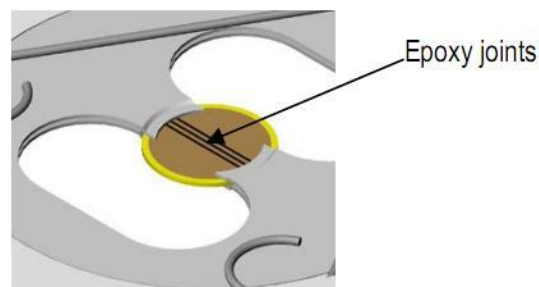
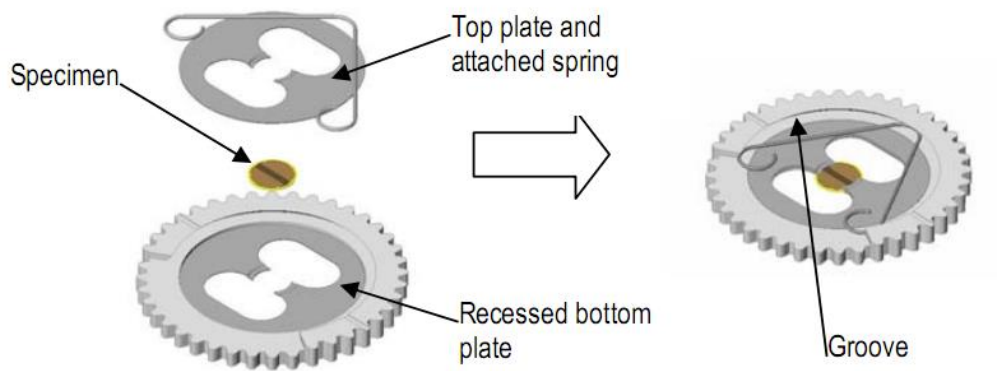
There are two types of sample holders available in the lab. Each one works with different loading kit.

a. Load sample into L.A. SPECIMEN GEAR ASS'Y

1) Place the specimen into the recessed bottom plate. Align the epoxy joints for preparing a cross section TEM sample as shown.

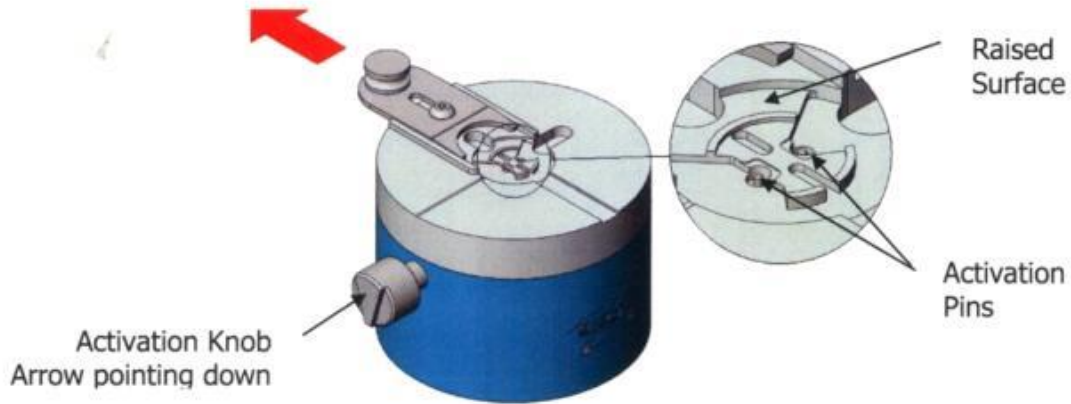
2) Position the top plate and attached spring over the bottom plate.

3) Compressing the spring with tweezers, insert the left, top and finally right leg of the spring into the groove.

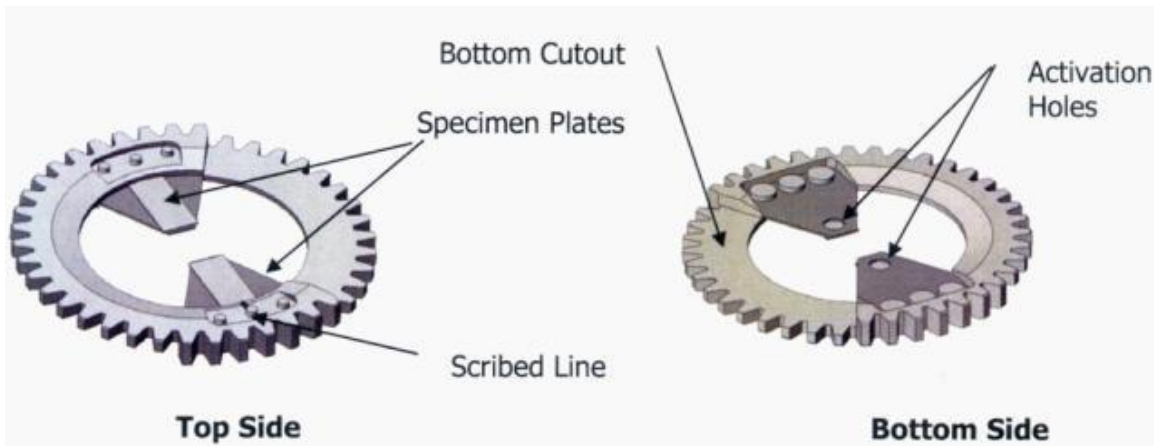


b. Load sample into Low Angle Specimen Holder with Activation Stand:

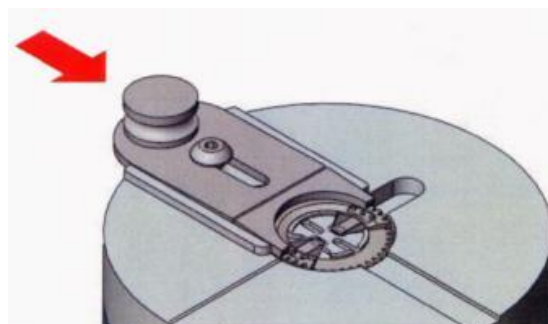
1) Slide the Slide Clamp away from the Specimen Holder seat. Turn the Activation Knob to Arrow pointing down position.



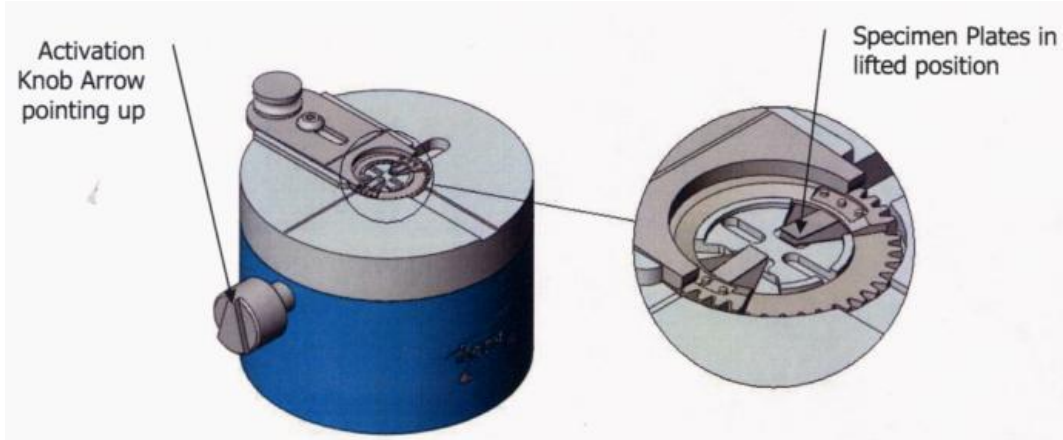
2) Put the Specimen holder into the seat of Activation Stand with the Activation holes aligned to Activation pins, and the Top side up.



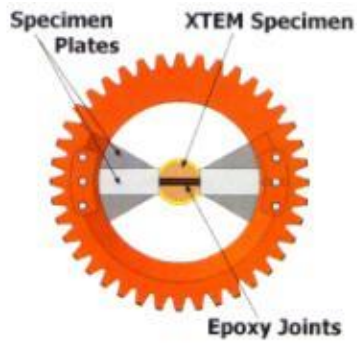
3) Carefully slide the Slide Clamp to the seat to secure the holder.



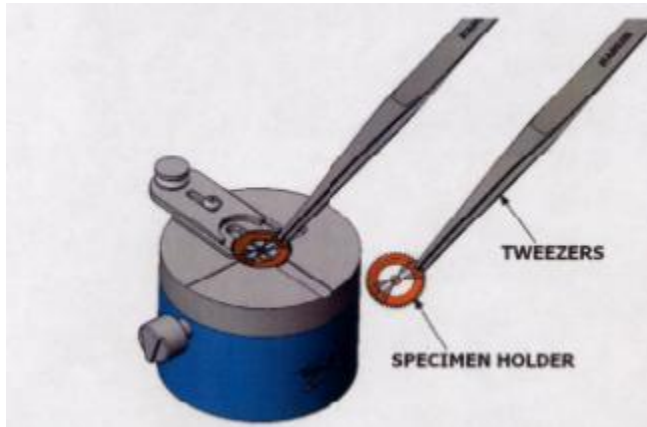
4) Turn the Activation Knob to Arrow pointing up position; this will lift the Specimen plates.



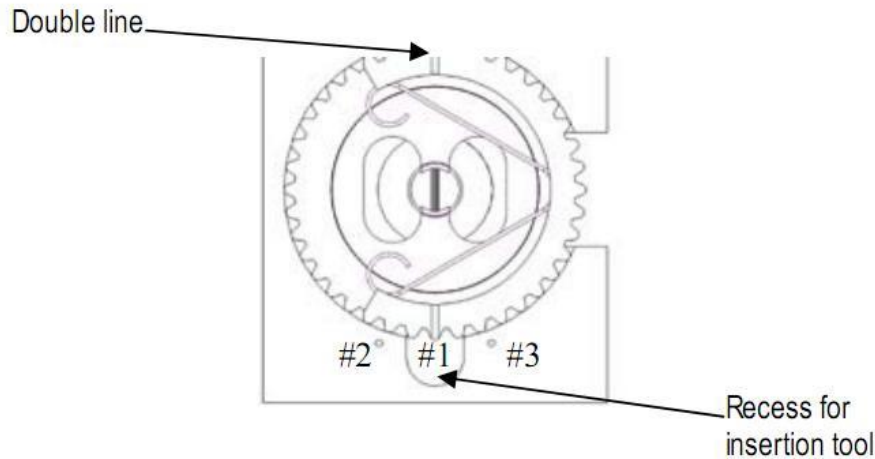
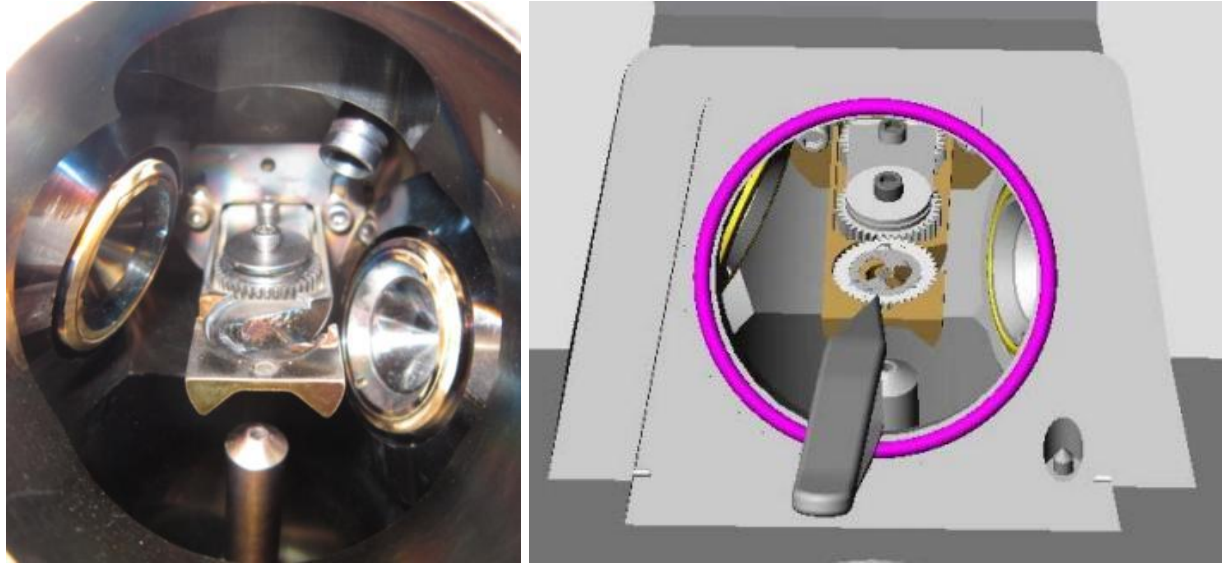
5) Insert the specimen with proper orientation. Such as, align the epoxy joints for preparing a cross section TEM sample as shown.



6) Carefully clamp the specimen by rotating the Activation knob with arrow points down.
7) Slide the Slide Clamp away, lift and remove the holder with tweezers.



8. Loading the specimen gear in to the chamber: Open the chamber door, grasp the specimen gear with tweezers, and insert it properly.

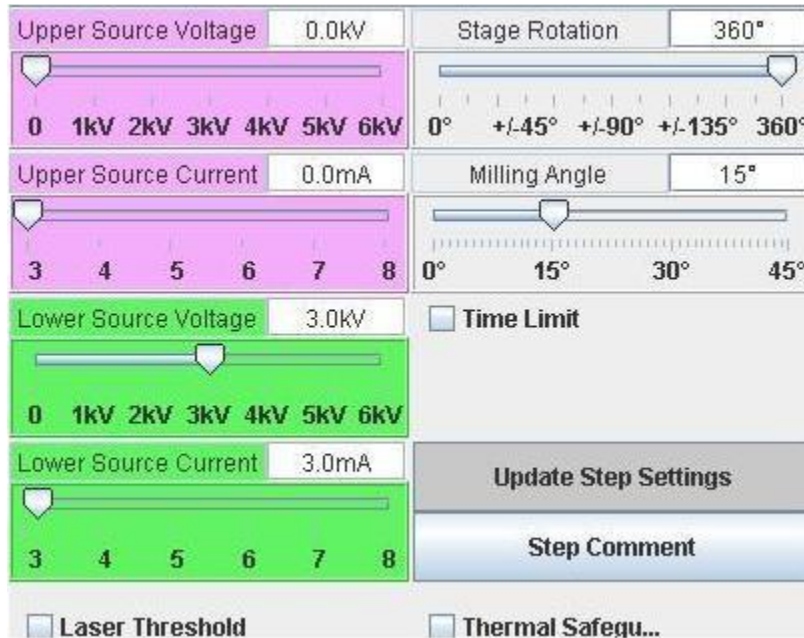


The gear needs to be aligned to different positions if a cross section TEM specimen is prepared with different milling settings:

Milling condition	Gear align set
Oscillated and milled using both ion sources	Double line points to position 1
Only the top source is used	Double line points to position 2
Only the bottom source is used	Double line points to position 3

9. Set up the parameters for ion sources either by typing in the fields, or dragging the sliders with the pointer.

- Voltage.
- Current.
- Stage rotation angle.
- Milling angle.
- The duration of the milling may set by select time limit and type 'hr:min:sec'.
- Click 'Update Step Settings' when you finish setting up the parameters.



Milling

1. Click **Pump** in the Ion Milling program to evacuate the specimen chamber.
2. Close the shutter on the front window. The shutter is to keep the window transparent so that users can check the situations in the specimen chamber.



3. Wait until chamber pressure reaches 2×10^{-5} torr.
4. Click **Start**. Once the milling starts, 'milling' will appear on the monitor with a beam emitting from se-

lected ion source and the 'start' button changes to a STOP button, which allows user to manually terminate the milling operation at any time.

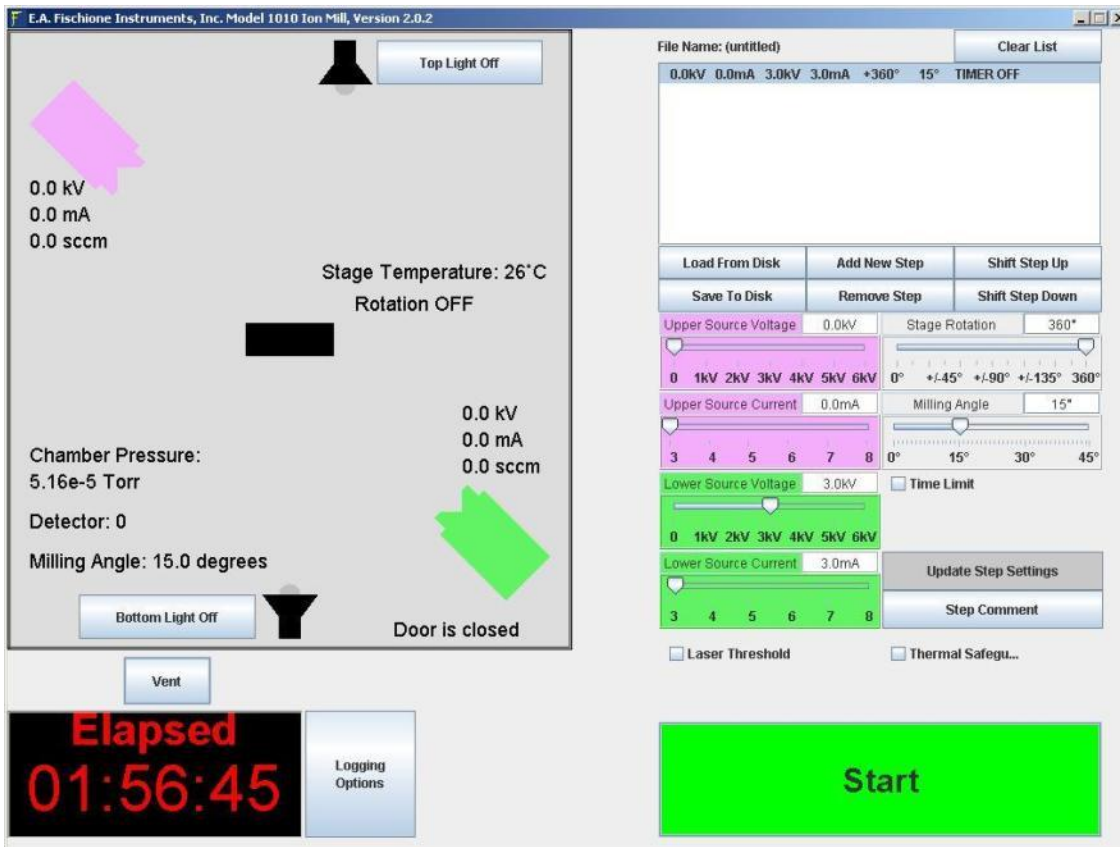
5. Click **Stop** to manually terminate the milling operation when the specimen is milled well. The system will take a little while to end the milling program: initialize a resetting chamber sequence (purging the gas line, returning the stage to horizontal, and re-centering it).

6. Click Vent to release the vacuum. The venting sequence begins with the power off of both the turbo-molecular and rough pumps. After a delay of 20 seconds, the vent valve is opened and the chamber is brought to ambient pressure in approximately 10 additional seconds.

7. Open the chamber access door and retrieve the specimen gear.

8. Take the specimen off the gear, transfer it either to a TEM sample holder, or storage box.

9. Returned gear to its storage box.



Shutdown Procedure

1. Click Pump in the Ion Milling program to evacuate the specimen chamber and verify that the vacuum level reaches 2×10^{-5} torr.
2. Close the the program by clicking X in the top right corner of the program window. The instrument will remain under vacuum.

3. Shut down the computer through Microsoft Windows.
5. Turn off the ION Mill by pressing the switch in the lower rear right corner of the machine to the OFF position.
6. Shut off the valves that supply Ar gas and water to the instrument.

References and Files

FISCHIONE MODEL 1010 ION MILL Manual, related tool manual and inputs from expert users.

Contact Information

Questions or comments in regard to this document should be directed towards Li Yang (yang@4dlabs.ca) in 4D LABS at Simon Fraser University, Burnaby, BC, Canada.