NANO TECHNOLOGY CENTER

# ION BEAM QUICK MANUAL

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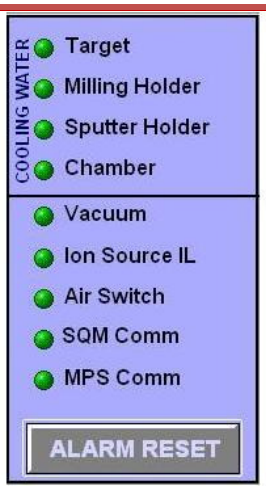
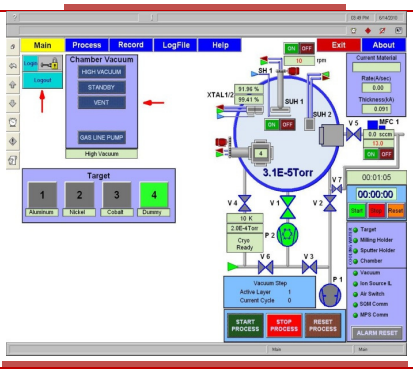
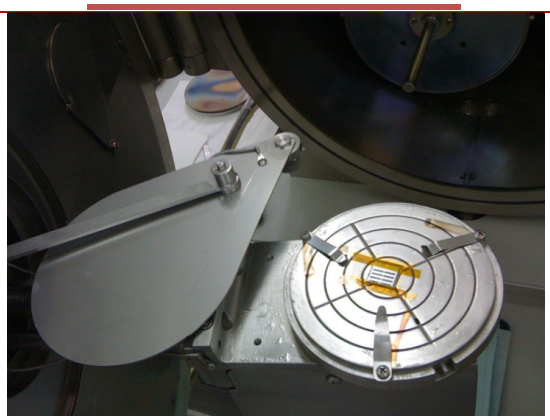
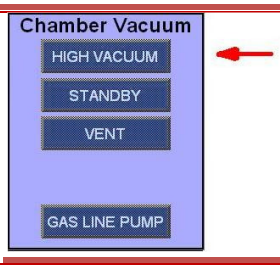
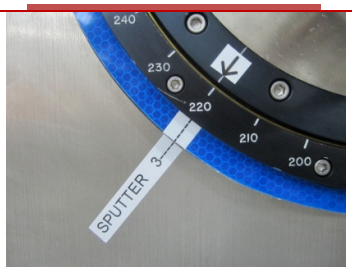
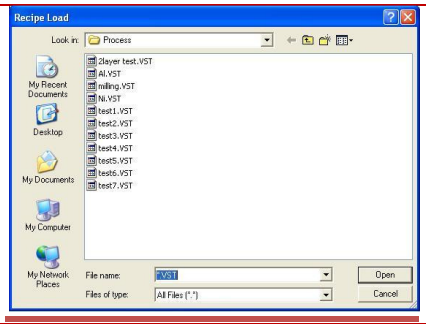
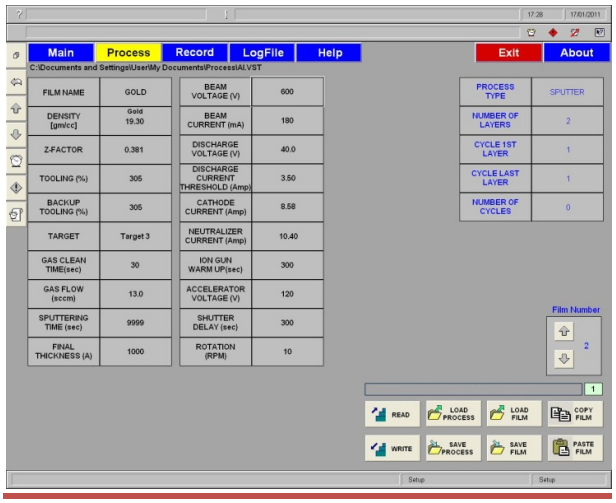
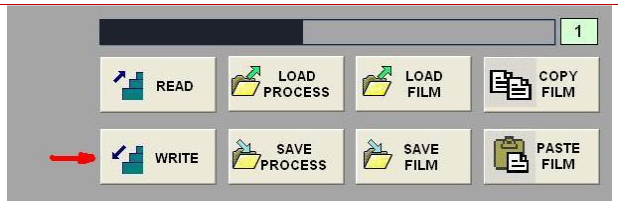
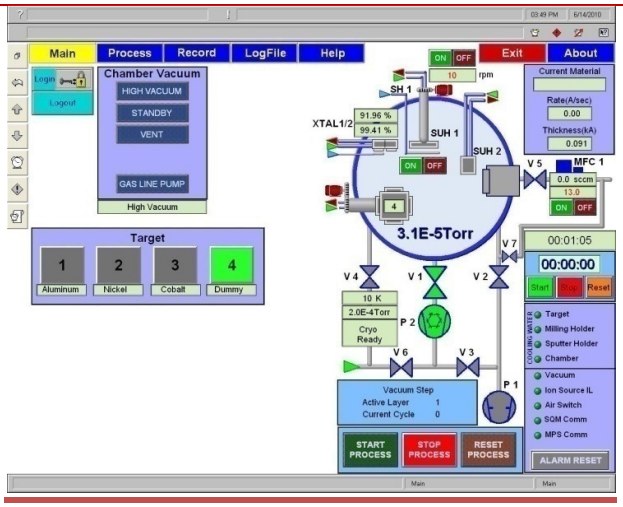
This machine has a touch screen make sure your hands are clean and that you don't have any solvents or other materials on your hands and gloves.

| SPUTTERING Sample Insertion or Removal | | |
|---|---|---|
| 1 | Make sure the power supply is turned on.<br><br>If not turn on by the power on switch. |  <br>  |
| 2 | Make sure there are no active alarms.<br><br>• If all the water alarms are active then the water cooling chillier needs to be turned on.<br><br>• Examine each alarm and fix the problem if all looks as it should press the *ALARM RESET* button. |  |
| 3 | Log in at main menu |  |
| 4 | On the main screen press the ***VENT*** button and wait until the chamber reaches atmospheric pressure. | |

| | | |
|---|---|---|
| 5 | Rotate the sample holder to the ***ACCESS*** position marked #1 (110º) |  |
| 6 | Open chamber door | |
| 7 | Rotate the sample holder to the ***LOAD*** position marked #2 (0º) |  |
| 8 | Open the shutter by clicking on the screen. |  |
| 9 | Place the sample on the sample holder and attach using fingers clamps or Kapton adhesive film. | |
| 10 | Close the shutter by clicking on the screen. | |
| 11 | Return the sample holder to ***ACCESS*** Position marked #1 (110º) Close the chamber door. |  |
| 12 | Click the ***HIGH VACUUM*** button **while holding the door closed with the other hand.** |  |
| 13 | Once the chamber is at vacuum (i.e. holding the door in place)), rotate the sample holder to the ***SPUTTER*** position marked #3(220º). |  |

# SPUTTERING Process Setup

| | | |
|---|---|---|
| 1 | Click the ***Process*** Tab | |
| 2 | Click the arrows under ***Film Number*** until it reaches the correct layer. |   |
| 3 | Click the ***LOAD Film*** button | |
| 4 | Choose the Film suitable for your needs | |
| 5 | (**Make sure the targets for use with this process are installed in the machine**) | |
| 6 | Make sure the loaded Film is the correct one. | |
| 7 | Check the process type label and make sure it is ***SPUTTER***.<br>If it is not:<br>Press the ***PROCCES TYPE*** and change it to ***SPUTTER.*** |   |
| 8 | Enter the desired film thickness in Angstroms in the ***FINAL THICKNESS*** field. | |
| 9 | If you wish to add layers to the process change the layer number by pressing the ***arrows*** under film number to the desired layer and repeat the procedure from paragraph 2. | |
| 10 | Update the number of layers in the ***NUMBER OF LAYERS*** field. | |
| 11 | When finished programming the process press the ***WRITE*** Button.<br>Wait till the transfer data bar is filled. **(failing to do so will run a previously inserted process)** |   |
| 12 | Return to the main screen by clicking the ***MAIN*** *tab*. |   |

| | | |
|---|---|---|
| 13 | Click the ***START PROCESS*** button |  |
| 14 | The Login Dialog will open: fill in user name, password, group name and comments. | |
| 15 | The film type and deposition step are indicated in the window above the "*START*, *STOP*, and *RESET PROCESS*" buttons. | |
| 16 | Every film deposition program sequences through the following steps:<br>1. Vacuum step: Waits until the chamber reaches 5E-6 Torr<br>2. Gas stabilization: Stabilizes the gas flow (30sec).<br>3. Ion gun warm up: Heats the ion gun for the first layer (5 min)<br>4. Deposition: sputtering<br>5. Cool down: Ion gun cool down after process has finished (5 min)<br>6. Starts next layer, if defined. When process has finished the *VENT* option is available.<br>7. After venting the chamber, remove your sample and pump the chamber by clicking the ***HIGH VACUUM*** button on the main menu. | |

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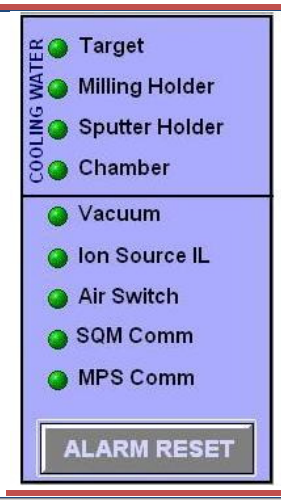
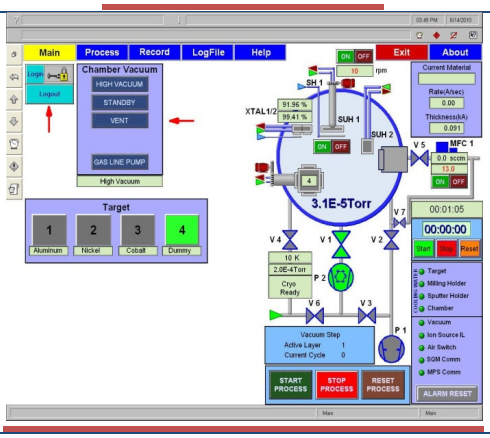
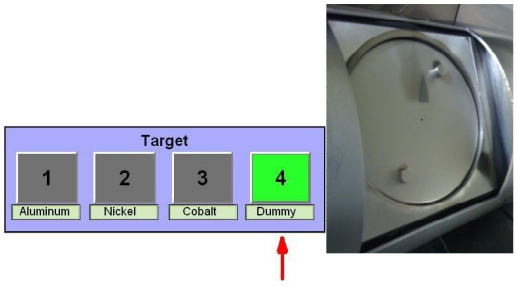
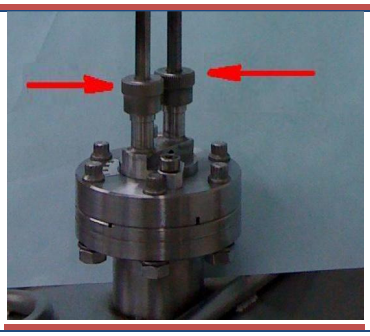
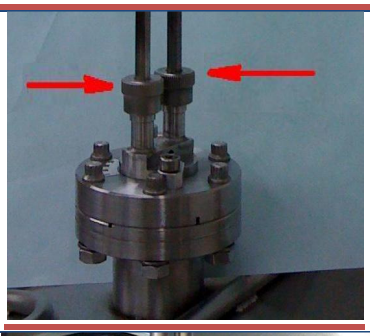
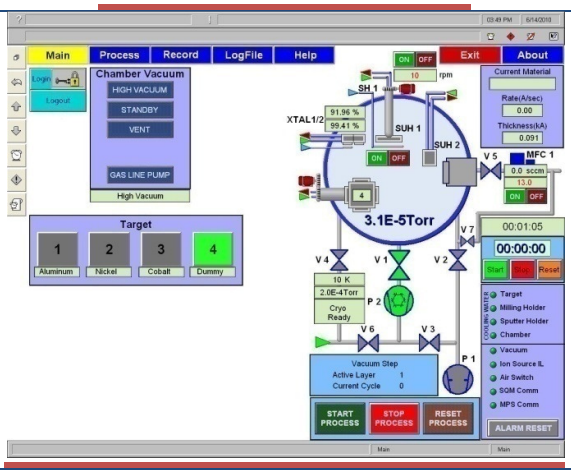
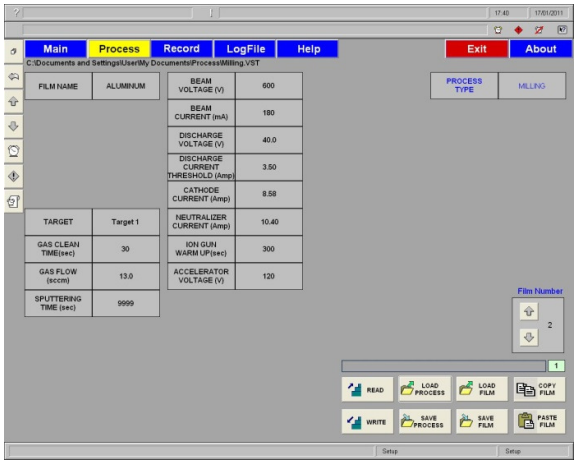
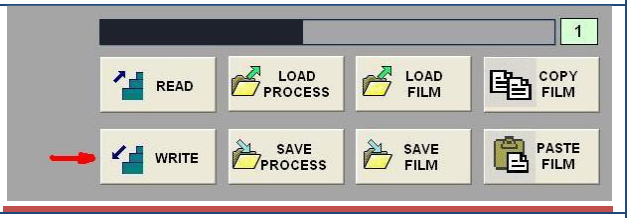
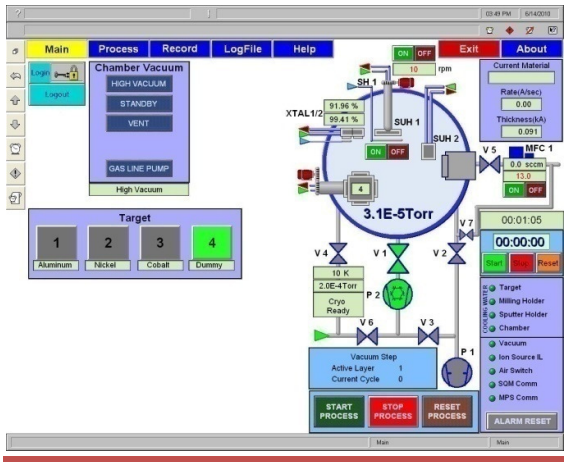
## Milling Sample Insertion

| | | |
|---|---|---|
| 1 | Make sure the power supply is turned on. If not turn on by the power on switch |    |
| 2 | Make sure there are there are no active alarms.<br>• If all the water alarms are active then the water cooling chillier needs to be turned on.<br>• Examine each alarm and fix the problem if all looks as it should press the *ALARM RESET* button. |   |
| 3 | Log in on the main screen |   |
| 4 | Click the Vent button on the main screen and wait until the chamber reaches atmospheric pressure. | |

| | | |
|---|---|---|
| 5 | Rotate the sample holder to the ***MILLING*** position marked #4 (180º). |  |
| 6 | Open the chamber door. | |
| 7 | Click on target ***number 4*** on the main screen. |  |
| 8 | ***Make sure target number 4 is a dummy target*.** | |
| 9 | The milling sample holder is located in the inner part of the chamber as shown at the picture. |  |
| 10 | Release the sample holder by releasing the locking nuts. |  |

| | | |
|---|---|---|
| 11 | Lower the sample holder into position by lowering the sample until it reaches the stopper. |  |
| 12 | Retighten the locking nuts. |  |
| 13 | Attach sample to sample holder using fingers clamps or Kapton adhesive tape. |  |
| 14 | Close the chamber door. |   |
| 15 | Click the ***HIGH VACUUM*** button **while holding the door is closed with the other hand.** | |

# Milling Process Setup

| | | |
|---|---|---|
| 1 | Click the *Process* tab |  |
| 2 | Click the ***LOAD FILM*** button | |
| 3 | Choose the ***MILING*** film | |
| 4 | Press the ***PROCESS TYPE*** and choose the ***MILLING*** option. | |
| 4 | (**Make sure the Dummy Target is installed in the Correct target station)** | |
| 5 | Make sure the loaded process is the correct one. | |
| 6 | Set the desired time in the "***SPUTTERING TIME***" field. | |
| 7 | When finished programming the process press the ***WRITE*** Button. Wait till the transfer data bar is filled **(failing to do so will run a previously inserted project)** |  |
| 8 | Return to MAIN screen by clicking the *Main tab*. |  |
| 9 | Click the ***START PROCESS*** button | |
| 10 | The Login Dialog will open; fill in user name, password, group name andcomments. | |
| 11 | The machine will then start the process automatically. | |
| 12 | The film and milling process step are indicated in the window located above the *START, STOP,* and *RESET PROCESS* buttons. | |
| 13 | Every film will sequence through the following steps:<br><br>1. Vacuum step: Waits till the chamber reaches 5E-6 Tor<br>2. Gas stabilization: Stabilizes the | |

| | | |
|---|---|---|
| | gas flow (30sec).<br>3. Ion gun warm up: Heats the ion gun (5 min)<br>4. Deposition: Milling<br>5. Cool down: Ion gun cool down after process has finished (5 min)<br>6. When process has finished the vent option is available. | |
| 14 | Click the ***VENT*** button. | |

## Milling Sample Removal

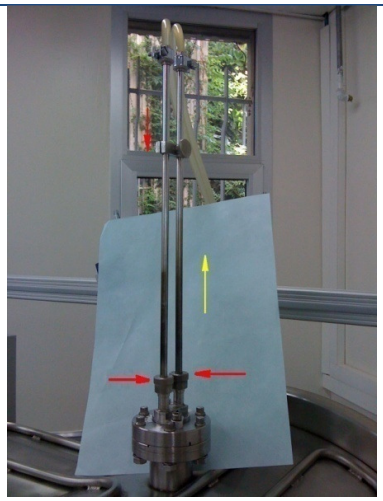
| | | |
|---|---|---|
| 1 | Make sure the sample holder is in the ***MILLING*** position #4(180º) (sputtering holder attach to the door) |  |
| 2 | Open the chamber door. |  |
| 3 | Remove the sample from the sample holder. | |
| 4 | After finishing the milling process return the sample holder to its home position by the following steps:<br>1. Release the sample holder by releasing the locking nuts.<br>2. Lift the sample holder into position by lifting the sample until it reaches its upper most position.<br>3. Retighten the locking nuts. |  |
| 5 | Pump the chamber by clicking the "***HIGH VACUUM***" button on the main menu. | |
| 6 | LOG OUT | |

**FIGURE 2.4 Schematic Diagram of the 12 cm Ion Source**

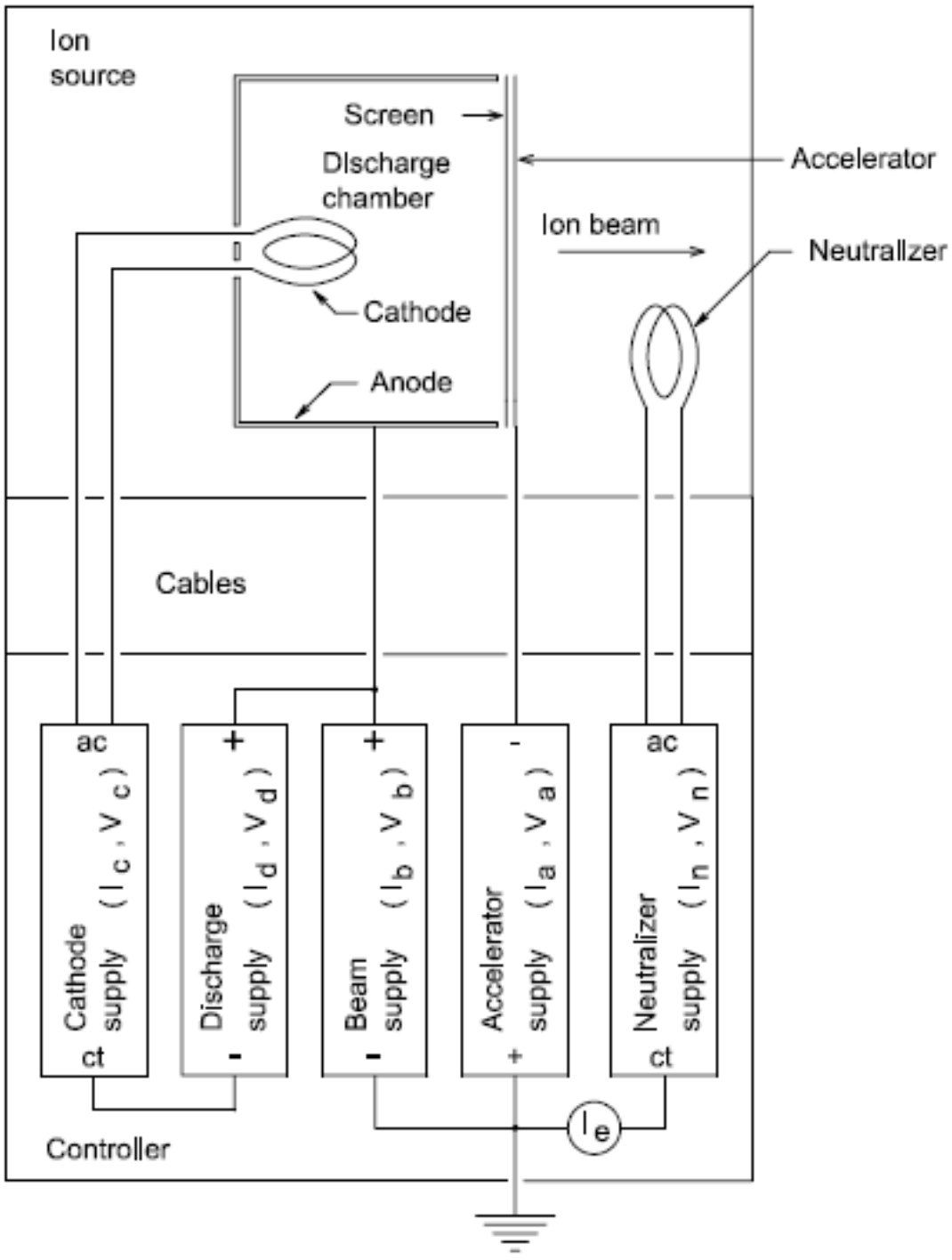



**Table 4.1: Argon Flow for a Range of Beam Currents**

| $I_b$, mA | Ar Flow |
|---|---|
| 90 | 11 |
| 170 | 12 |
| 240 | 13 |
| 480 | 18 |
| 510 | 20 |

**Table 4.2: Maximum Beam Current for a Range of Ion Beam Voltages**

| $I_b$, mA | $V_b$, V | $V_a$, V |
|---|---|---|
| 90 | 300 | 60 |
| 170 | 400 | 80 |
| 240 | 600 | 120 |
| 480 | 800 | 160 |
| 510 | 1000 | 200 |

**Table 5.1: Approximate Discharge Currents for a Range of Beam Currents**

| $V_b$, V | $I_b$, mA | $V_a$, V | $I_d$, A |
|---|---|---|---|
| 300 | 90 | 60 | 1.2 |
| 400 | 170 | 80 | 2.2 |
| 600 | 240 | 120 | 2.8 |
| 800 | 480 | 160 | 5.6 |
| 1000 | 510 | 200 | 6.0 |

**Table 5.2: Maximum Beam Current for a Range of Ion Beam Voltages**

| $I_b$, mA | $V_b$, V | $V_a$, V |
|---|---|---|
| 90 | 300 | 60 |
| 170 | 400 | 80 |
| 240 | 600 | 120 |
| 480 | 800 | 160 |
| 510 | 1000 | 200 |

FIGURE 5.1 Beam Profile for a 90 mA, 300 eV Ion Beam Using Argon at a Source to Probe Distance of 30.5 cm (12 inches)

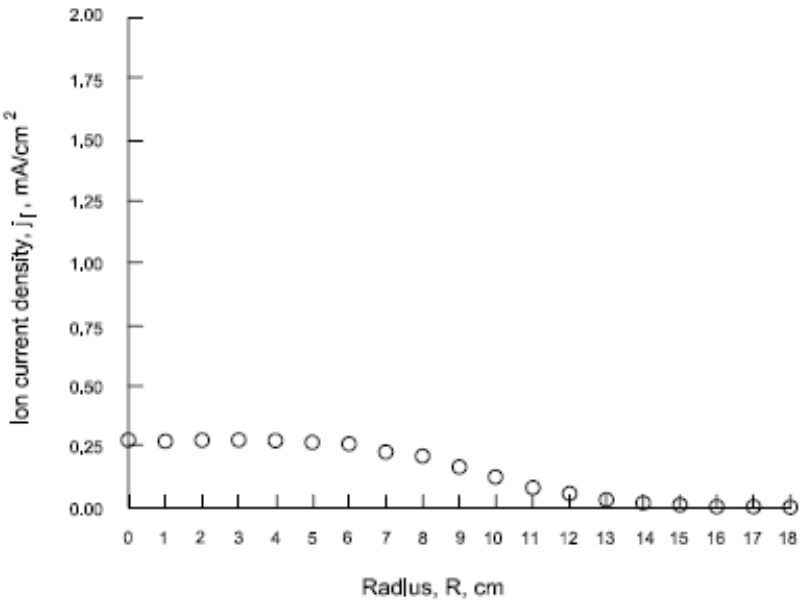



FIGURE 5.2 Beam Profile for a 170 mA, 400 eV Ion Beam Using Argon at a Source to Probe Distance of 30.5 cm (12 inches)

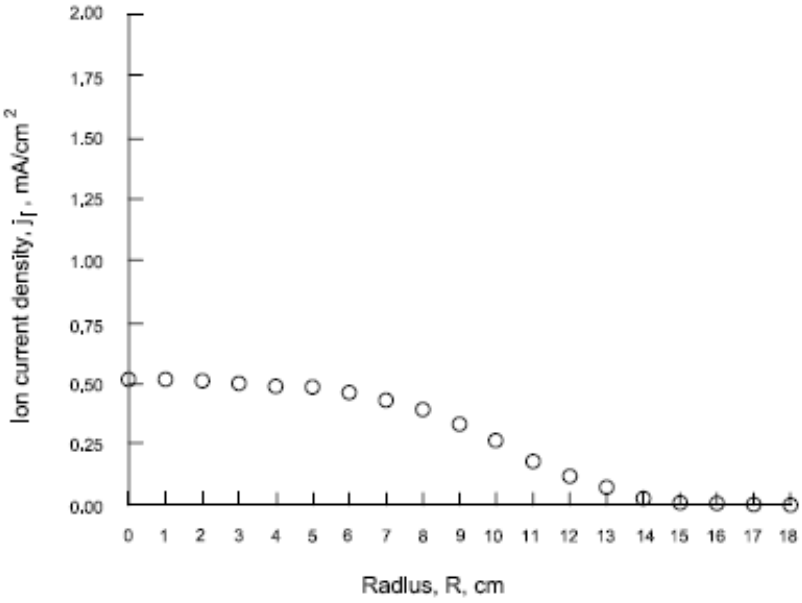


FIGURE 5.3 Beam Profile for a 240 mA, 600 eV Ion Beam Using Argon at a Source to Probe Distance of 30.5 cm (12 inches)

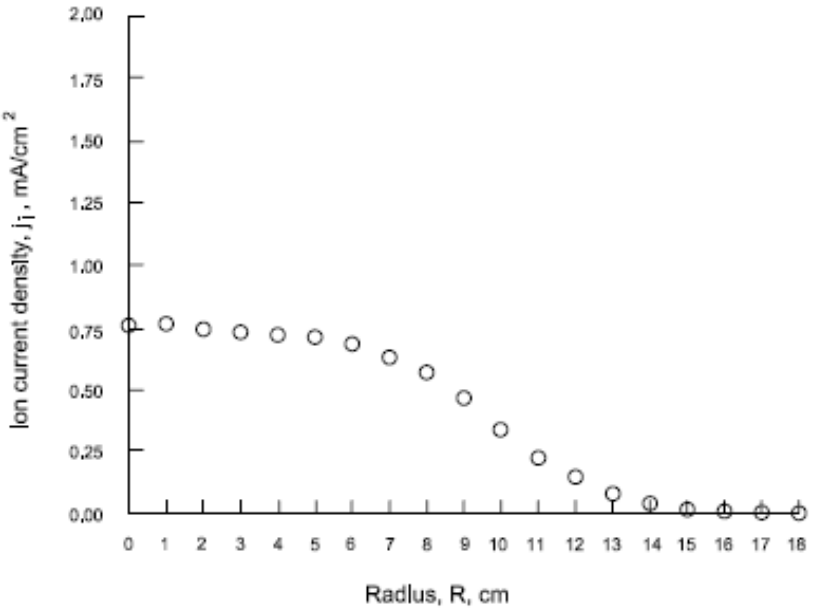



FIGURE 5.4 Beam Profile for a 480 mA, 800 eV Ion Beam Using Argon at a Source to Probe Distance of 30.5 cm (12 inches)

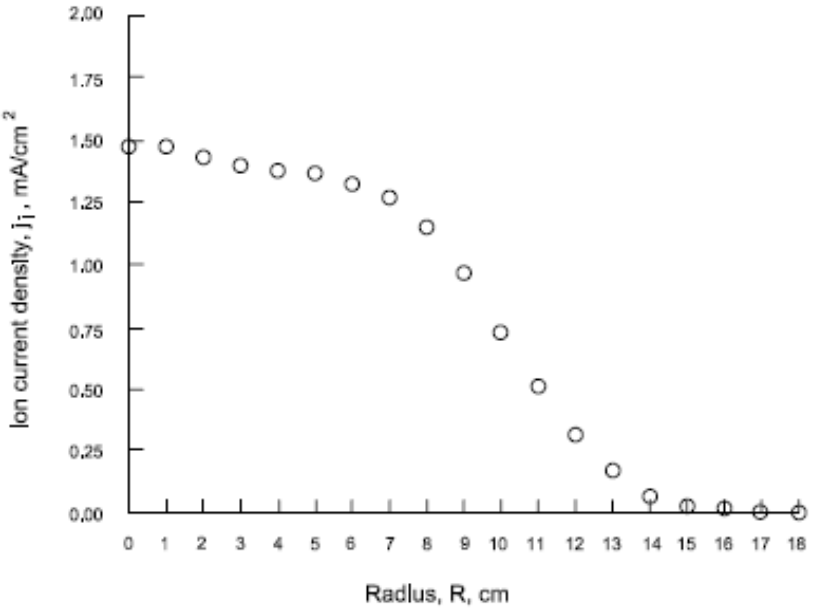


FIGURE 5.5 Beam Profile for a 510 mA, 1000 eV Ion Beam Using Argon at a Source to Probe Distance of 30.5 cm (12 inches)