

Nanolithography Software Manual

Revision 1, January 2013

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Published 2009

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Note on Printing

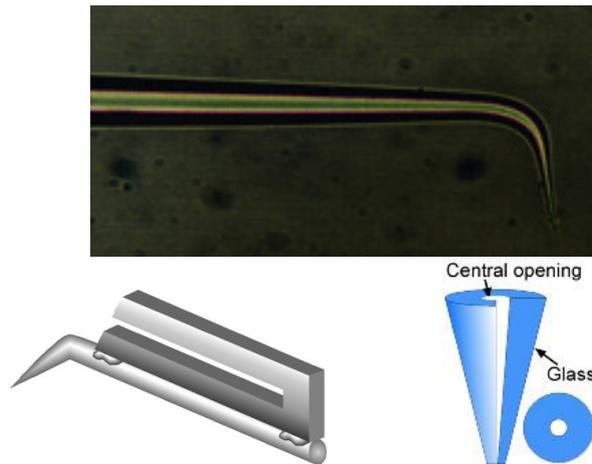
This manual is designed to be printed in color, single-sided on A4 paper

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AFM based Nanolithography General Information:

AFM based Nanolithography can achieve sub-micron nano-writing of a variety of materials with a highly controlled spatial accuracy. Glass hollow capillary is pulled to create a nanopipette with a tiny aperture (could be as small as a few tens of nanometers). The nanopipette is glued on a tuning fork; hence it could be controlled by the AFM system and be accurately positioned on the substrate.



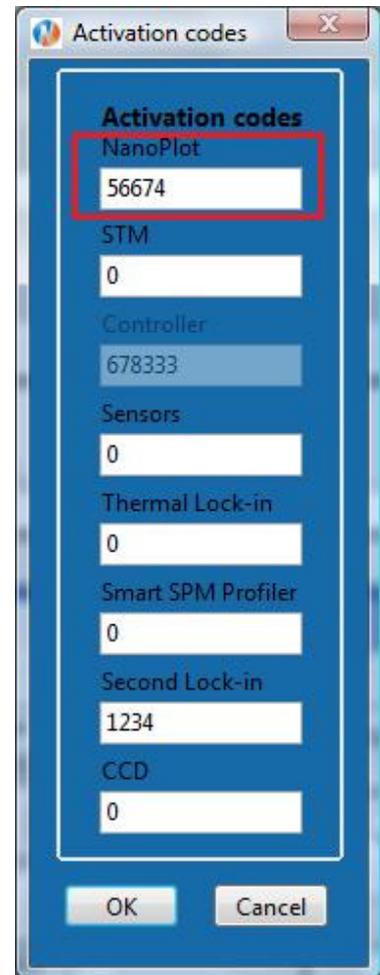
The Nanolithography mechanism is based on capillary forces that are created between the liquid inside the nanopipette opening and the substrate. Hence this method is often referred to as **Fountain-pen-Nanolithography** or **FPN** method.

Nanonics recent innovation is the use of electrically driven flow to create highly controlled material patterns along with the highly controlled positioning of the nanopipette. The electrical field that is applied across the nanopipette could enhance or disable the flow of the material from the nanopipette, hence giving another dimension of control over the written pattern. Voltage applied across a glass nanopipette could create electroosmotic or even electrophoretic flows. Dielectrophoresis could be achieved in some configurations. These are research fields and in this manual we will only try to give you the tools to allow you to carry out research in these fields, along with giving you a tool for more controlled Nanolithography method and a method for liquid nano-injection.

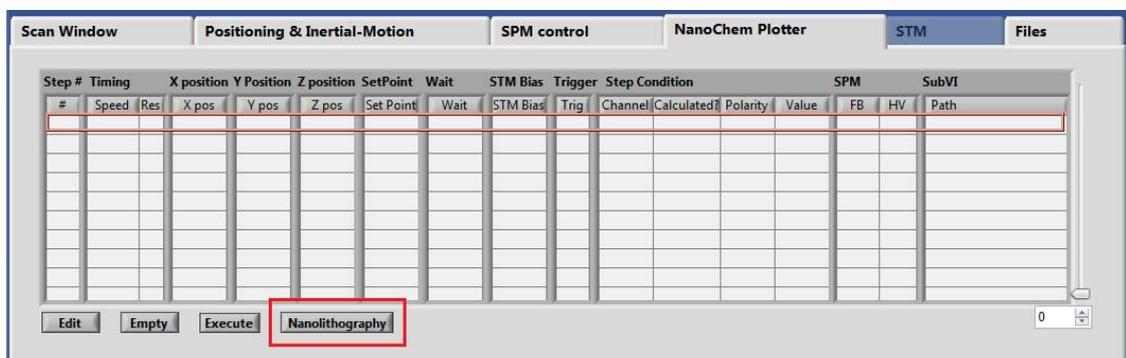
Nanolithography Software

Software Activation

1. In order to activate Nanolithography Add-On Software click on *Software* tab in NWS software and then click on *Unlock Features* button.
2. Put the activation code [56674] in “NanoPlot” field and click Ok button. The *Nanochem Plotter* tab will be activated.

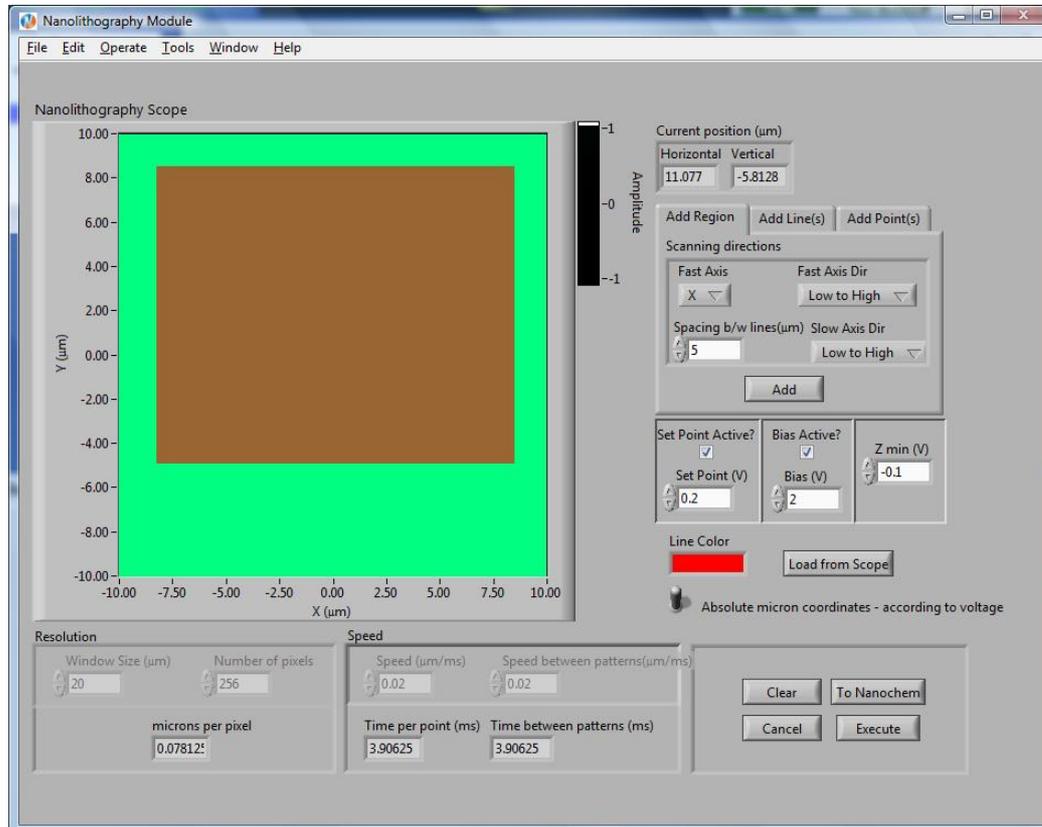


3. Click on NanoChem Plotter tab and then click on *Nanolithography* button to open the Add-On software.

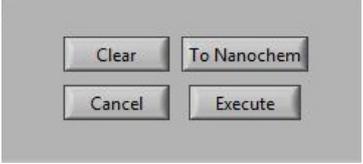
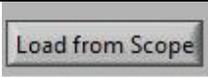
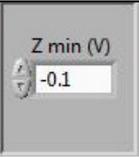
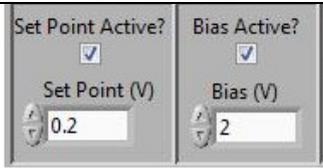
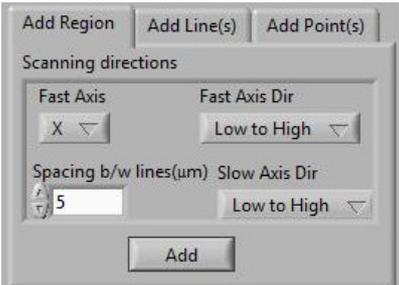
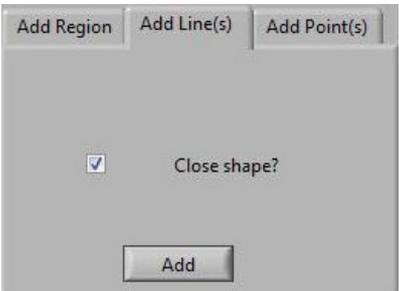
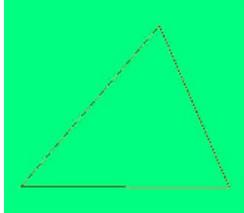


Software description

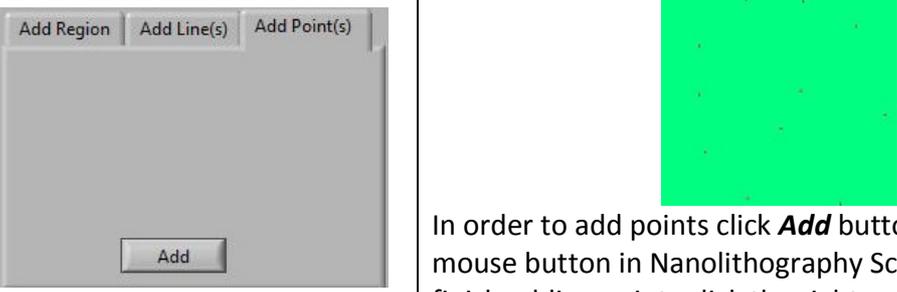
The main window of Nanolithography Software is represented below.



	<p>Presentation of Scan Window. The dimension of this window is defined in <i>Resolution field</i> below of the Scope.</p>
	<p>Defines Window size of Nanolithography Scope and number of pixels.</p>
	<p>Speed ($\mu\text{m}/\text{ms}$)-Speed of tip movement on the pattern Speed between patterns ($\mu\text{m}/\text{ms}$) - Speed of tip movement between the patterns</p>

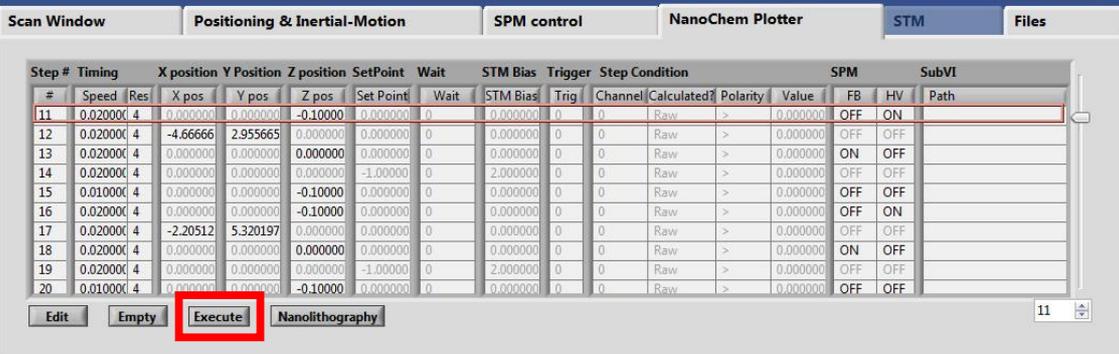
	<p><u>Control Panel of Nanolithography Software:</u></p> <p><i>Clear</i>- Empty the Nanolithography Scope area <i>Cancel</i>- Closing the Nanolithography Software without any action <i>Execute</i> – Starting drawing patterns <i>To Nanochem</i>- Sending the list of commands to Nanochem plotter before executing</p>
	<p>Push this button to see last acquired image</p>
	<p>The retract distance (in microns) of scanner between the patterns.</p>
	<p>Applying Bias Voltage or SetPoint during Nanolithography process. Uncheck the options if it is not needed.</p>
	<p><u>Add Region Panel</u> Allows drawing of series of lines (line-by line) over certain region. In order to draw the region click on <i>Add</i> button and draw region in Nanolithography Scope area.</p>
	<p><u>Add Line (s) Panel</u> Allows adding single lines at different directions. Check the “Close shape?” field if the lines should close the geometric shape.</p>  <p>In order to add lines click on <i>Add</i> button. Then click with left-mouse-button at the beginning of the line in Nanolithography Scope window. To add the next line which will connect to the first one, click the left-mouse-button at the beginning of the next line. In order to finish drawing click the right-mouse-button.</p>
	<p><u>Add Point(s) Panel</u> Allows adding single point on the scope field</p>

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In order to add points click **Add** button. Then click left-mouse button in Nanolithography Scope window. To finish adding points click the right-mouse-button (this will be the last point).

4. In order to see the list of commands click on “*To Nanochem*” button. The list of commands will appear in the table.



Step #	Timing	X position	Y Position	Z position	SetPoint	Wait	STM Bias	Trigger	Step Condition	SPM	SubVI					
#	Speed	Res	X pos	Y pos	Z pos	Set Point	Wait	STM Bias	Trig	Channel	Calculated?	Polarity	Value	FB	HV	Path
11	0.02000	4	0.000000	0.000000	-0.10000	0.000000	0	0.000000	0	0	Raw	>	0.000000	OFF	ON	
12	0.02000	4	-4.66666	2.955665	0.000000	0.000000	0	0.000000	0	0	Raw	>	0.000000	OFF	OFF	
13	0.02000	4	0.000000	0.000000	0.000000	0.000000	0	0.000000	0	0	Raw	>	0.000000	ON	OFF	
14	0.02000	4	0.000000	0.000000	0.000000	-1.00000	0	2.000000	0	0	Raw	>	0.000000	OFF	OFF	
15	0.01000	4	0.000000	0.000000	-0.10000	0.000000	0	0.000000	0	0	Raw	>	0.000000	OFF	OFF	
16	0.02000	4	0.000000	0.000000	-0.10000	0.000000	0	0.000000	0	0	Raw	>	0.000000	OFF	ON	
17	0.02000	4	-2.20512	5.320197	0.000000	0.000000	0	0.000000	0	0	Raw	>	0.000000	OFF	OFF	
18	0.02000	4	0.000000	0.000000	0.000000	0.000000	0	0.000000	0	0	Raw	>	0.000000	ON	OFF	
19	0.02000	4	0.000000	0.000000	0.000000	-1.00000	0	2.000000	0	0	Raw	>	0.000000	OFF	OFF	
20	0.01000	4	0.000000	0.000000	-0.10000	0.000000	0	0.000000	0	0	Raw	>	0.000000	OFF	OFF	

5. Click Execute to start drawing the patterns.
6. In order to empty the table click on **Empty** button