Solver Nano Quick Instructions

1. Mount your sample on the sample stage.
    a. Use a steel disc, adhere your sample with double-sided tape or a carbon sticky.
    b. Use the appropriate number of spacers. The stage can raise just high enough to scan the surface of a steel disc on top of two spacers.
    c. Use the “elephant” gauge to make sure your sample isn’t too tall. ***This is critical. Mounting a sample that is too tall can cause damage to the microscope when placing the head on the base.***
    d. Leave the head off the base for the moment.
2. Start the “Nova Px” software
    a. Wait for the Initialization to complete and “SPM OK” to appear in the main window. If there is an error or it reads “Power Off”, see Troubleshooting at the end of this guide.
3. Click the “Aiming” button on the Nova Px bar. This will bring up the readout of the four-quadrant photodiode.
4. Mount your probe into the holder.
5. Loosen both set screws on the underside of the head.
6. Using the laser positioning screws, align the laser onto the back of the cantilever. Make sure that the laser intensity is at least 20 on the “Aiming” window.
    a. There are two ways to do this:
        i. With the camera: Place the head on the base, then perform steps 10-13. Locate the laser on the camera image and align it to the tip of the cantilever.
        ii. “White Paper” method: Hold a sheet of white paper out to see the laser spot. Use the laser positioning screws to find the edge of the sample, then to find the shadow and interference pattern caused by the cantilever. Move the laser to the tip of the cantilever.
    b. To turn the laser on with the head off of the base, set the cap piece to the left side of the stage, just forward of the stage. This should turn on the stage light and laser. Be careful not to shine the laser into your eyes.
7. Using the Photodiode positioning screws, move the laser to the center of the photodiode on the “Aiming” window.
8. Tighten both set screws. ***Do not overtighten. These screws should be just tight enough to hold. Overtightening can cause damage to the microscope.***
9. Place the head on top of the base.
10. Move the camera arm over the hole in the top of the head, and turn on the camera light.
11. Click the “Camera” button.
12. Click the green triangular “Play” button on the camera window. The camera image should appear on the screen.
13. Focus the camera onto your tip using the manual controls on the camera arm.
    a. From this point, you should leave the camera in its current x-y position, and can

drop your focus to the sample by manually adjusting the camera height.

14. Make sure the system is set for either “Semicontact” or “Contact” as appropriate for your sample, the technique, and your probe. This setting is a dropdown menu on the main window.
15. **Semicontact mode only**: Click the “Resonance” button in the main window.
    a. Set the “From” and “To” values in the Auto section to values appropriate for your tip. (The expected resonance value will be listed on the package your probes come in).
    b. Set the “Amplitude” and “Phase” to appropriate values for your probe. (Good starting values are 10 and 0, respectively. You may need to try a few different settings to find what works best for your particular probe.)
    c. Click the large “Auto” (Has a large green ‘Play’ symbol) button to auto-set the drive piezo to the resonant frequency of your sample.
    d. Make sure that the amplitude and phase set by the program are what you intended. If not, hit the Amplitude and/or Phase buttons until the values stabilize at the set point.
16. Use the “Stage X” and “Stage Y” controls on the sides of the base to find your area of interest on the sample.
17. Make sure the Setpoint and Gain are set to appropriate values for your tip. (Good starting values are: Contact - Setpoint 2, Gain 10; Semicontact - Setpoint (1/2 of your set amplitude value, usually 5) Gain 1.0. These values may need to be tweaked for your particular probe.)
18. In the Approach window, click “Landing” to land the probe on your sample.
19. Watch the Amplitude or Deflection line on the Landing window. When the probe is on the sample, the line should have very little noise. If there is too much noise in the signal, reduce the gain or lift off the surface (“Move Away” button) and try a different Setpoint.
20. You’re now ready to scan. Press the “Scanning” button on the main window to open the scanning window.
21. Select an appropriate scan size, number of points, scan rate, and scan type on the scanning window. (Good starter values are: 5um scan size, 256 points, 1 Hz, and Contact/Semicontact Error (depending on your mode). Adjust these settings as necessary.)
22. Save your data after every completed scan by opening the Data window (Click “Data” on the main program window) and selecting “Save All Frames” from the file menu there.
23. When done, go to the Approach window and click “Move Away” (button with blue arrows pointing away from each other)
24. Raise the camera and move the camera arm out of the way.
25. Remove the head from the base.
26. Unmount your tip from the head.
27. Remove your sample from the stage.
28. Shut down the light on the camera.
29. Shut down the Nova Px software.
30. Sign the log book

Laser Alignment

If you're having trouble aligning the laser onto the tip follow this procedure

1. With the set screws unlocked, and your probe in place, place the head onto the stage.
2. Move the camera arm into position and focus on your tip.
3. While watching the video output from the camera, use the laser positioning knobs to move the probe/laser forward. You should see the laser cross onto the probe or the holder at some point.
4. Move the laser into position using the positioning knobs.
5. Adjust the photodiode using the photodiode positioning knobs.
6. Raise the camera and swing the arm out of the way
7. Remove the head, turn it upside down, and gently tighten the set screws.

Troubleshooting

Q: I get no resonance peak when I do a scan in the Resonance window
A1: Make sure that the system is set to “Semicontact” in the main window.
A2: Make sure that the “From” and “To” values in the “Auto” section are set appropriately for your probe.

Q: I can’t get rid of noise in the signal once I’ve landed on the sample.
A: If you’ve tried reducing gain and still can’t find get rid of noise in the signal, please try: Reloading the probe, re-setting your sample on the stage, and trying different amplitude and setpoint values.

If there is a bit of dust, dirt, etc. under your probe in the holder, it can cause the probe to shift as it oscillates, creating noise. If your sample is not firmly secured, either to the mounting plate or to the stage, it may oscillate while in contact with the probe, creating noise. Finally, every type of tip is different, and every tip within the same batch is slightly different. You may need to use different amplitude and setpoint values for each tip. Experiment with these values to see if you can find values that give you better results.

Q: After trying to initialize, the SPM returned an error.
A: Contact Adam Wise, adamwise@andrew.cmu.edu. 412-589-9029.

Q: Instead of saying “SPM OK”, the main window reports “Power Off”.
A: Make sure the control stack is turned on.
A2: Make sure there are no other copies of the Nova software running, only the first copy of the software will be able to take control of the microscope, any subsequently started copies will report “Power Off”.
A3: Restart the System: Power off the control stack then restart the computer.
A4: If none of these works, contact Adam Wise.

Q: The computer hangs on reboot.
A: Make sure the control stack is turned off. The computer will not boot properly when it is on. Let the computer start up, then power on the control stack.