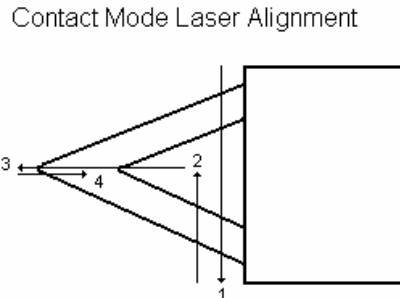
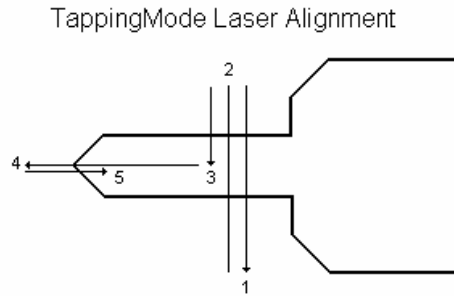


AFM OPERATION INSTRUCTIONS

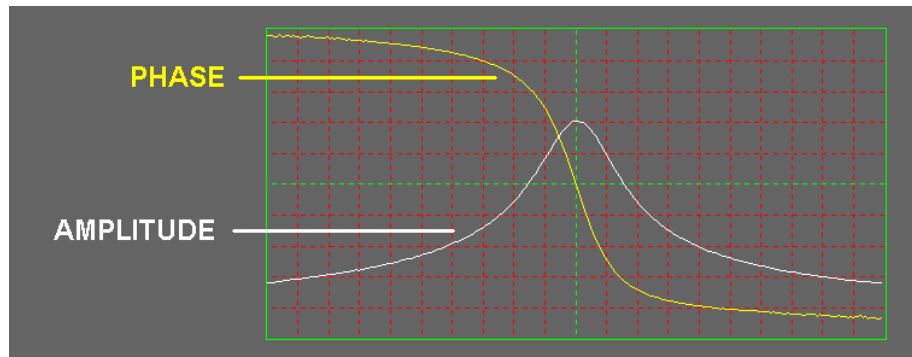
1. **Sign in the Logbook!!!**
2. Log on to the computer using your network ID and Password
3. Power On in the following order
 1. Sony Monitor
 2. AFM Light (Do not need to turn past filled markers!)
 3. AFM Controller Box
4. Double-Click on the **Nanoscope** Icon to start the AFM software
5. Click on the **Real-Time** (yellow microscope) icon to begin using the AFM
6. Load the AFM profile you would like to use
 - a. Note – The default mode is Tapping, so if you would like to do TappingMode, you can probably skip this step. The bottom status bar indicates which profile is currently loaded.
 - b. To do this, click on the **Microscope Menu**, and scroll down to the **Profile** Option. Click this, and then select the option you would like to use (probably Tapping), and then click on the **Load** button
7. Locate Tip by selecting the **Locate Tip** Icon (magnifying glass on yellow tip).
 - a. Adjust the camera with the two knobs located on the front of the camera. The tip of the cantilever should be in the cross hairs on the Sony Monitor.
 - b. Adjust the focus by pressing the focus button on the trackball, and sliding the trackball accordingly. If the entire cantilever cannot be in focus at the same time (remember it is held at a downward angle), make sure the tip of the cantilever is in focus.
8. Align Laser onto the tip of the cantilever using the two knobs located on the top of the AFM head. The following diagram may be helpful.



Note – When aligned properly, the sum signal should reach its maximum value, typically 2-4 for TappingMode, and ~ 4 for Contact Mode.

9. Adjust the Laser Spot on the photodiode using the two knobs located on the side of the AFM head.
 - a. For TappingMode, the spot should be centered in the crosshairs, with a vertical displacement within +/- 0.1 V
 - b. For Contact Mode, the spot should be centered laterally (within +/- 0.1 V), and with a vertical displacement of ~ -2 V (between 0 and -4 V).

10. For TappingMode operation, the resonant frequency of the cantilever must now be found. Click on the **Autotune** icon (blue tuning fork), and then select the **Autotune** button. The computer will then cycle through some pre-set drive amplitudes, and automatically measure the resonant frequency of the cantilever. The resultant chart should look similar to the following.



11. Focus Surface by clicking on the **Focus Surface** Icon (magnifying glass on red bars). Move the tip (and camera) vertically by pressing the focus button on the trackball, and then sliding the trackball accordingly. To translate the stage, simply slide the trackball, or press the lock button and slide the trackball once to maintain a steady translation.

Note - Be careful when focusing on smooth surfaces, as it may be difficult to find surface features to focus on. Focusing through the surface may cause the tip to crash on the surface, which destroys the mechanical integrity of the tip and it can no longer be used. Instead, look for the edge of the sample first, and focus on that before moving to the center of the sample

12. Set up Scan Parameters:

Scan Controls

Scan Size: Start with 1-5 μm
Scan Rate: Start with 1-2 Hz
Samples/Line (resolution): Start with 256

Feedback Controls

Integral Gain: TappingMode \rightarrow 0.5, Contact Mode \rightarrow 2.0
Proportional Gain: \sim 2X the Integral Gain

Channels 1-3

Data Type: At least Height (ch. 1) and whatever else
Data Scale (Z-Range): Select for good contrast

13. Engage Tip on Surface by clicking the **Engage Tip** icon (green arrow down). The AFM will go through some precautionary procedures, and then engage on its own. Once the tip is engaged, the control box will beep, and imaging will commence immediately.

Note – Please avoid crashing the tip. See step 10.

14. Optimize all scan parameters. Click on the **Scope Trace** icon (sin curve graph).
 - a. For TappingMode, you need to control how “hard” you are tapping. Increase the **Amplitude Setpoint** (right arrow key), until the scope trace indicates that the surface is NOT being touched. Then, press the left arrow key until contact is initiated. The corresponding amplitude setpoint is referred to as A_0 . You should always start with amplitude of $0.8A_0$! (and eventually adjust it to different value for selected samples)
 - b. For both TappingMode and Contact Mode, adjust the **Scan Size**, **Scan Rate** and **Z-range (Data scale)** to meet your requirements.

- c. Finish by adjusting the gains. Select the Microscope Menu, and click on the **Auto Gain Adjust** option. The software will suggest some optimized gains. If you like, select OK, or click CANCEL to return to the original values
15. Capture the image.
 - a. Select a filename for your image. Click on the **Capture Menu**, and select the **Capture Filename** option. Type in the name of you file. The extension is automatically added as .000, and successive images will be given subsequent extensions (.001, .002, ...).
 - b. Capture the image by clicking on the **Capture** icon (yellow camera). The image will not be saved until the full scan is complete. To cancel a capture at any time, click on the **Cancel Capture** icon (yellow camera with a red line through it).
 - c. To expedite the capture process, the begin new scan icons (blue with arrow up or arrow down) may be used to initiate a new scan.
 16. **Withdraw** the tip to stop the scan (Red Arrow Up)
 17. Reposition the surface for a new scan by clicking on the **Focus Surface** icon (magnifying glass on red bars), or load a new sample by clicking on the **Stage** menu, and selecting **Load New Sample**.
 18. To examine your captured images, click on the **Offline** icon (wavy rainbow all the way on the right).

Note – all captured images need to be flattened. To do this, select a channel (**Utility** Menu – **Select Left/Center/Right Image** – click on the **Flatten** icon (rolling pin).
 19. Move all files to your home drive (h:\ drive), by highlighting your files, and then select **File** Menu and click on the **Move** option.

Note – images will only be viewable using Nanoscope software, or other AFM specific programs. To view using a graphics program, you must convert your .### file to a Tiff file. For this, select desired file – Select **Utility** Menu – **Tiff Export**.
 20. When done, power off in order:
 1. Exit Nanoscope Software
 2. Logoff the computer
 3. Turn off the AFM control box
 4. Turn off the Sony Monitor
 5. Turn off the AFM light
 6. Return dust cover to AFM
 21. Remember to sign in the **Logbook!**