AFM

Notes by Daniel Hartmann, 6/10/99

Notes: Always read before doing anything!
You are not allowed to sign up for the AFM until the Friday before the week when you want to sign up.

Always wear gloves when you go inside the box.

In the "Motor" menu on the computer, the "step X,Y" thing is not an accurate step. The way it works is that the piezos move the sample over slowly, and then they jerk back quickly, relying on the "tablecloth out from under a wineglass" effect.

Do not adjust the red-taped screws.

Start Up
Turn on the monitor that's used to look at the tip.

Turn on the light to the optical microscope.

Load your cantilever into the cantilever holder. Make sure it is in the groove and right-side up.

To align the laser on the cantilever:

(0) Raise the head up away from the sample holding spot, using the "Up" position of the motor control switch. Do this until you're sure that when you put the cantilever holder in place, the tip will not hit the sample holding spot.

(1) Put your cantilever holder in, with the mounted cantilever.

(2) Take the head off the retaining springs and point the laser down at a piece of paper. *Don't stretch the wire that goes to the head!*

(3) Move the laser (using the laser adjust screws), in the X-direction until you see the spot appear on the paper. Now you know it's missing the cantilever. Then move it slightly back so that it hits the cantilever.

(4) Now move the laser (using the laser adjust screws) in the Y-direction. If you're on the tip of the cantilever, then as you move in the Y direction, you should see the spot…then it should disappear as you pass over the tip…then it should reappear on the other side of the tip. If this doesn't happen, it means that you are probably on the cantilever body, not on the tip.

(5) Repeat Steps (2) and (3) as needed, until you see what you expect to see as the laser passes over the tip.

(6) Now adjust the mirror-slide-switch on the back of the head until you maximize the detected power.

(7) Now adjust the "photodiode adjustment knob" until the difference between the two photodiodes is minimized. (Try to get it = 0). Make sure the instrument is in tapping mode using the mode selection switch.

Putting Your Sample In

Take the cantilever holder out.

Put your sample (mounted on a puck) in.

Raise the head up away from the sample holding spot, using the "Up" position of the motor control switch. Do this until you're positive that after you've put your sample in, when you put the cantilever holder in place, the tip will not hit the sample.

Now focus on the sample with the optical microscope. On clean samples, it helps to first focus on an edge of your sample (by physically moving the puck with tweezers until you see an edge), and then move to the region of the sample where you want to scan.

Put the cantilever holder in, but remain focused on the sample.

Lower the head down towards the sample-holding-spot, using the "Down" position of the motor control switch. Do this until you see the slightly-out-of-focus tip.

You may have to adjust the XY stage that the AFM is mounted on, so as to move the AFM with respect to the optical microscope so that you can see the tip with the optical microscope.

Operation: Software Stuff

Tune the cantilever using "autotune" (Click first on the tuning fork)

Bring tip down into contact with sample using the down arrow

Move from one parameter to another with the up and down arrow keys. Adjust the value of the parameters with the side arrow keys. Parameters to Adjust:
Setpoint: I found recently that lowering the set point by a notch or two gives better scans.
Scan Size (10um is good…above that, you will have some hysterisis of the piezos)
Scan speed (1 Hz is good)
X / Y offsets: (These move the tip exactly a certain number of microns in the X and Y directions, as opposed to the motor control buttons, which are very rough.)
Z-range: This gives the height range that you're looking at.
Scan Angle: This is a good button to play with to make sure that you're not looking at artifacts. If you see something in your scan, and then you change the scan angle, you should see that same something, but now at an angle.
Capture button: You have to press this before the scan that you want begins! The best way to be sure of getting a scan captured is to click on the capture button, and then click on one of the arrows that starts the scan over at the top or bottom. Alternatively, you can force a capture no matter what you've done, by double clicking on the capture button.

After you've taken your scans,
Click on the waveform icon in the right corner. The menu bar will probably just have three choices right now: "File", "Image", and "Utility".

Click on Image, and select the left or right image.

Now, after you've selected one of the images, the processing capabilities become available.

First, flatten the image.

Then you can view it in 3D, or whatever.

To rename a file, go to "File✍ Rename".

To move a file to your directory, use the "Copy" command. It will give you the opportunity to save the file in a new directory. Then you can delete them from the "!" directory.

2.1.1. MultiMode SPM

The heart of the system is the SPM itself, shown below in figure 2.2.

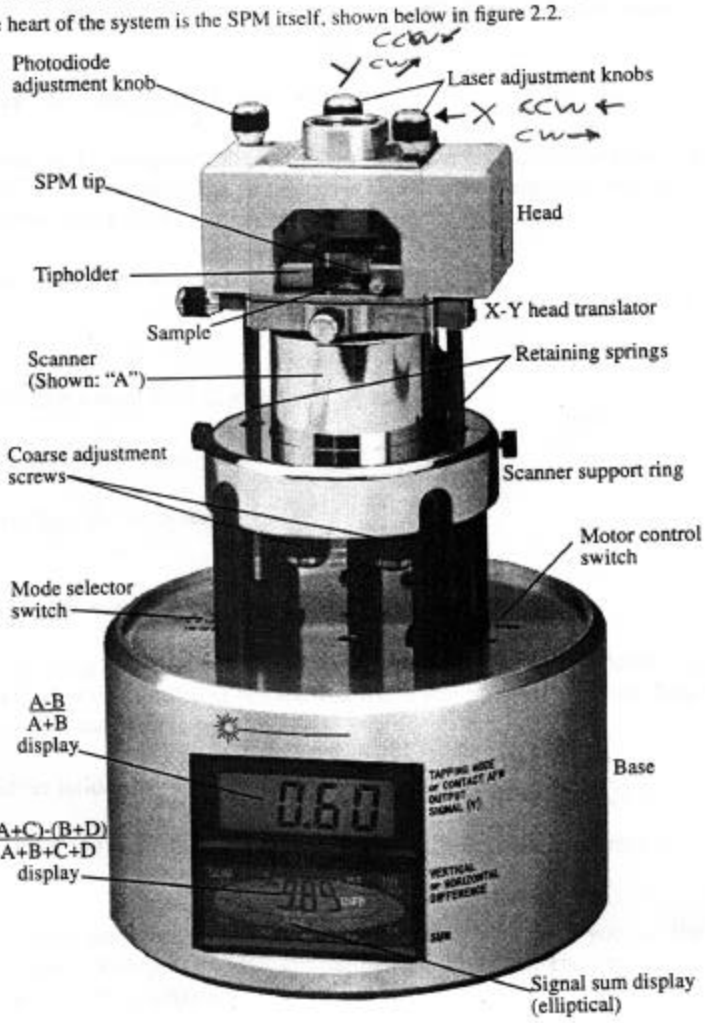

Figure 2.2. MultiMode SPM.