

# Atomic Force Microscope – John’s Dynamic Mode Operating Instructions

(jcb rev 9/21/07)

## Start up Electronics and Software (manual pages 27 & 37):

### 1) Turn on the control electronics (long hexagonal black box)

Indicator lights should blink yellow

### 2) On laptop PC, load “Nanosurf easyScan2 Program

Indicator lights on controller should become steady yellow, except:

- “STM scan head” = dark (because it instead sees an AFM scan head)
- “Video Module” (unless are using AFM #4 which DOES have video)
- “Probe Status” may remain red at this point

White light should go on at AFM cantilever position

### 3) Click Menu: File / Parameters/Load and select file “Default\_EZ2-AFM.par”

## Select dynamic (tapping) mode - Find resonant frequency of cantilever (manual p. 42):

### 4) Click on Operating Mode icon (5<sup>th</sup> down on left margin):



A vertical panel should appear near left end of screen

If it or the sub-panels below do not appear,

click Menu: Options/Config User Interface

and check the “Standard Level” box

**4b) Expand “Operating Mode” sub-bar**

**4c) Set “Mounted Cantilever” = NCLR**

**4d) Set “Operating Mode” = Dynamic Force**

**4e) Expand “Mode Properties” sub-bar**

**4f) Set “Free vibration amplitude” = 100 mV if reasonably flat sample OR**

**300 mV if steep or deep features (CD, IC . . .)**

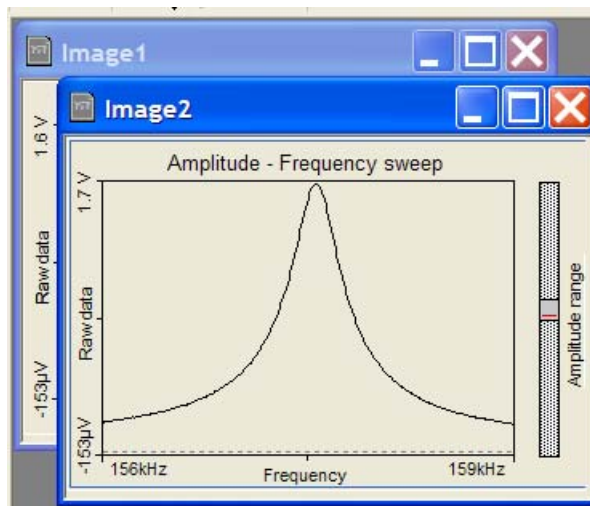
**4g) Check the box “Display Sweep Chart”**

**4h) Click the “Set” button**

AFM will now search for resonant frequency of the cantilever of the type specified in step 4c)

If it succeeds you will see two charts pop up, first with a sharp peak

Second chart will have a greatly expanded peak



**IF PLOT IS NOT AS ABOVE (or does not appear): STOP!**

**YOU have either:**

**Wrong Operating Mode**

**Wrong Mounted Cantilever type**

**Wrong cantilever**

**Improperly mounted cantilever**

**If you DO get the charts as described above, CONTINUE:**

**Optimize feedback loop for type of sample you are examining:**

5) Click on Z-controller icon (6<sup>th</sup> down on left margin):



5b) Set “Set point” to 50%

5c) Set “P gain” = 10000

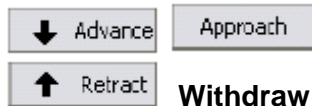
5d) Set “I gain” = 1000

**Approach the sample to be measured (manual page 39):**

6) Click on Positioning icon (6<sup>th</sup> down on left margin):



6a) Expand right “Approach Panel” until can read full wording of buttons



6b) With no sample in place OR AFM well above sample:

Use  and  buttons to raise or lower head to starting position flush to 1mm below body of AFM (as shown at left below)



***CRITICAL THAT FOLLOWING IS DONE RIGHT!***

### COARSE MANUAL APPROACH:

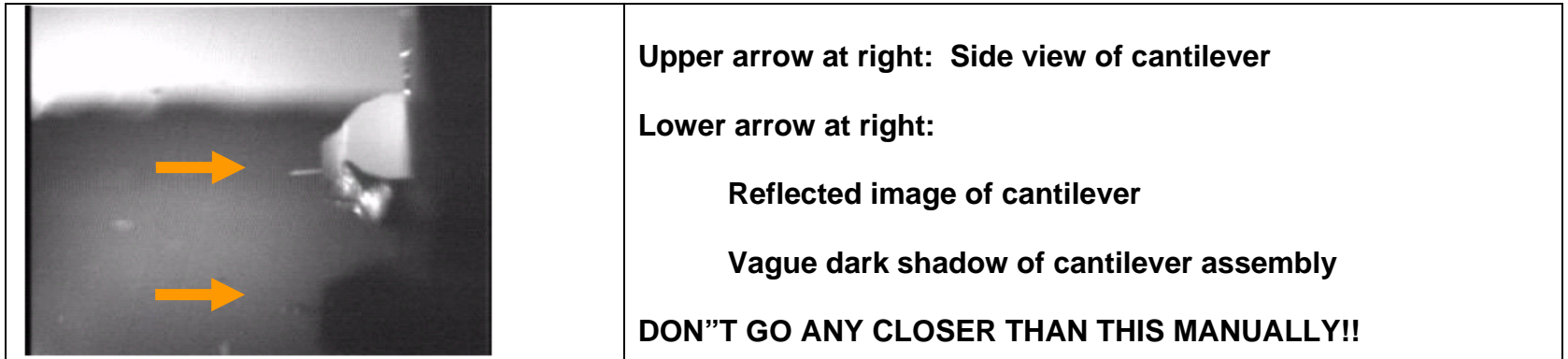
7a) WHILE PRESSING DOWN ON AFM body so that it does not move:

Turn rear screw clockwise until cantilever is 1-2 mm from sample surface

(Judge this by eye view from front of unit):

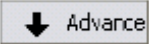
7b) Find side view of cantilever through lens (or with AFM #4 Click:  for TV image)

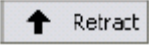
7c) Using side view, continue adjusting screw until shadow of cantilever enters view as shown below:



## MOTORIZED FINE APPROACH (using buttons to control motor)

YOU controlling AFM (fairly coarse):

 = Turn on motor (while button is depressed) to move closer to sample

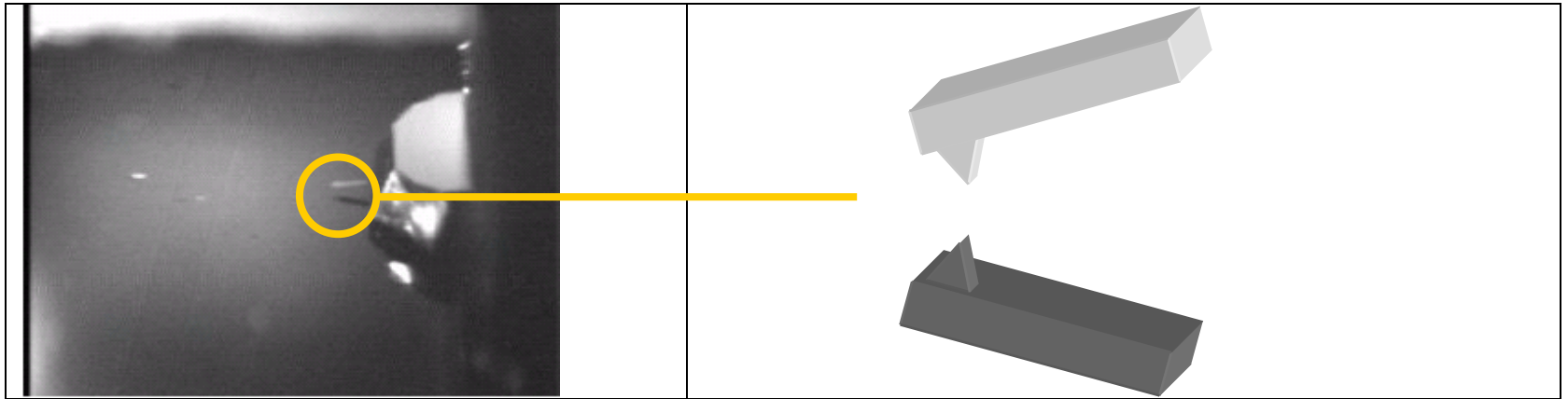
 = Turn on motor (while button is depressed) to move away from sample

AFM doing things automatically (very fine and slow):

 = An automatic slow final approach to sample with AFM sensing contact

Withdraw = Automatic slow movement away from sample

**8a) Use Advance button to move in toward sample until cantilever tip ALMOST meets its reflection**



DON'T LEAVE CURSOR OVER  Advance May start even when mouse button not pushed

RESULT: Crashes cantilever into sample, breaking it

8b) Complete approach by clicking  Approach automatic final approach button

## Starting a measurement (manual page 43):

9) Click the imaging icon  Use START, STOP, ZOOM buttons as with STM

## Ending a Measurement

10a) Click “Withdraw” button to automatically pull back a little ways from sample. Stop and then:

10b) Click  Retract to then pull farther back