	<b>Department of Physics</b> <b>National University of Singapore</b>		<b>Ref. No</b> <i>SOP/001</i>
	<b>Standard Operation Procedure</b>		<b>Rev. No</b> <i>002</i>
<b>Title:</b> Park system atomic force microscope			<b>Pages:</b> <i>5</i>
<b>Lab: Nanomaterials &amp; Devices Group</b>			
<b>Written by</b>	<b>Approved by</b>	<b>Issue date</b>	<b>Review date</b>
Vu Thanh Trung Nam	A/Prof Eda Goki	25/12/2021	25/12/2024

## 1. Purpose

The objective of this SOP is to provide guidelines to all the laboratory personnel on operating Park system atomic force microscope.

## 2. Scope

The procedure is applicable to all research staff, research students and technical staff working in the laboratory.

## 3. Responsibility

It is the responsibility of the PI in conjunction with the laboratory I/C to ensure that all research and technical staff and students are advised, prepared and trained.


### 3.1. Principal Investigator

The principal investigator is responsible for the implementation of these guidelines and takes ownership of all research and technical staff, graduate and undergraduate students under his charge in ensuring that they will carry out their activities in a reasonably practicable manner. The PI has to ensure that all the personnel mentioned above are adequately advised, prepared and trained.

### 3.2. Staff / Students

All research and technical staff and graduate students are under the obligation to work and behave safely and are responsible for taking care of their own health and safety and not placing themselves or others at risk of injury

## 4. Personal protective equipment

 <b>NUS</b> National University of Singapore	<b>Department of Physics</b> <b>National University of Singapore</b>		<b>Ref. No</b> <i>SOP/001</i>
	<b>Standard Operation Procedure</b>		<b>Rev. No</b> <i>002</i>
<b>Title:</b> Park system atomic force microscope			<b>Pages:</b> <i>5</i>
<b>Lab: Nanomaterials &amp; Devices Group</b>			
<b>Written by</b> Vu Thanh Trung Nam	<b>Approved by</b> A/Prof Eda Goki	<b>Issue date</b> 25/12/2021	<b>Review date</b> 25/12/2024

At a minimum, safety glasses with side shields, long sleeved laboratory coats, chemically resistant gloves, and closed toed shoes should be worn. This is to be considered as minimum protection and must be upgraded if necessary.

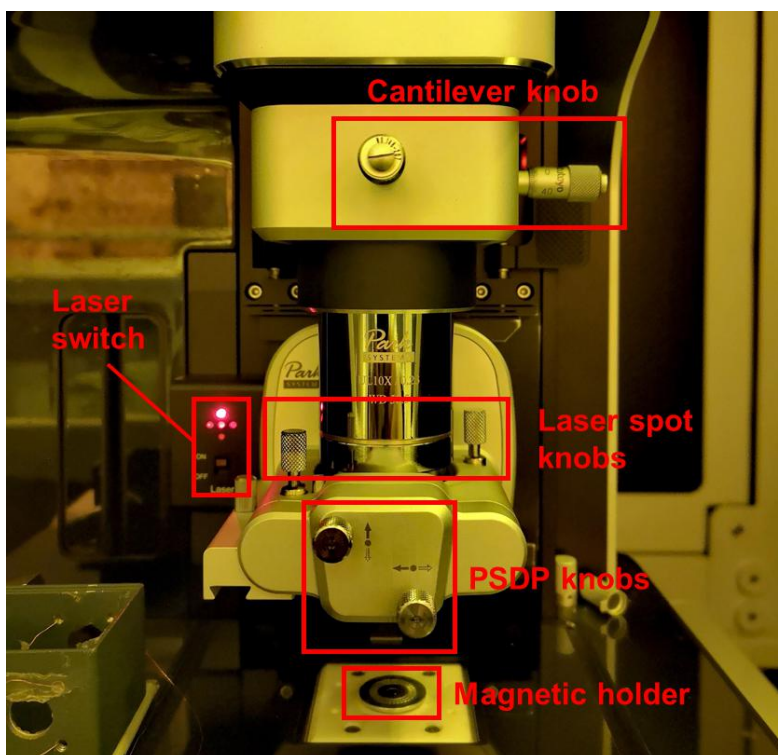
## 5. Safety precautions

Inspect equipment to be used and ensure all are in proper working condition. Report any equipment deficiencies prior to use.

## 6. Procedure

### 6.1. Loading sample

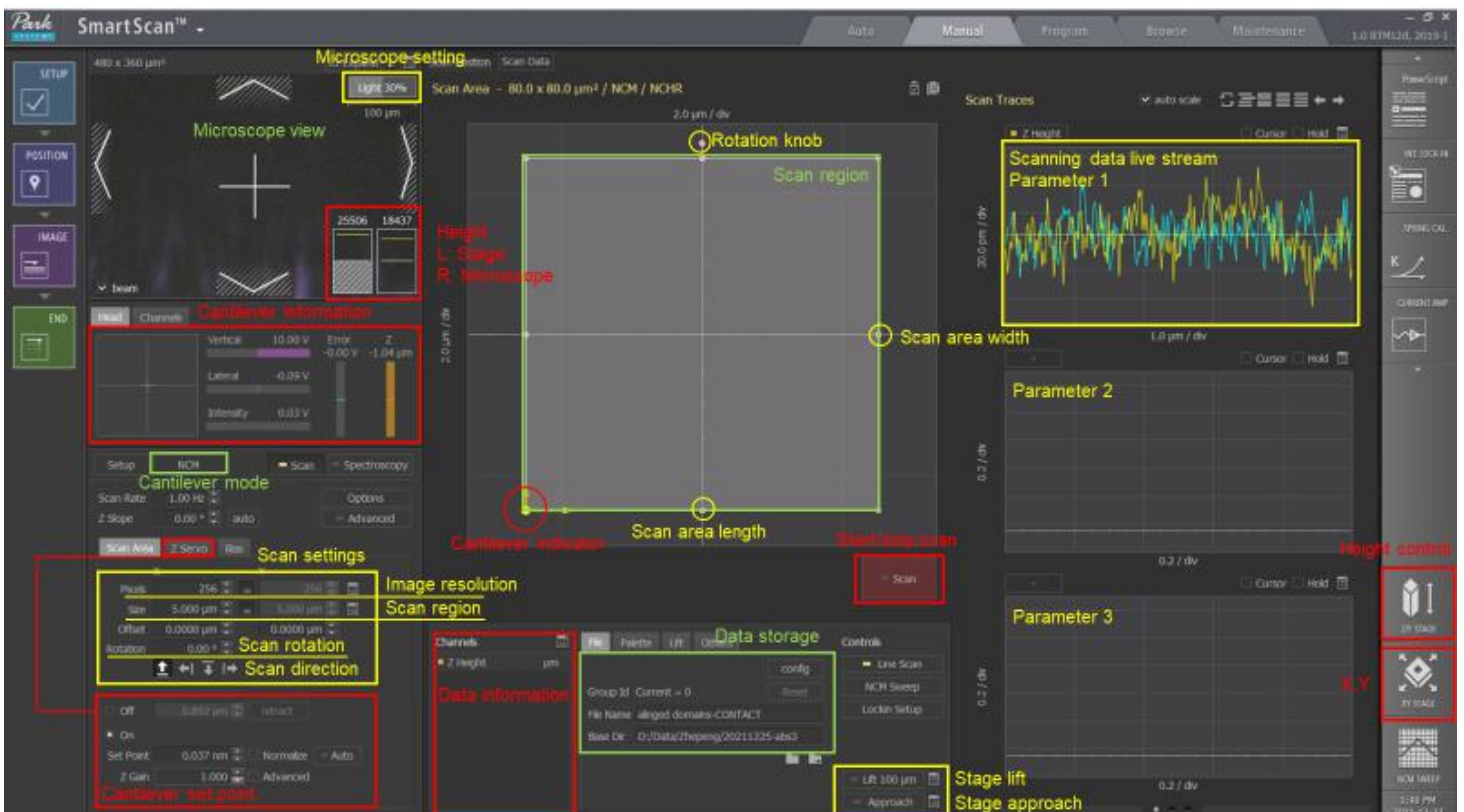
- Sticker sample wafer on the magnetic sample holder with double scotch tape
- Loading cantilever on the stage (By superuser)  
Install the stage and switch on laser



<b>Department of Physics National University of Singapore</b>		<b>Ref. No</b>	<i>SOP/001</i>
<b>Standard Operation Procedure</b>		<b>Rev. No</b>	<i>002</i>
<b>Title:</b> Park system atomic force microscope		<b>Pages:</b>	<i>5</i>
<b>Lab: Nanomaterials &amp; Devices Group</b>			
<b>Written by</b>	<b>Approved by</b>	<b>Issue date</b>	<b>Review date</b>
Vu Thanh Trung Nam	A/Prof Eda Goki	25/12/2021	25/12/2024

## 6.2. Cantilever calibration

- On controller, wait 5s, on computer, on **SmartScan™** software, wait for initialization (exclamation mark disappear).
- Raise **Z height** to maximum to avoid tip crashing, put sample on magnetic holder by tape.
- Check correct tip type (NHCR for non-contact), resonant frequency ( $Q > 300$ ).
- Change **focus** to see cantilever, align cross on screen with the center of triangular tip of cantilever.
- Lower **focus** to minimum, then lower **Z height** until seeing surface (9000 is warning height).
- Find sample, current cross position is the lower left corner of scanning area, make sure scanning area can cover the sample.
- Check **laser on, voltage > 2.5** (adjust laser position if not), green dot indicator on PSPD (adjust PSPD if not).



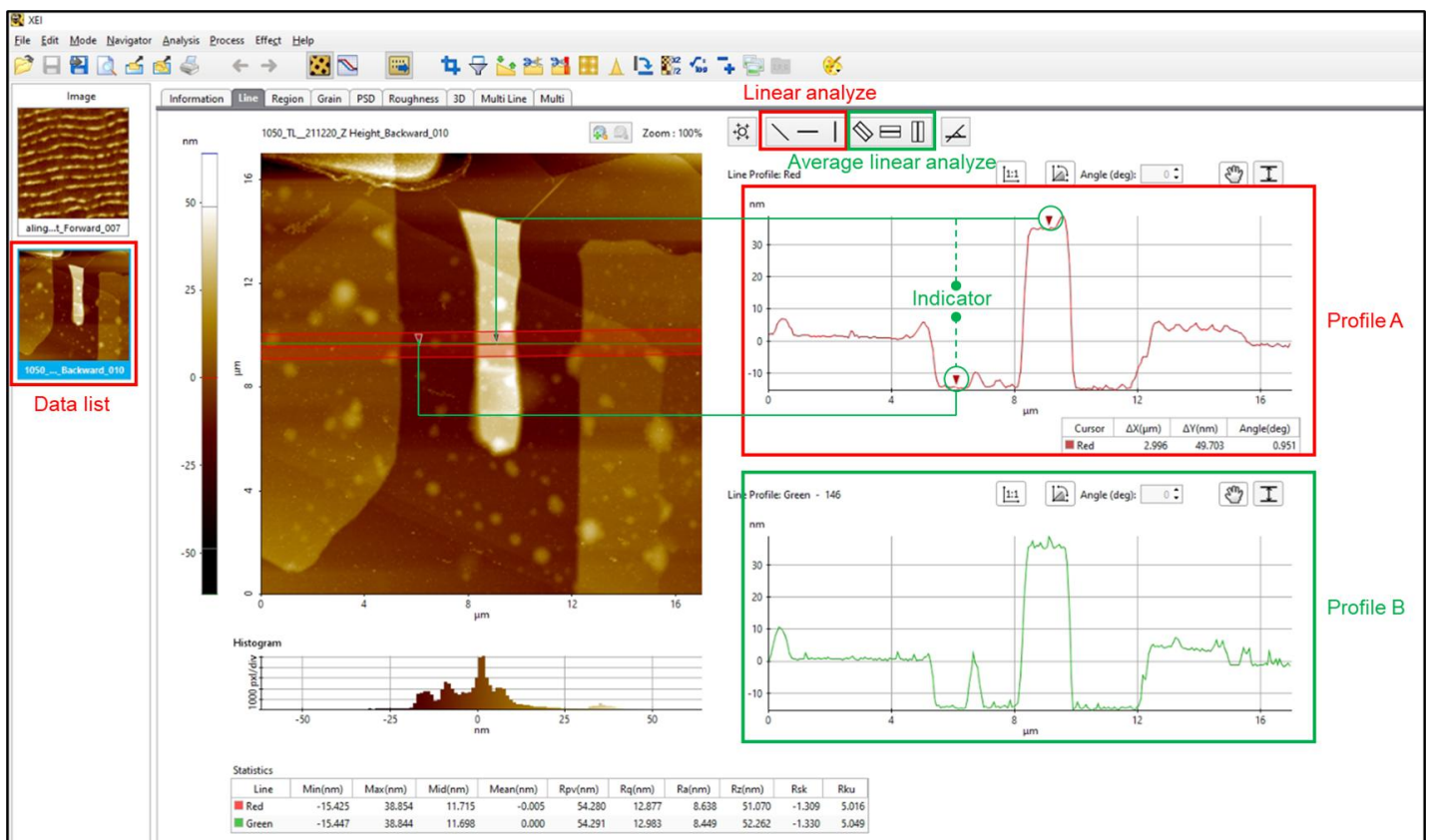
<b>Department of Physics National University of Singapore</b>		<b>Ref. No</b>	<i>SOP/001</i>
<b>Standard Operation Procedure</b>		<b>Rev. No</b>	<i>002</i>
<b>Title:</b> Park system atomic force microscope		<b>Pages:</b>	<i>5</i>
<b>Lab: Nanomaterials &amp; Devices Group</b>			
<b>Written by</b>	<b>Approved by</b>	<b>Issue date</b>	<b>Review date</b>
Vu Thanh Trung Nam	A/Prof Eda Goki	25/12/2021	25/12/2024


### 6.3. Sample characterization

- Click **Approach**.
- Check **Forward Height** matches **Backward Height**, can decrease Scan Rate (typical 0.75 Hz), **Set Point** (typical 5 nm) or increase **Pixel** (typical 1028) to match.
- Quick check with 64x64 pixels scan to see the precise scan position.
- Move cursor on screen to cover the expected region of sample.
- Click **Scan** and make sure the computer does not sleep or hang (play some music maybe).
- All images are auto saved in the designated folder.

### 6.4. Unloading sample

- Click **End**.
- Raise **Z height** to maximum to avoid tip crashing and unload magnetic holder, take sample out.
- Close AFM lid



	<b>Department of Physics</b> <b>National University of Singapore</b>		<b>Ref. No</b> <i>SOP/001</i>
	<b>Standard Operation Procedure</b> <b>Title:</b> Park system atomic force microscope		<b>Rev. No</b> <i>002</i>
			<b>Pages:</b> <i>5</i>
<b>Lab: Nanomaterials &amp; Devices Group</b>			
<b>Written by</b> Vu Thanh Trung Nam	<b>Approved by</b> A/Prof Eda Goki	<b>Issue date</b> 25/12/2021	<b>Review date</b> 25/12/2024

#### 6.4. Data analysis

- Find data file, double click to open in XEI
- Use line profile or Ave. line profile to measure the height of sample

### 7. Safety control measure

#### 7.1. Administrative measure

- The AFM tips inventory is regulated by authorized AFM superuser, the tips can only be replaced by superuser
- The key of AFM power cabinet is regulated by safety lead

#### 7.2. Engineering control

- The AFM measurement device is installed inside enclosed chamber
- Proper PPEs

### 8. Revision History

Date Revised	Revision No.	Author	Revision Summary
20.12.2019	001	Vu Thanh Trung Nam	Text
27.12.2021	002	Chen Mingjun	Images