

离子电导显微镜使用手册

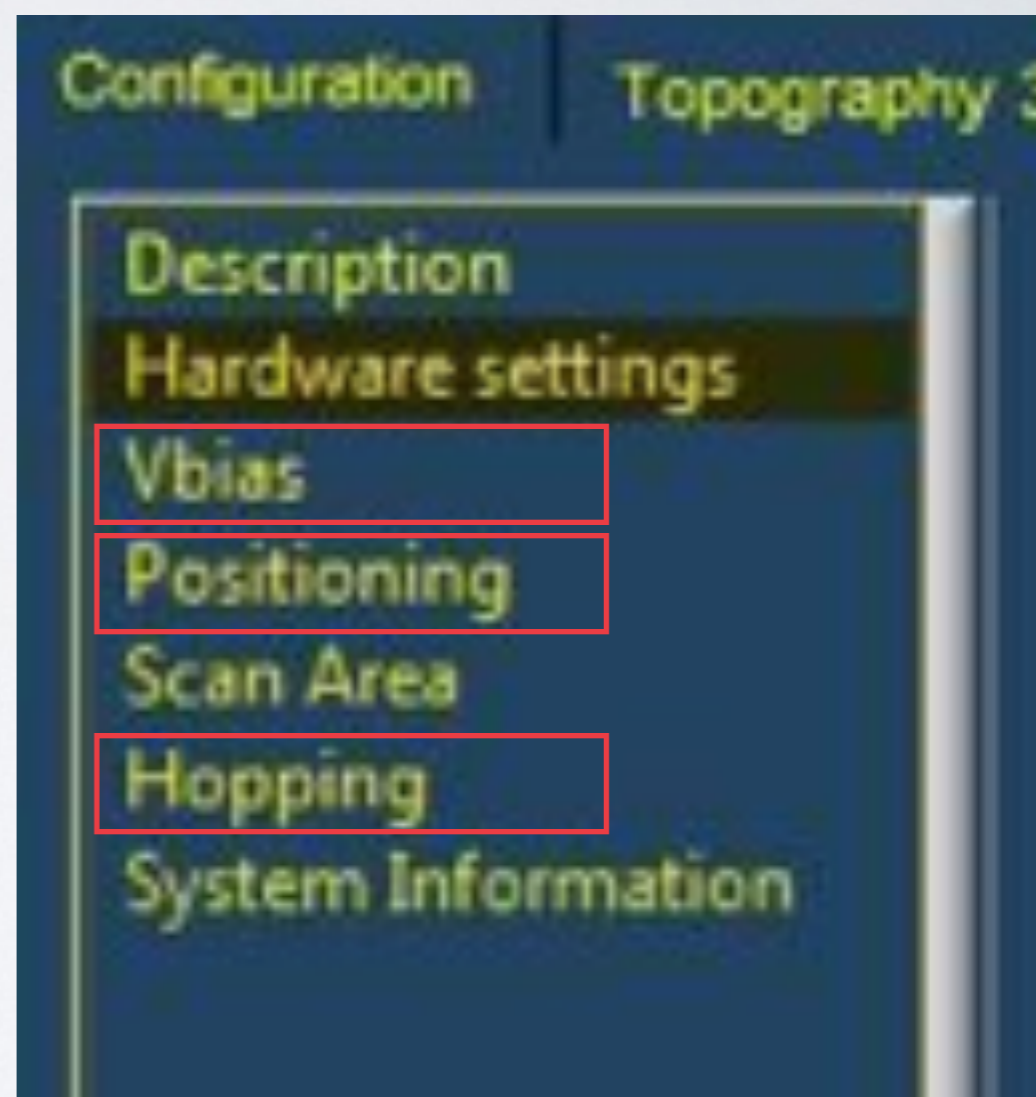
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操作流程

- 打开仪器顺序
- 拉制电极
- 预设软件
- 点击Immerse入液
- 调节软件参数
- 点击Approach
- 适当调节软件参数
- 标记电极位置
- 开始扫描
- 结束扫描

调节：
VBias
Positioning
Hopping

调节：
VBias
Hopping



一、打开仪器顺序

打开两个电源

打开电脑和防震台开关

打开示波器

打开ICnano controller

打开PI piezo amplifier unit

打开光源

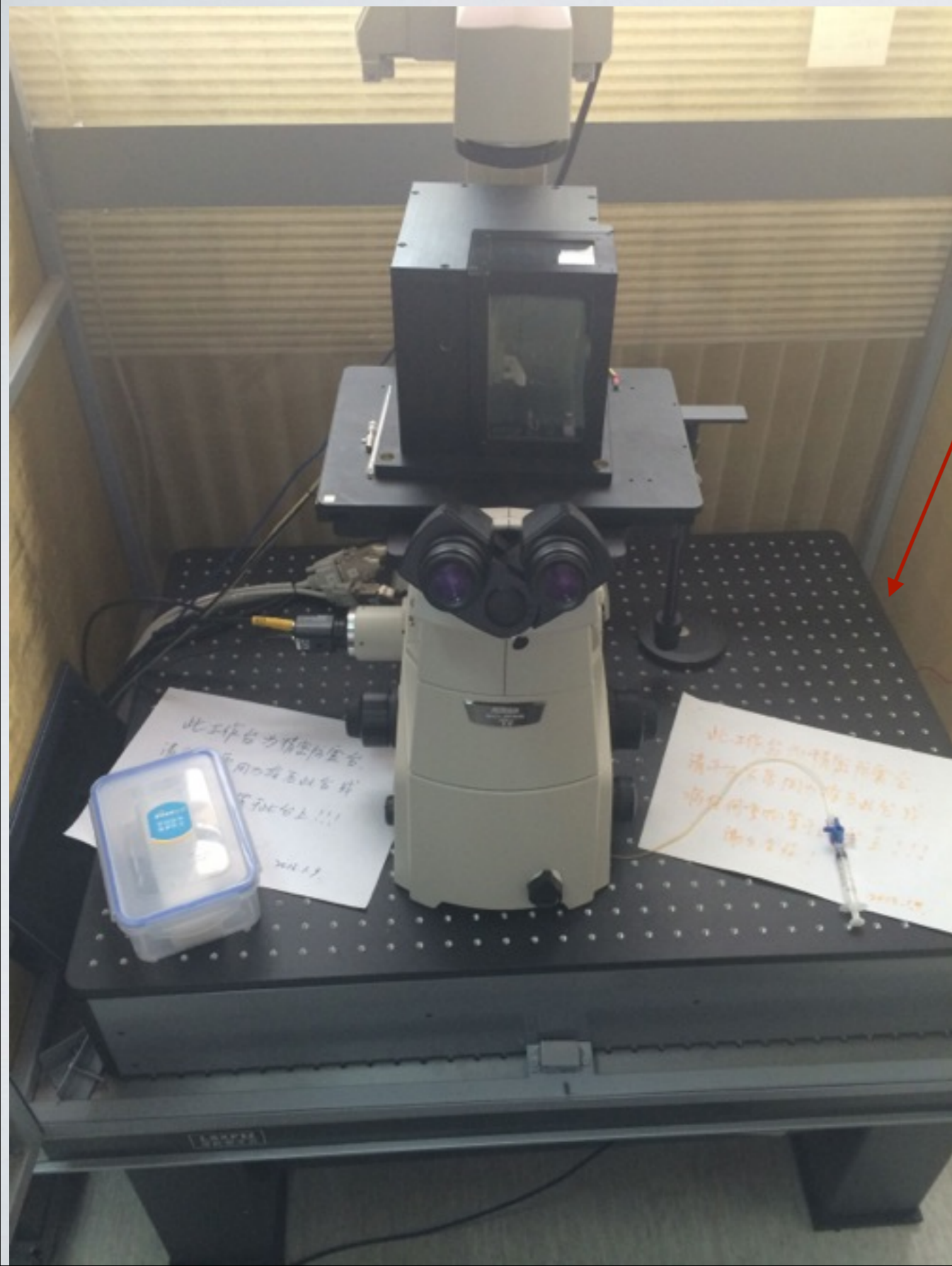
打开ICnano软件和debut软件

两台电源，长按“开/关机”键打开或关闭

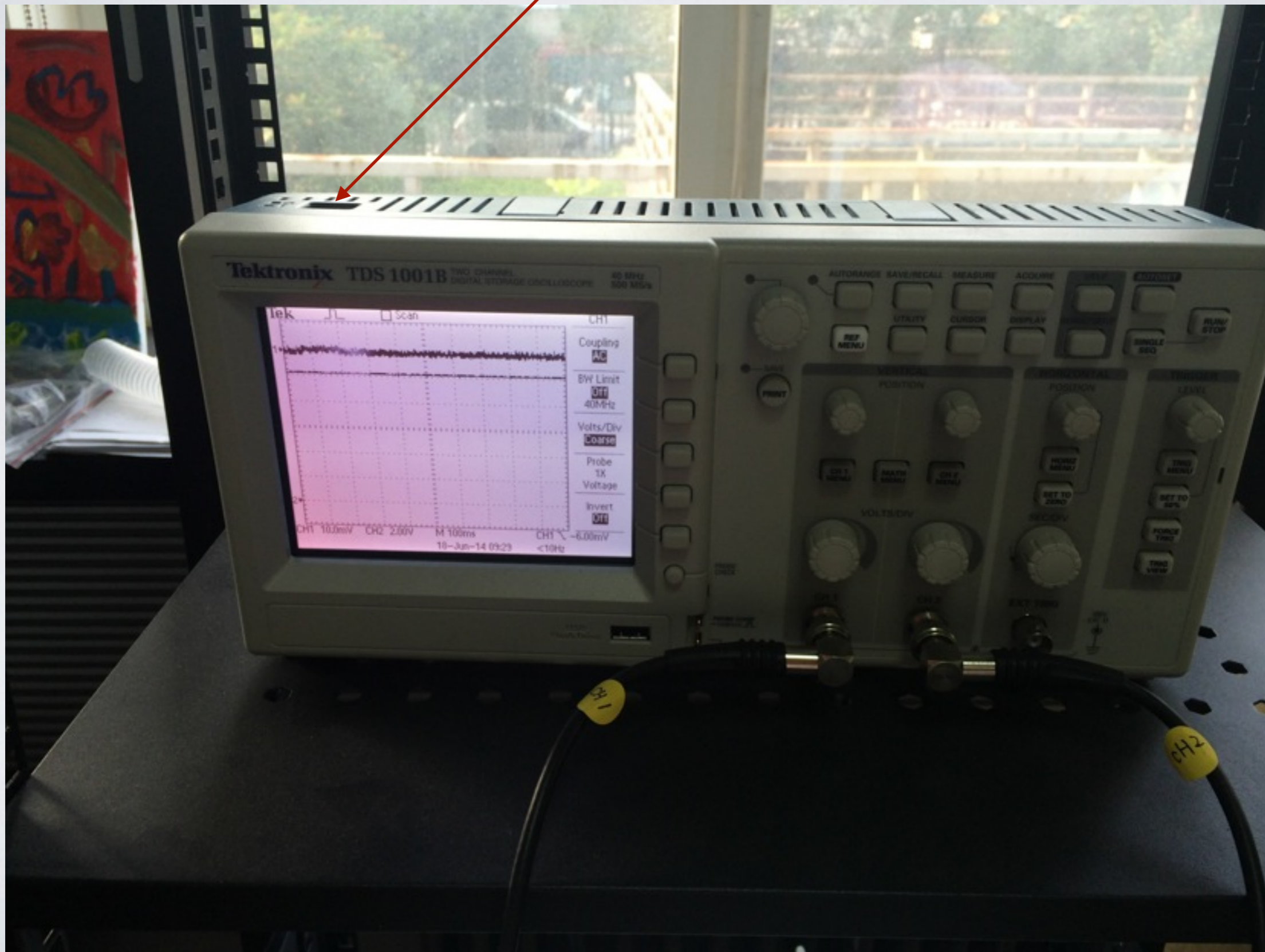


打开电脑开关

防震台及其侧面的开关



示波器开关位置



ICnano controller及其背部开关位置



PI piezo amplifier unit及其背部开关位置



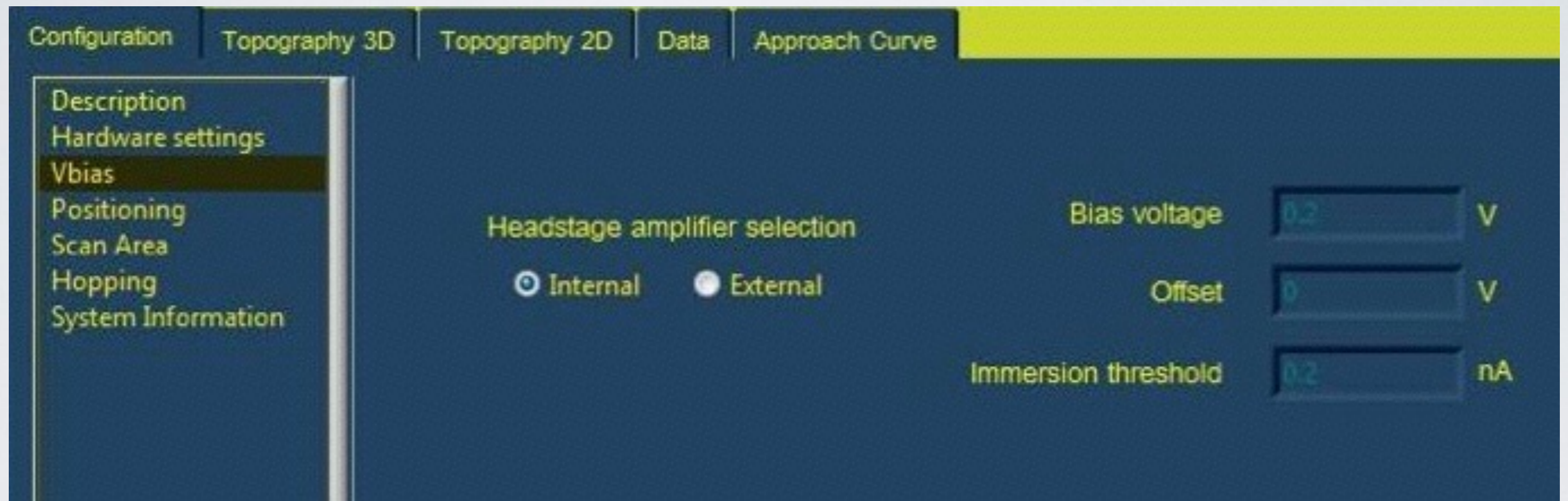
光源
请在关闭前调至最小亮度



二、预设软件

VBias部分

For 100-200M Ω pipette, a typical Bias Voltage is 200mV
the immersion Threshold can be set at 0.2V = 0.2 nA = 200 pA



二、预设软件

Positioning部分

(白色数字显示说明书中的推荐数值)

The screenshot shows the software interface with the following settings:

Parameter	Current Value	Recommended Value	Unit
Z coarse approach speed	10	1-10	um/s
Z coarse immerse speed	1500	1500	um/s
XY coarse speed	1000	1000	um/s
Z coarse withdraw speed	100	100	um/s
ZP piezo stop criteria	125		um

二、预设软件

Hopping部分

The screenshot shows a software interface for configuring the Hopping part of a system. The interface has a dark blue background with yellow text and input fields. At the top, there are tabs for Configuration, Topography 3D, Topography 2D, Data, and Approach Curve. The Hopping tab is currently selected. On the left side, there is a vertical menu with options: Description, Hardware settings, Vbias, Positioning, Scan Area, Hopping (highlighted), and System Information. The main area contains several configuration parameters, each with a label, a numerical input field, and a unit. The parameters are: Minimum hop height (1000 nm), Detection threshold (4 0.1%), Fall rate (20 nm/ms), Rise rate (500 nm/ms), Pre measurement pause (4 ms), Ion current measurement time (15 ms), Z hopping limits (Min: 0, Max: 25 um), and Idle position (X: 0, Y: 0 um).

Parameter	Value	Unit
Minimum hop height	1000	nm
Detection threshold	4	0.1%
Fall rate	20	nm/ms
Rise rate	500	nm/ms
Pre measurement pause	4	ms
Ion current measurement time	15	ms
Z hopping limits (Min)	0	um
Z hopping limits (Max)	25	um
Idle position (X)	0	um
Idle position (Y)	0	um

三、点击IMMERSE入液 入液后

- change the Z velocity to 100um/s and tick on Position Monitor relative to zero the relative position of the pipette along the Z travel axis.



四、调节软件参数：Vbias

设定

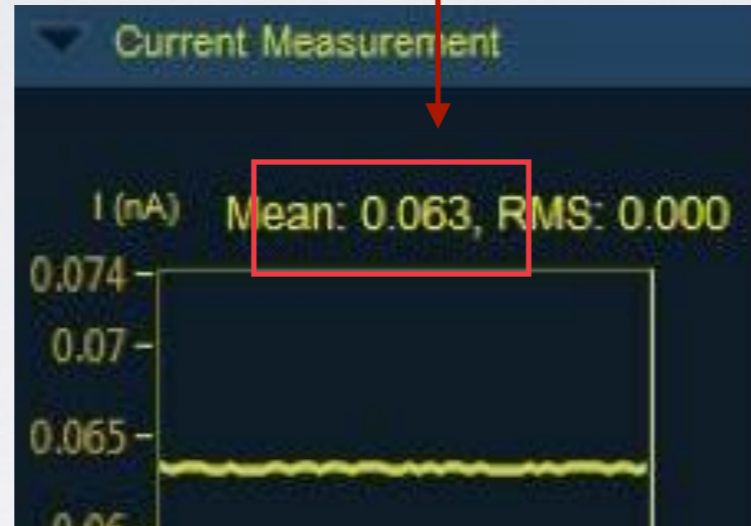
Bias voltage = 0

Offset = 0

读电流值

调节Offset

(必要时取负值)
把电流值拉回零



电流波动
应小于 $0.01V=0.01nA$

Configuration | Topography 3D | Topography 2D | Data | Approach Curve

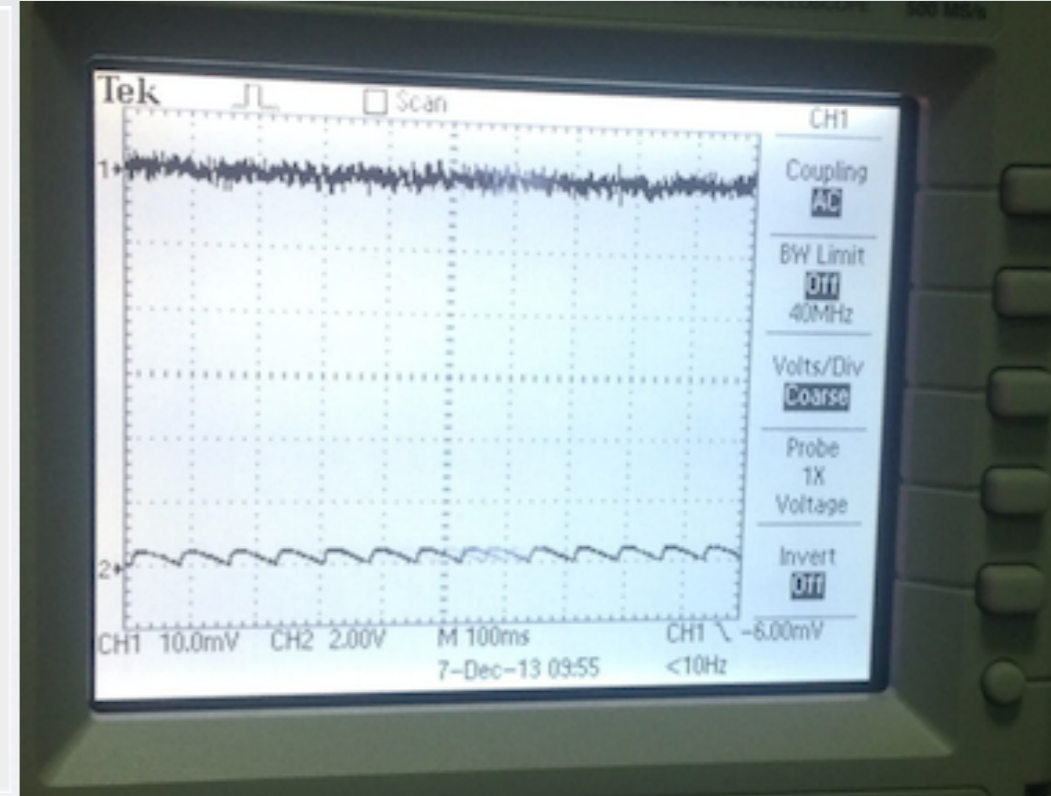
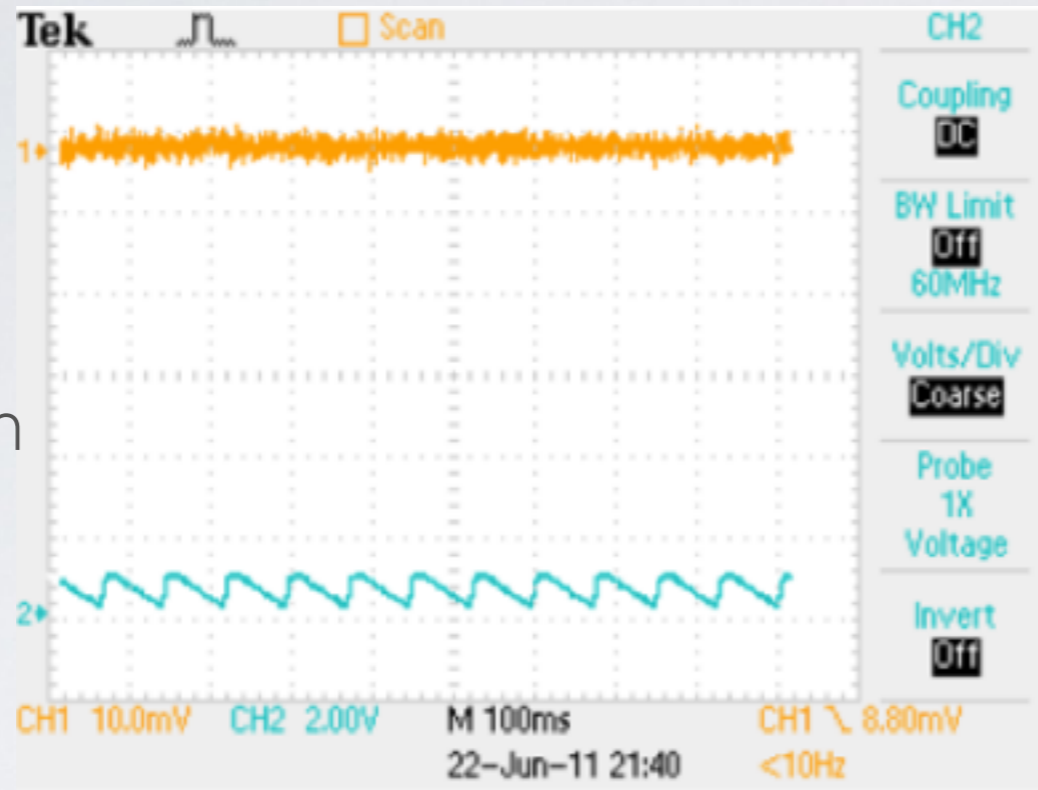
Description
Hardware settings
Vbias
Positioning
Scan Area
Hopping
System Information

Headstage amplifier selection
 Internal External

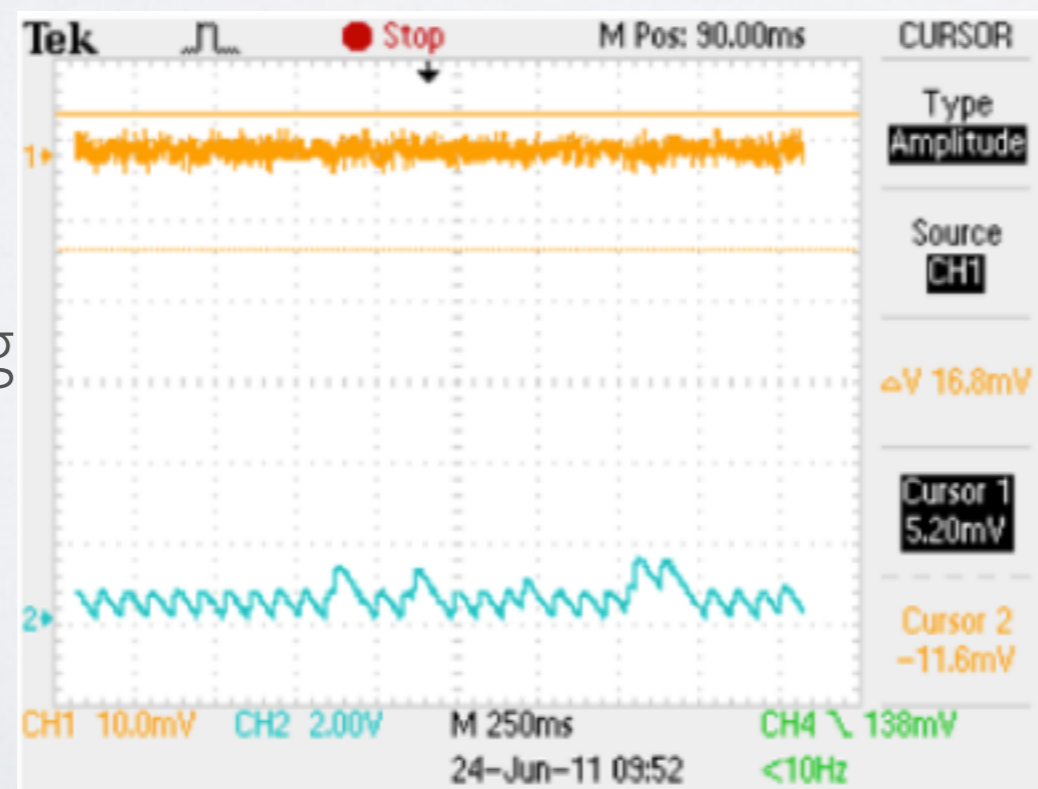
Bias voltage: 0.2 V
Offset: 0 V
Immersion threshold: 0.2 nA

The screenshot shows the software interface with the 'Vbias' section selected in the left sidebar. The 'Headstage amplifier selection' is set to 'Internal'. The 'Bias voltage' is set to 0.2 V, 'Offset' is set to 0 V, and 'Immersion threshold' is set to 0.2 nA. Red boxes highlight the input fields for Bias voltage and Offset.

此时示波器中应显示：
Channel 1 为一条平直的线
Channel 2 为锯齿状线

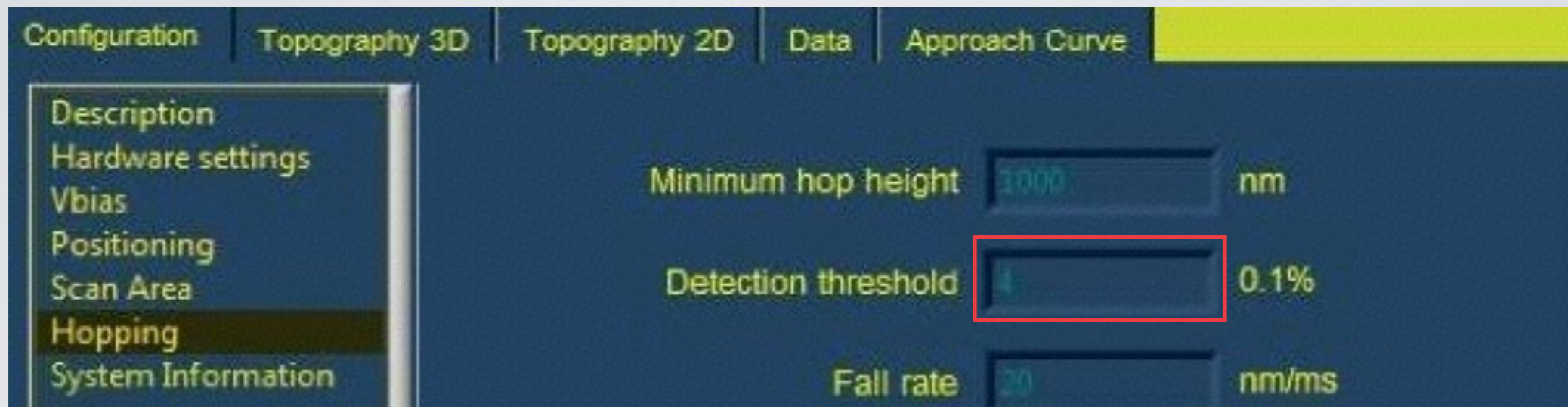


正确结果
可以进行Approach



不正确结果
需要调节Hopping
(详见下一页)

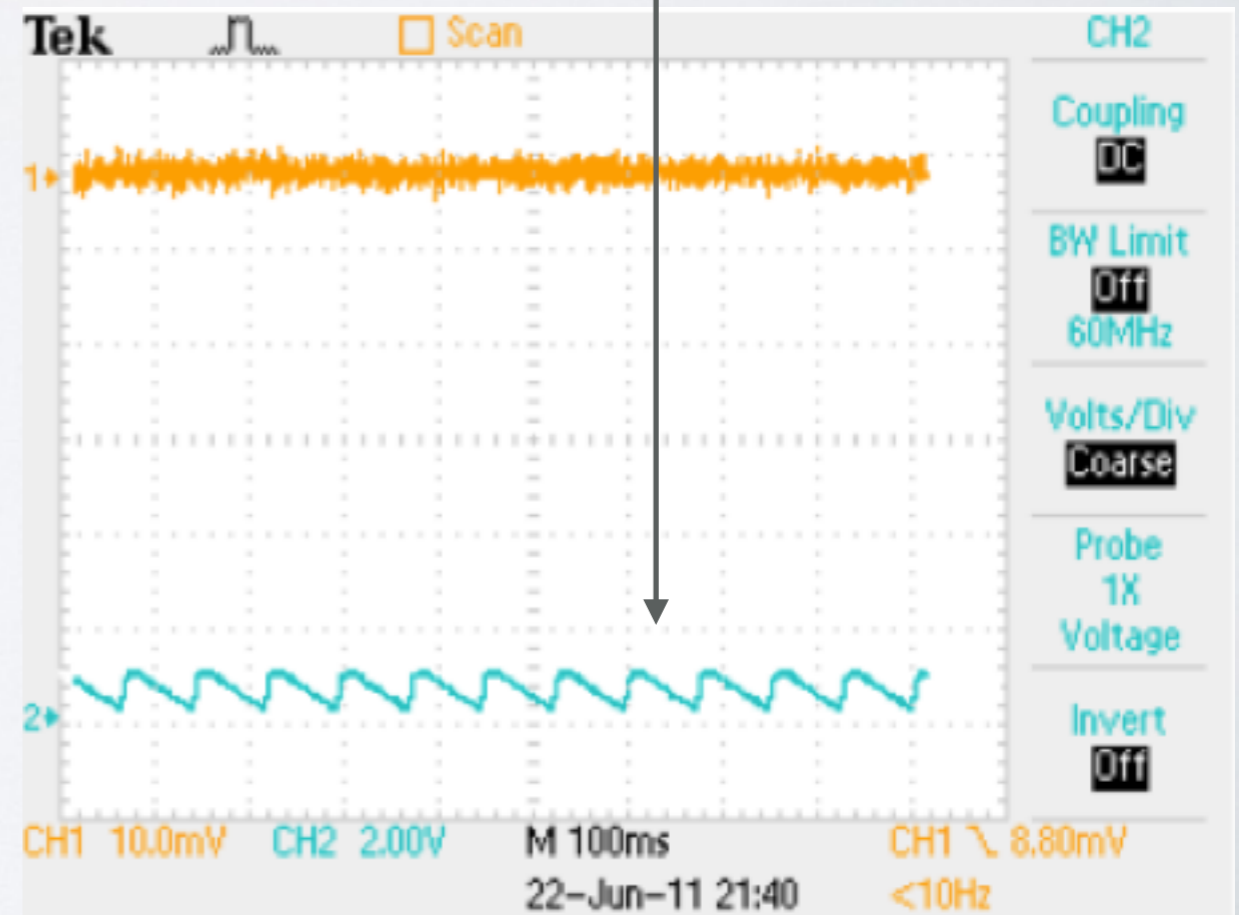
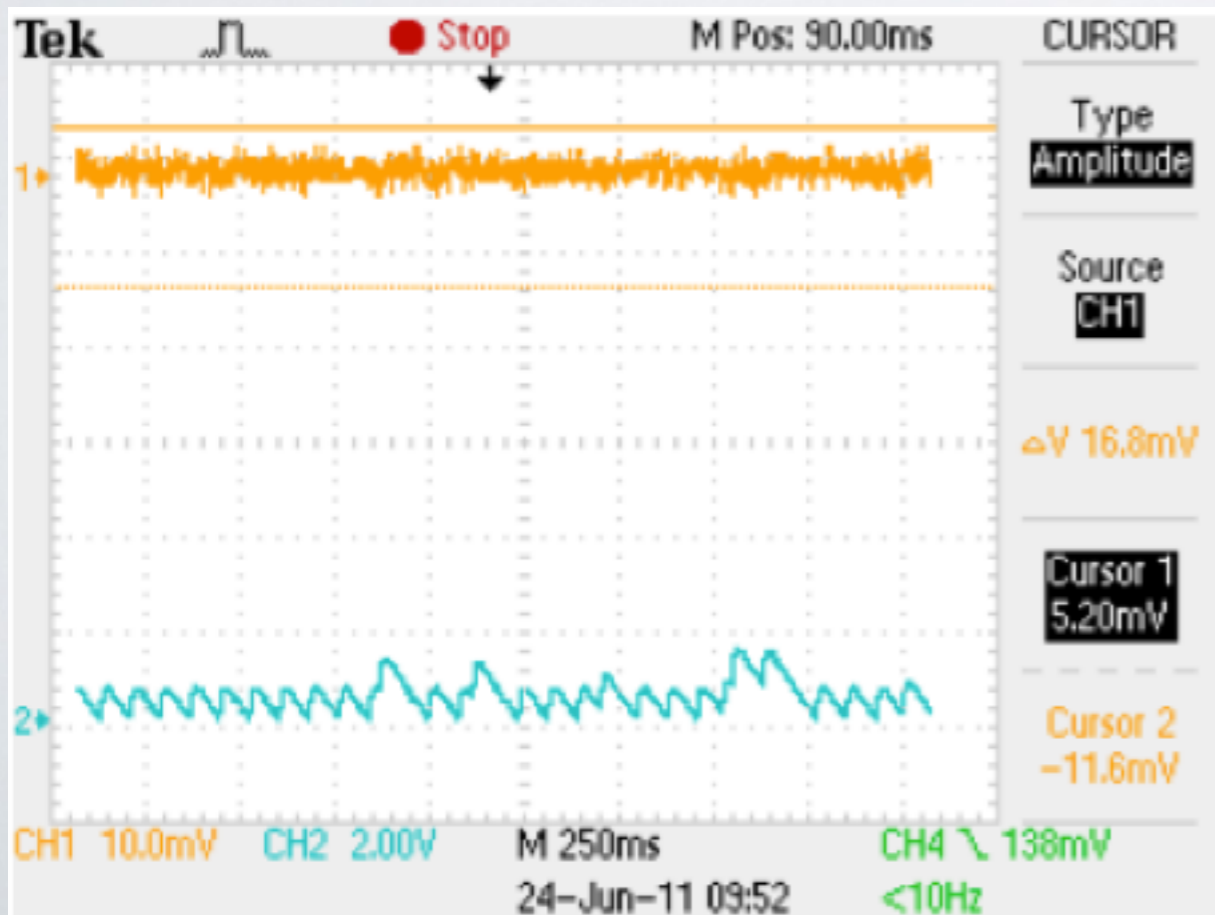
四、调节软件参数：Hopping



先将Threshold设为0



以1为单位递增
直至出现锯齿状图形



信号依然不稳定的原因

- 电极控制不正确 (电极保证100-200MΩ)
- 对于P-1000电极控制仪的参数对电极尖端的影响 (参考P-1000电极控制仪说明书)

	increase	decrease
Heat	longer taper higher resistance	shorter taper lower resistance
Pull	smaller tips longer taper	larger tips shorter taper
Velocity	smaller tips longer taper	larger tips shorter taper
Time	shorter taper	longer taper
Pressure	shorter taper lower resistance	longer taper higher resistance

- 接地线未接好，有干扰信号

五、点击Approach 直至显示In Control

表示电极已接近样品表面

适当调节VBias和Hopping参数后即可扫描

六、此时可在光镜下寻找、标记、移动电极尖端位置

调节光镜的准焦螺旋及载物台的横纵轴，以找到电极尖端所在位置

在显示器上标注电极尖端位置

点击withdraw，将电极尖端远离样品表面



勾选Joystick，用摇杆操作，变动样品与电极尖端的相对位置，找到所要扫描的位置

再次点击Approach，使电极接近样品表面

七、开始扫描

调节Scan Area参数，设定扫描范围和分辨率

点击  开始扫描

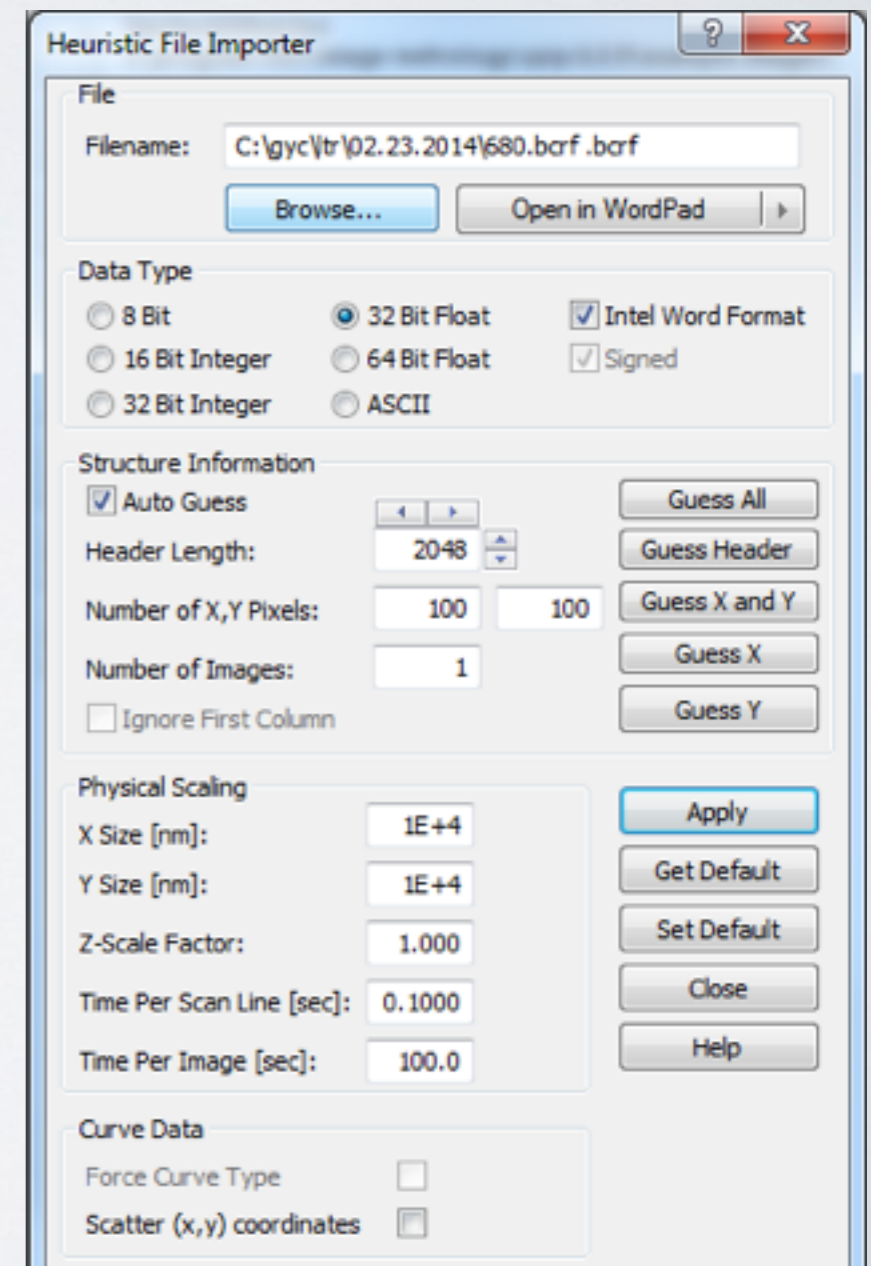
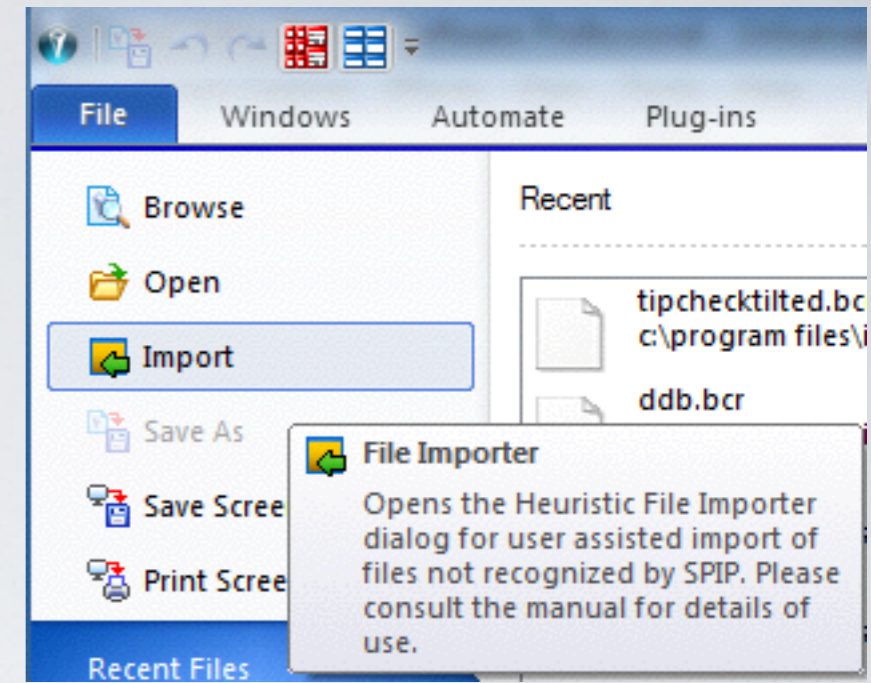
八、扫描完成，数据导出

进入data页面，点击export导出并存储数据

九、图像修改、数据统计

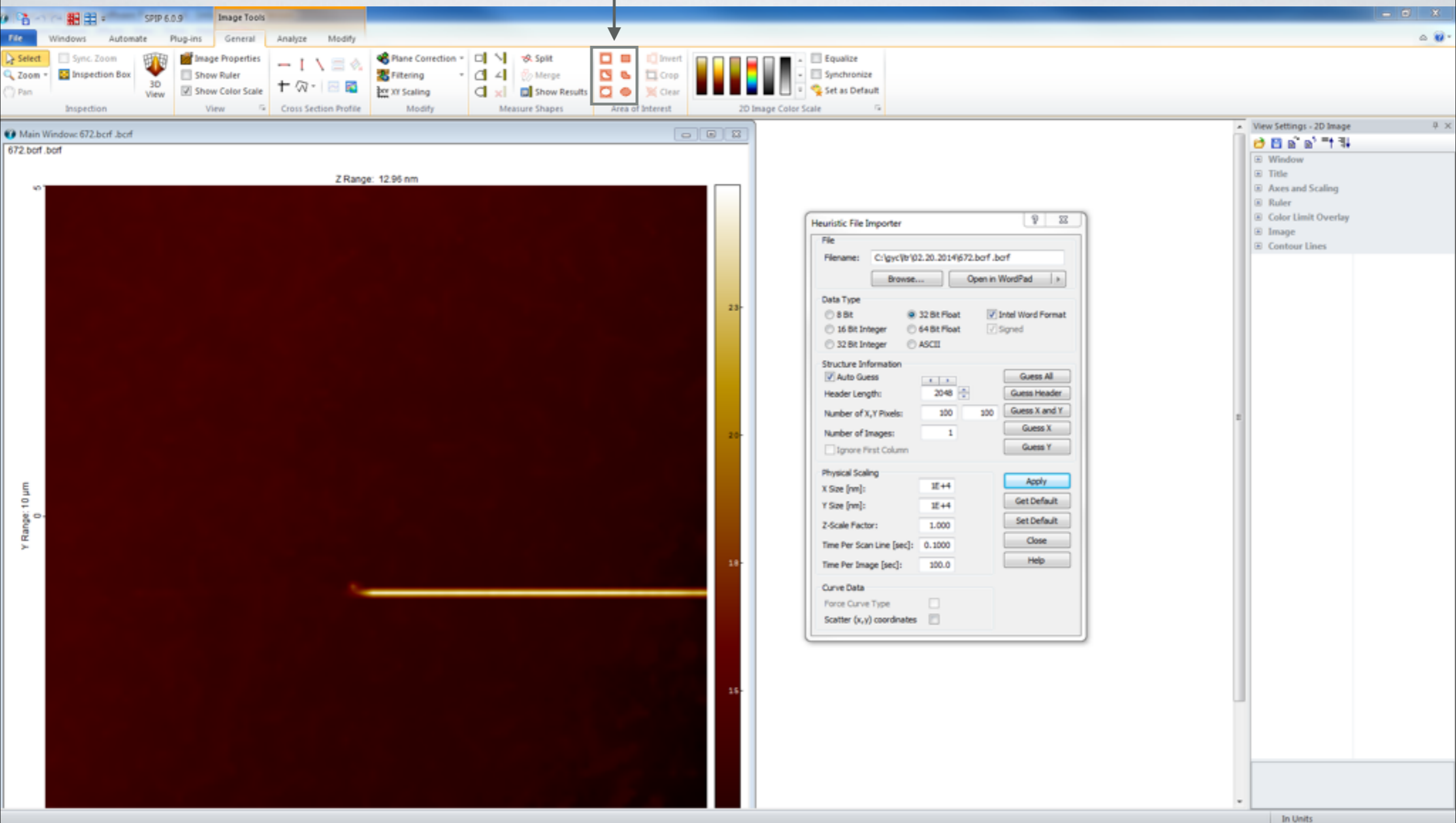
1. 打开SPIP软件，点击Import，导入数据

2. 点击Browse选择所要导入的数据文件，
调节适当的分辨率，点击Apply，导入完成



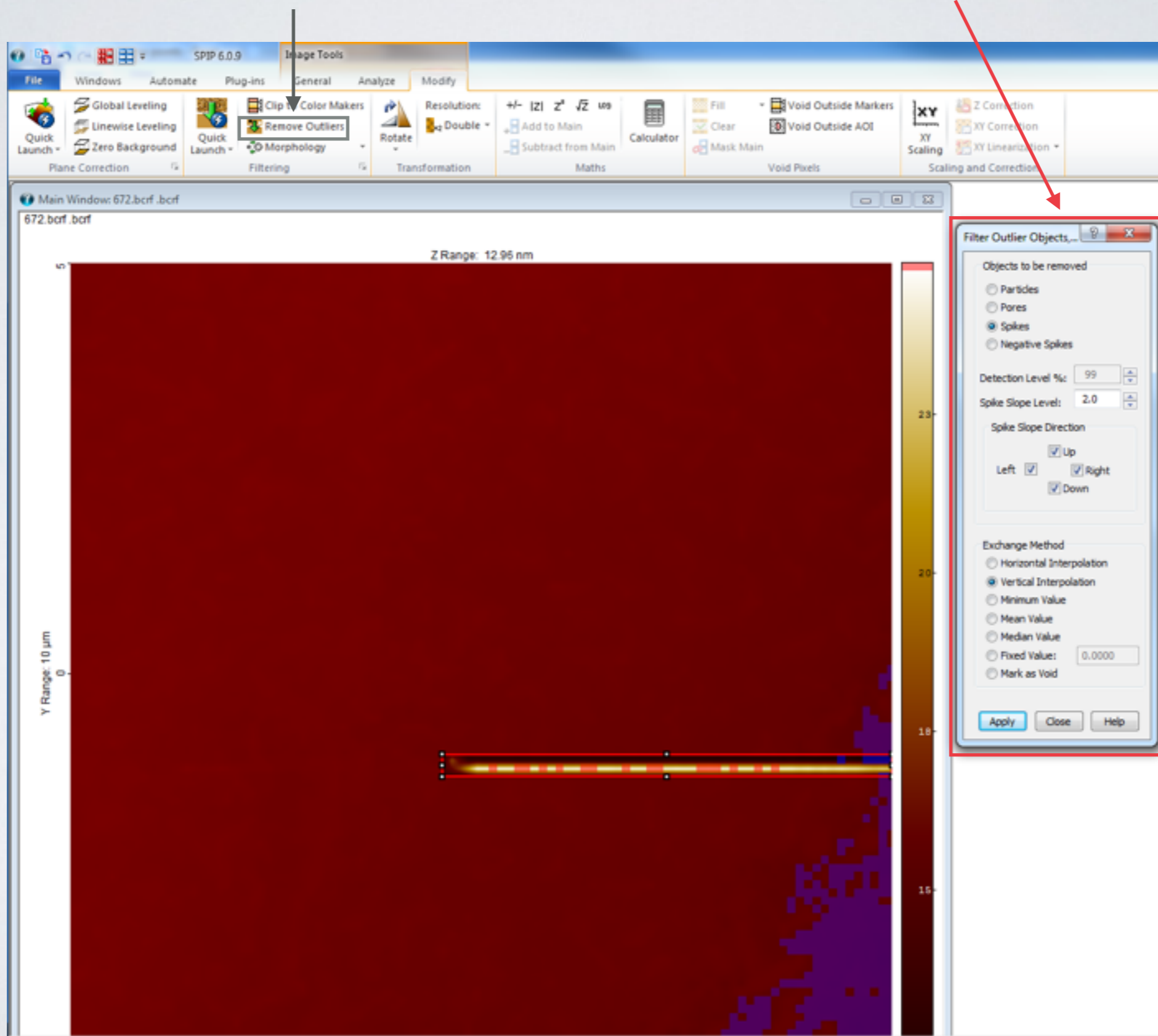
图像修改，移除异常点

点击框选按钮，框选所要修改的部分



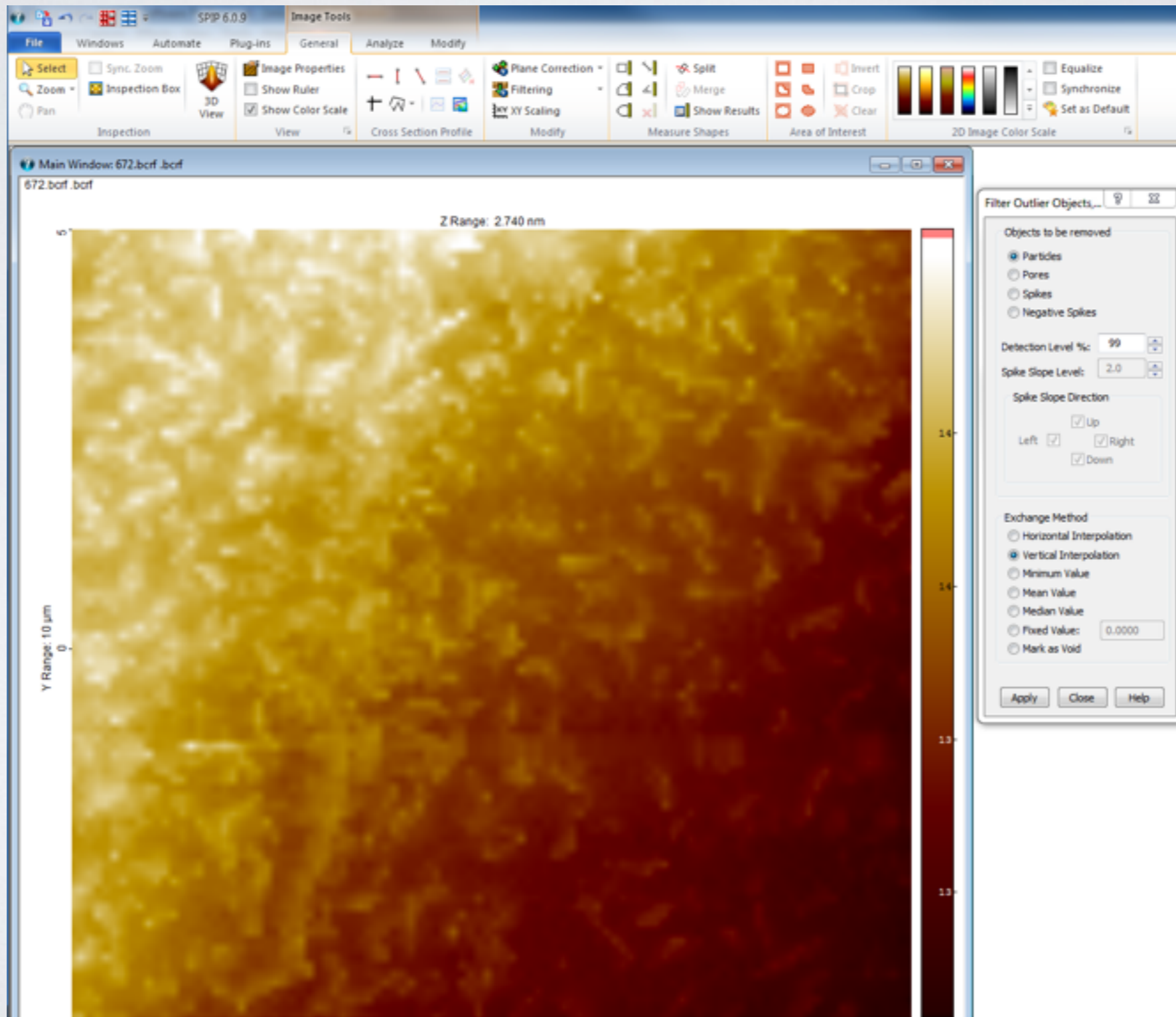
图像修改，移除异常点

点击Remove Outliers按钮，打开修改窗口



图像修改， 移除异常点

调节适当的修改方式， 点击Apply， 修改完成
保存图像或进行其他统计操作



十、实验结束，关闭仪器顺序

关闭ICnano软件和debut软件

关闭光源

关闭PI piezo amplifier unit

关闭ICnano controller

关闭示波器

关闭电脑开关

关闭防震台开关

关闭两个电源

关于离子电导显微镜具体讲解，请参考：

ICnanoS2 Users Guide

关于**SPIP**数据处理软件的更多功能，请参考：

SPIP Manual