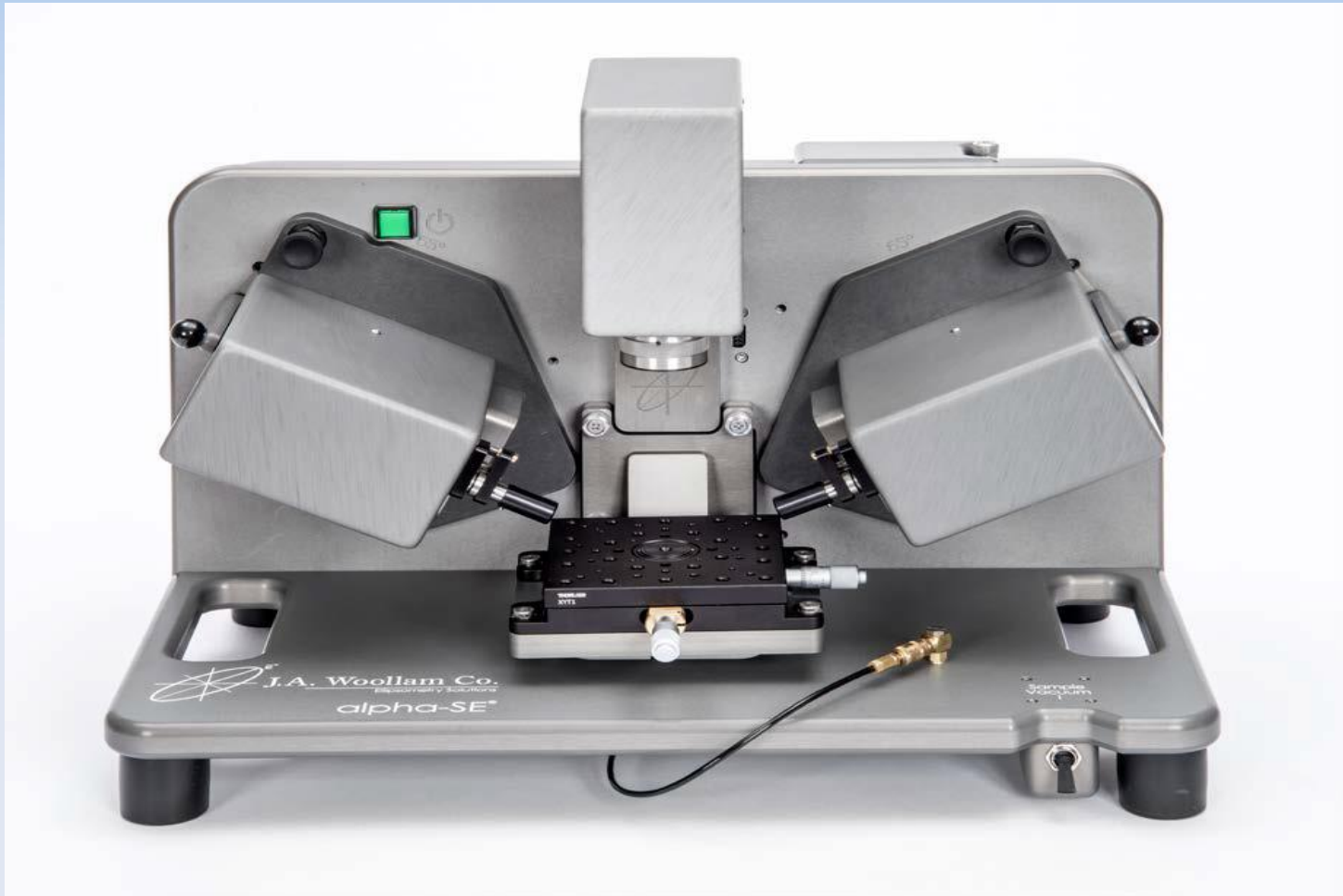
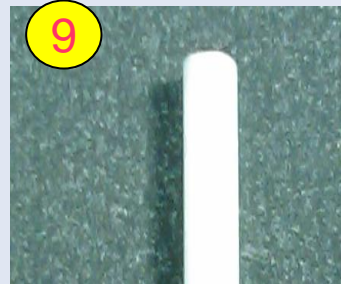
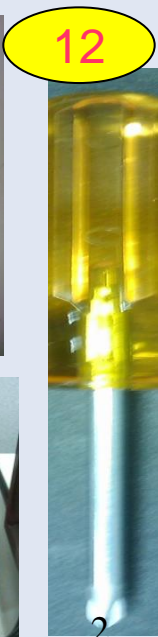
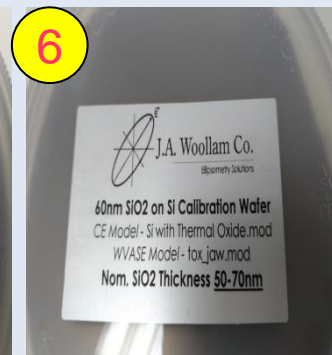
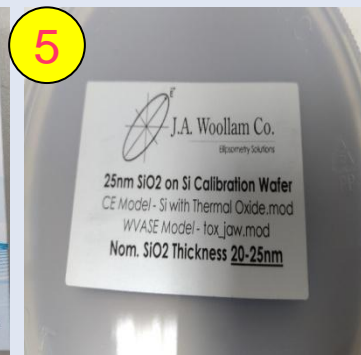
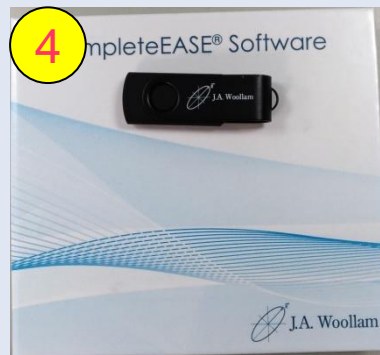
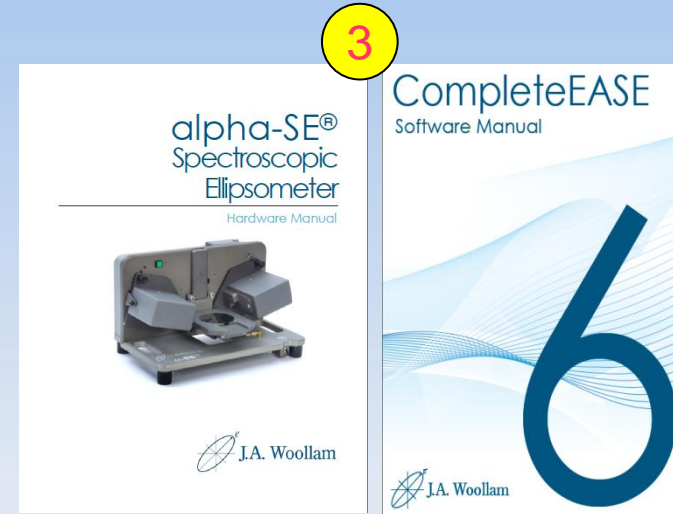
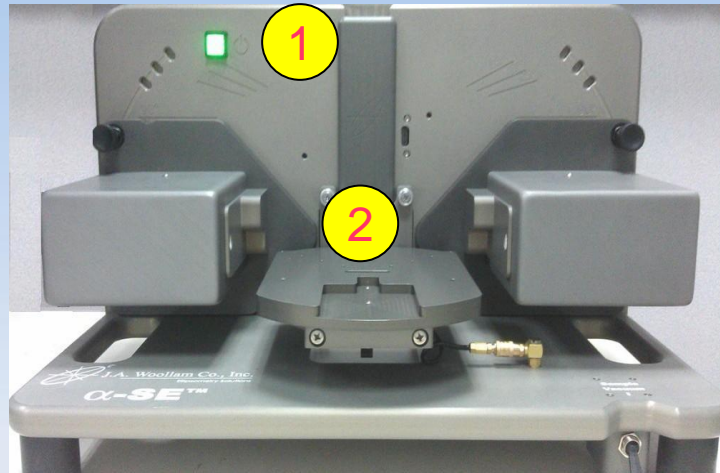


# Alpha-SE 操作手冊



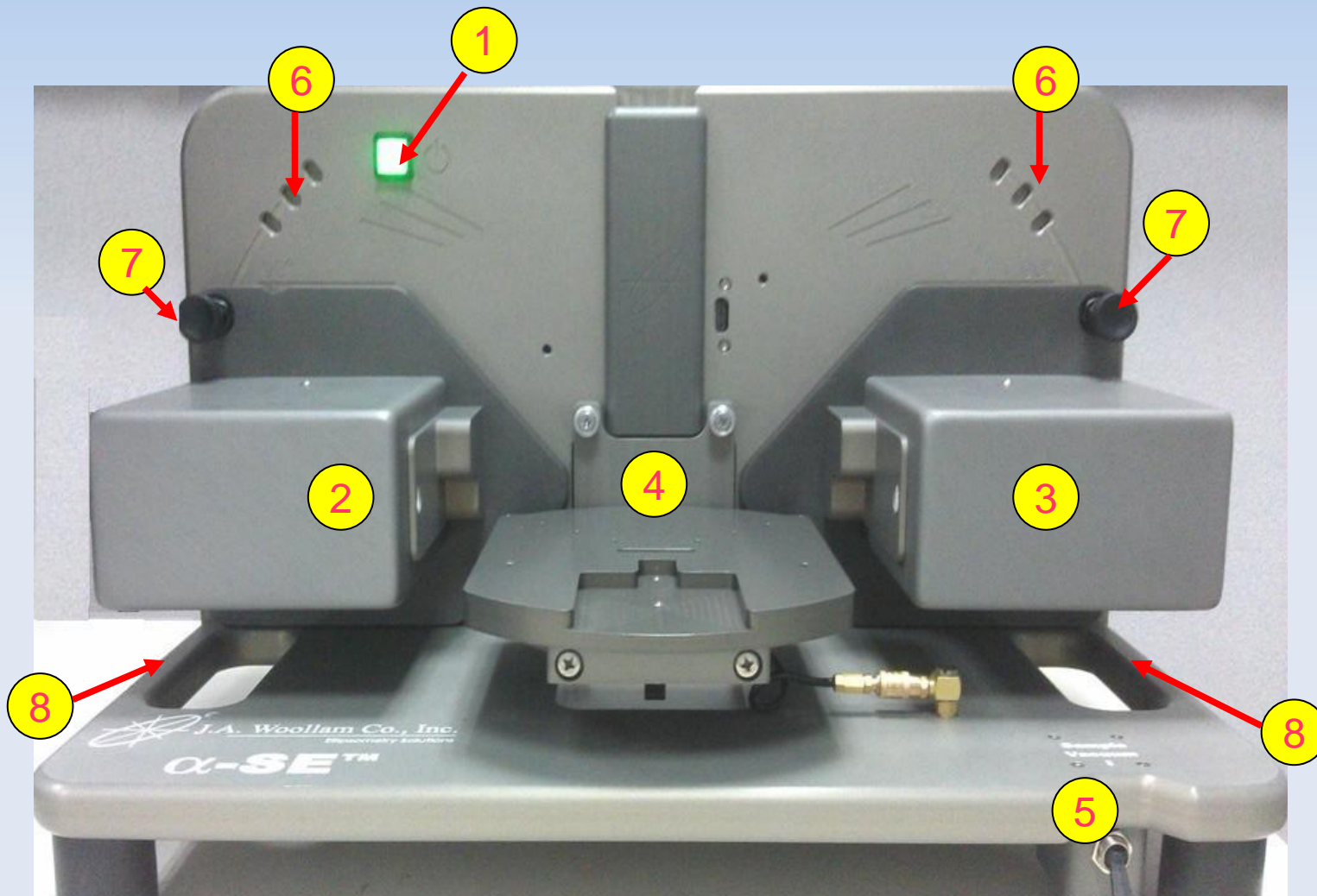
# 機器附件清單

- 1) Alpha-SE主機
- 2) 樣品台
- 3) 操作手冊x 2
- 4) 軟體安裝USB  
(5位使用者安裝)
- 5) JAW 25nm樣品
- 6) JAW 60nm樣品
- 7) 電源供應器 (含電源線x2)
- 8) 備用燈x 2
- 9) Wafer定位插梢x 2
- 10) USB線
- 11) 真空泵浦 (含氣管)
- 12) 十字起子



# Alpha-SE 外觀介紹-正面

- 1) 電源開關
- 2) 光源
- 3) 光譜儀
- 4) 樣品台
- 5) 真空吸氣開關
- 6) 65°、70°、75°  
定位孔
- 7) 角度定位插梢
- 8) 移機時握把



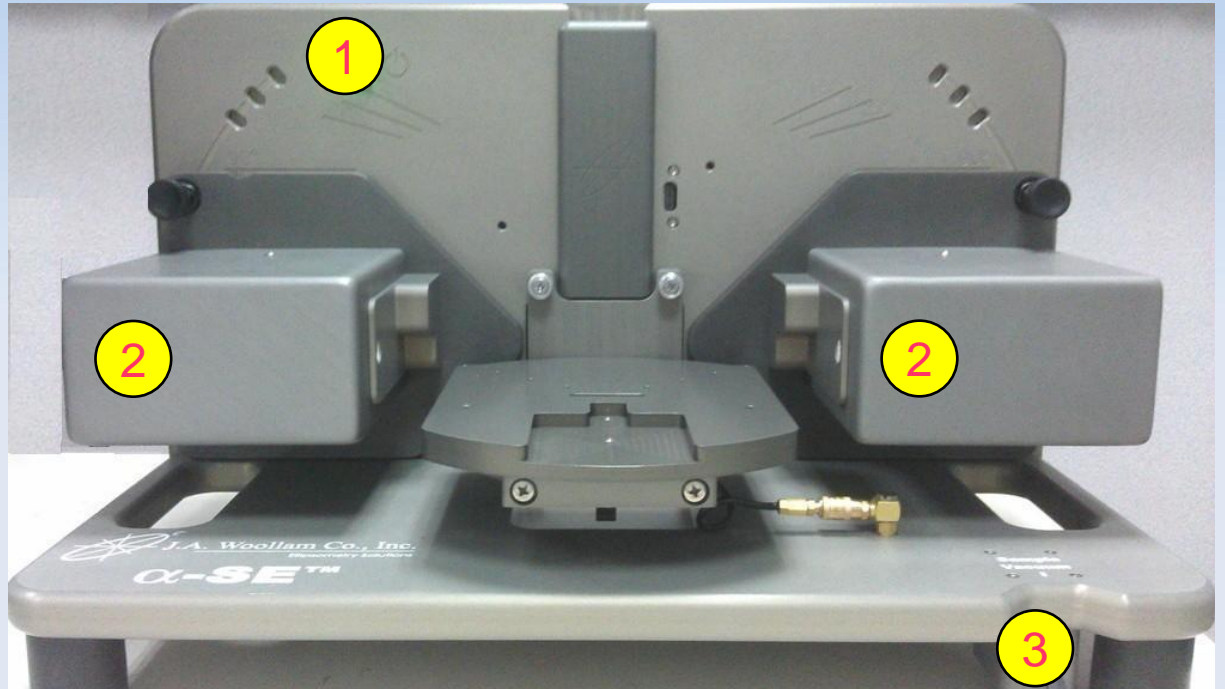
# Alpha-SE 外觀介紹-背面

- 1) DC24V電源輸入孔
- 2) USB Cable 插座
- 3) 真空吸氣管接頭  
(輸入氣管壓力：  
5-10 in .Hg ，  
170-340 mbar )



# 開機步驟

- 1) 開啟Alpha-SE主機電源（綠燈亮）
- 2) 光源與光譜儀固定於90度位置（水平）
- 3) 關閉真空吸氣開關（向下）
- 4) 開啟真空泵浦電源（ON）
- 5) 等待熱機**30**分鐘使光源穩定

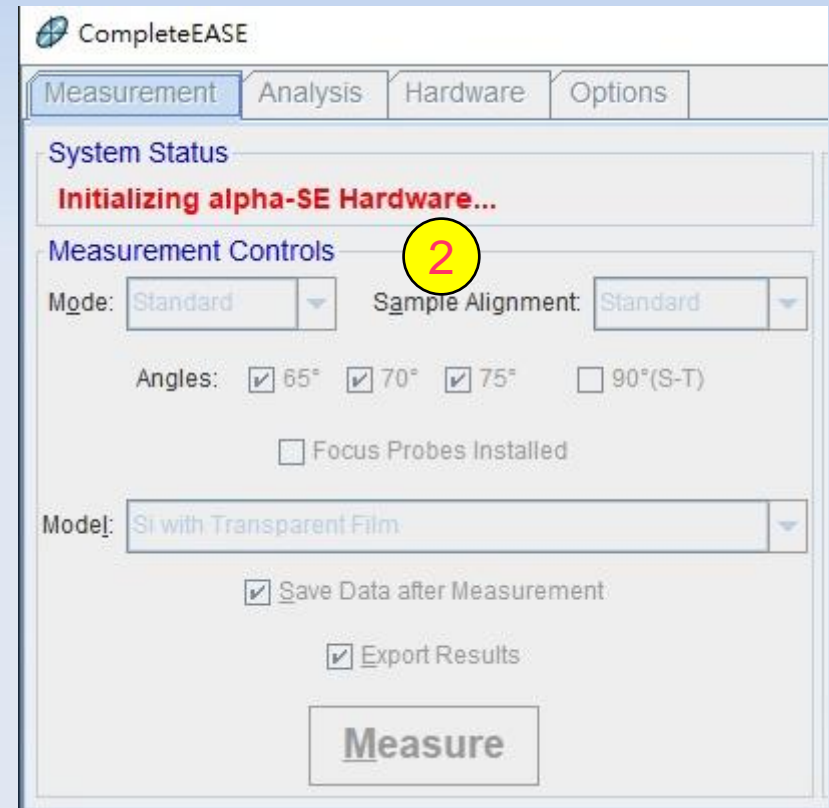
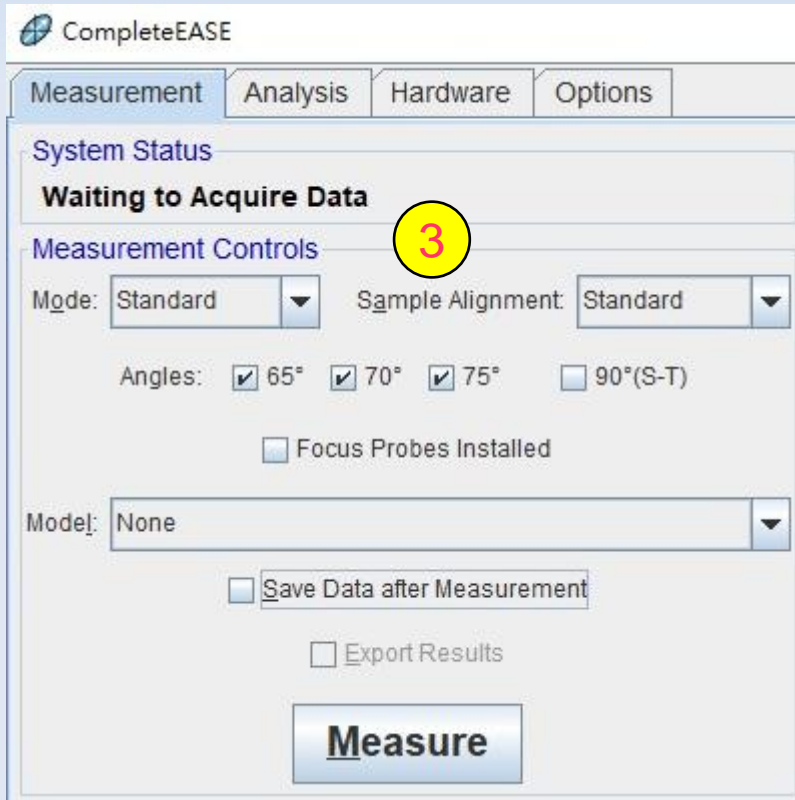


PS: Windows 作業系統電腦電源  
請勿設定進入睡眠模式



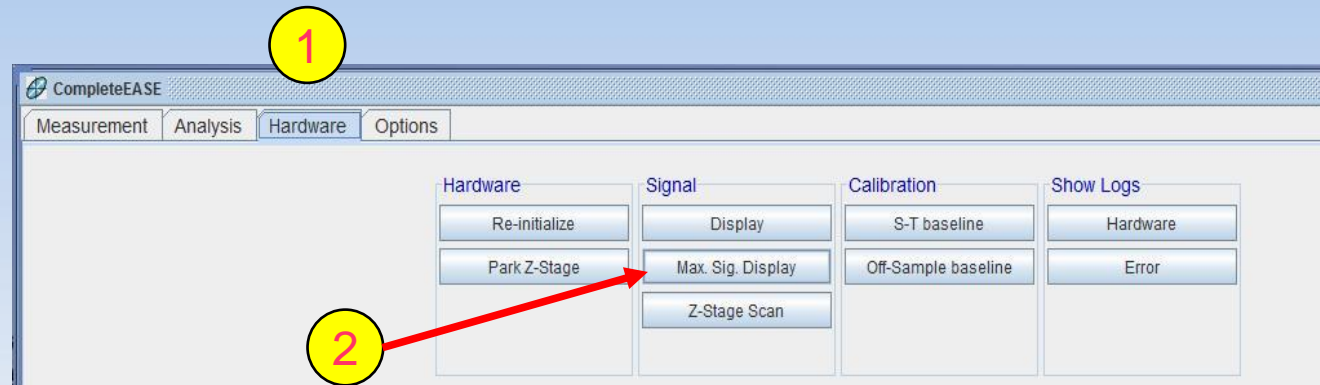
# 硬體初始化

- 1) 雙擊 CompleteEASE
- 2) Alpha-SE 初始化 (紅色字體)
- 3) 初始化完成 (黑色字體)



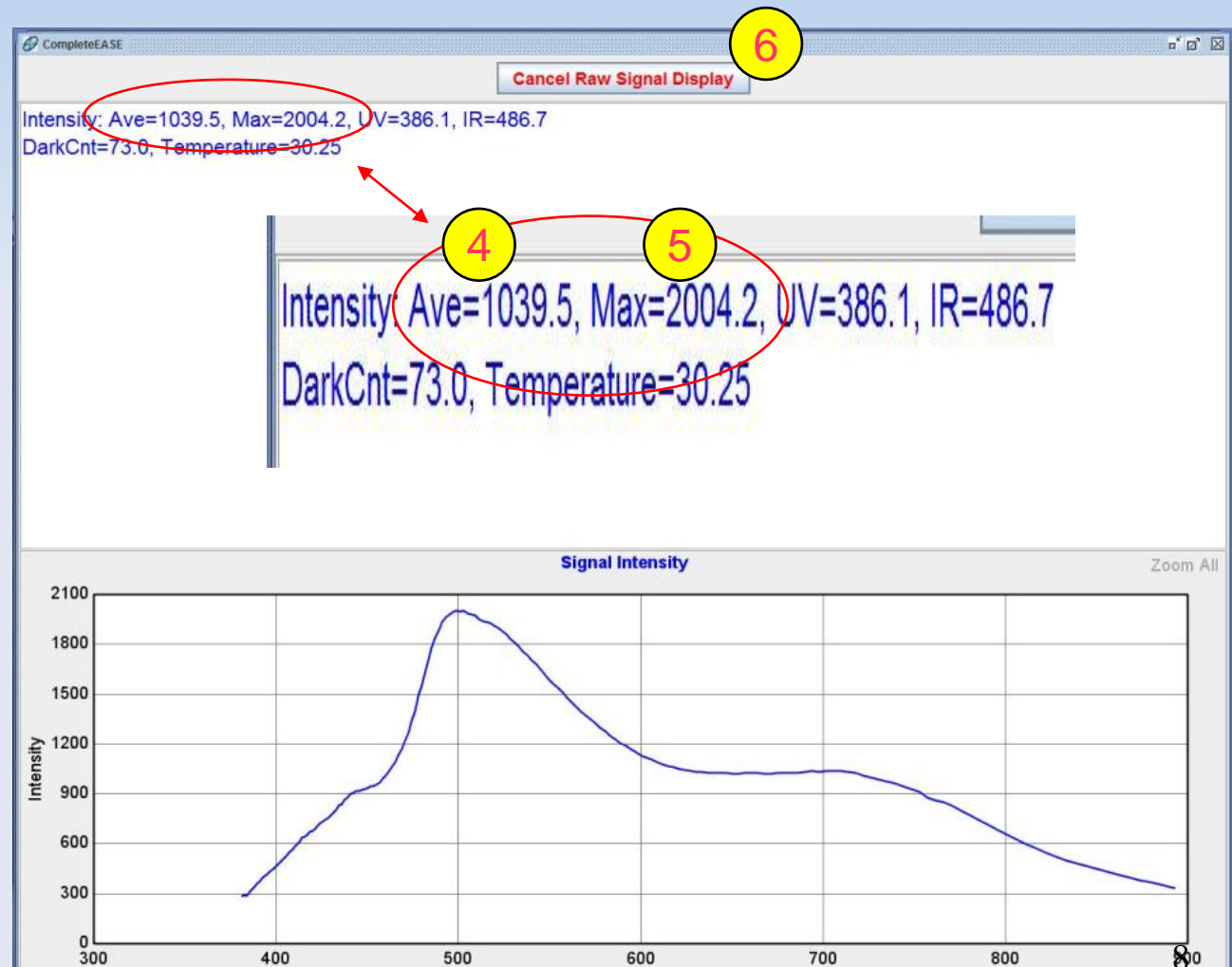
# 燈泡強度檢查-1

- 1) 單擊 Hardware
- 2) <Max. Sig.Display>
- 3) Searching.....



# 燈泡強度檢查 -2

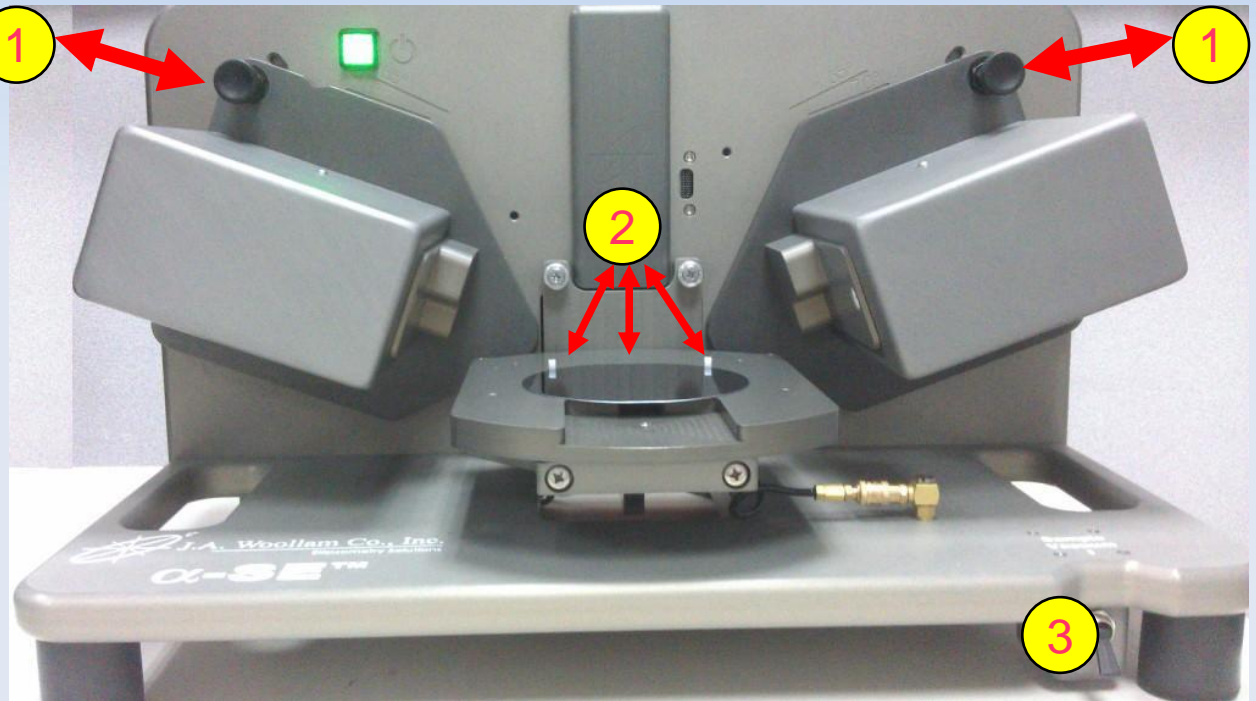
- 4) 確認Ave=**500-2000**
- 5) 確認Max=**1200-3200**
- 6) 單擊<Cencel Raw Signal Display> 離開
  - 如訊號強度過低，請確認燈泡位置是否鬆脫，如仍持續過低，請更換新燈泡
  - 如訊號強度過高，請燈泡位置拉高些許，使Max數值於範圍內





## A. 置放樣品

- 1) 拉起角度定位插梢，直到將光源移到70度後放開插梢
- 2) 將JAW 25nm 樣品平放於樣品台並緊靠Wafer定位插梢
- 3) 開啟真空吸氣開關（向上）



## B. 測試參數選擇

- 1) Mode選擇 Standard
- 2) Sample Alignment 選擇 Standard
- 3) Angle勾選"70°"
- 4) 單擊 Model 下拉選單
- 5) 單擊<Choose From File Dialog>
- 6) 選擇 Basic目錄
- 7) 選擇" Si with Thermal Oxide.mod"
- 8) 單擊<Open>

The screenshot shows the CompleteEASE software interface with several steps highlighted by yellow circles:

- Step 1:** The 'Mode' dropdown menu is open, showing 'Standard' selected.
- Step 2:** The 'Standard' option is highlighted in the dropdown menu.
- Step 3:** The 'Angles' section shows the '70°' radio button selected.
- Step 4:** The 'Model' dropdown menu is open, showing 'None' selected.
- Step 5:** The 'Choose From File Dialog' button is highlighted.

The 'Open Model' dialog box is also shown, with the following details:

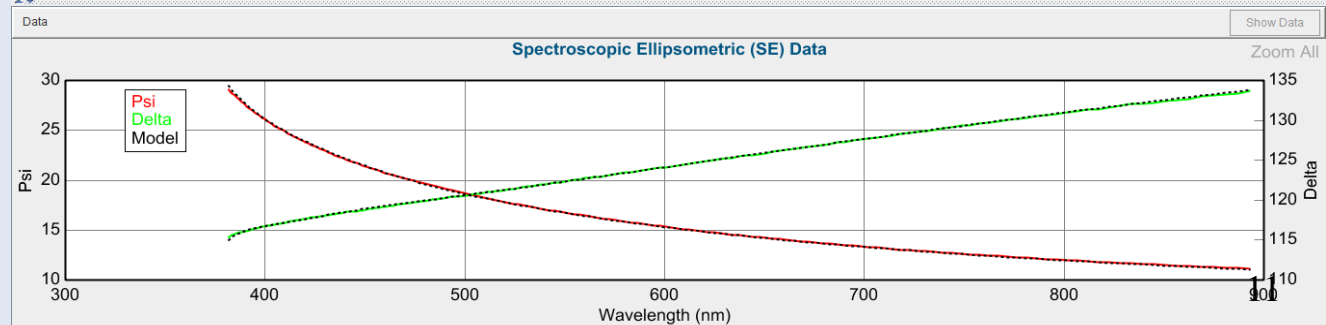
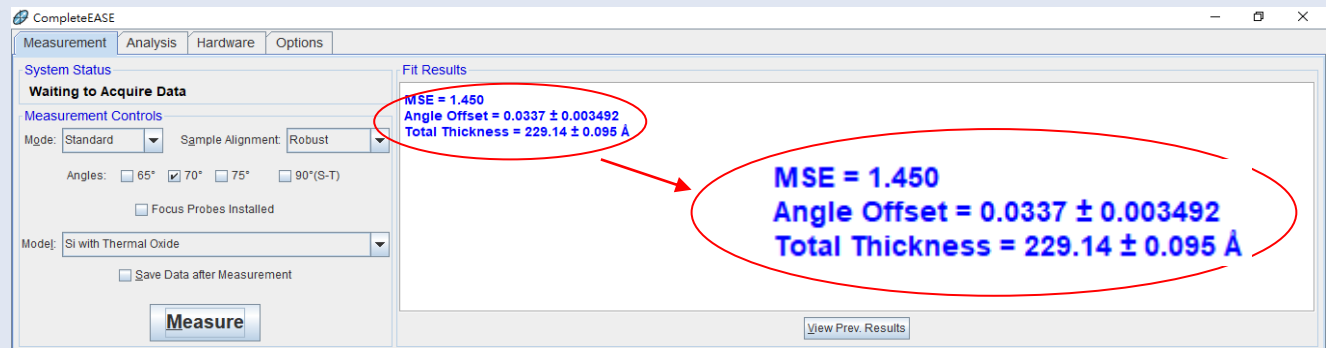
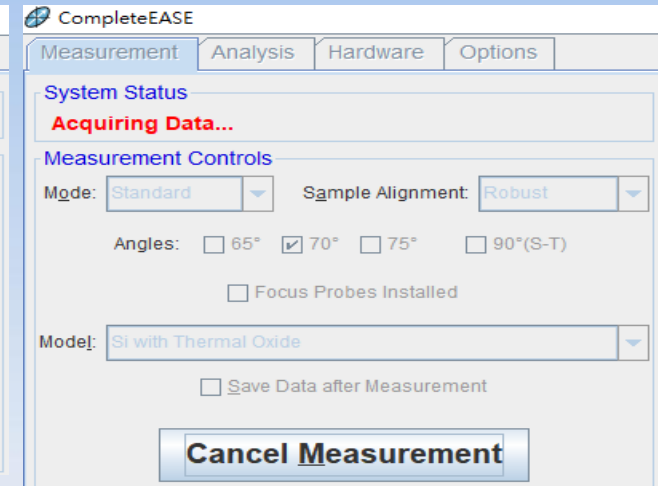
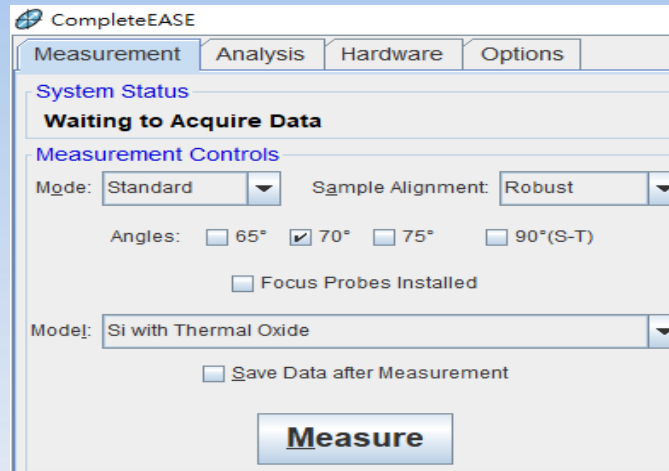
- File Location:** The 'Basic' folder is selected in the left pane.
- Files:** A list of files is shown, with 'Si with Thermal Oxide.mod' selected and highlighted.
- File Name:** The text 'Si with Thermal Oxide.mod' is entered in the 'File Name' field.
- Buttons:** The 'Open' button is highlighted.

## C. 測試及檢視結果

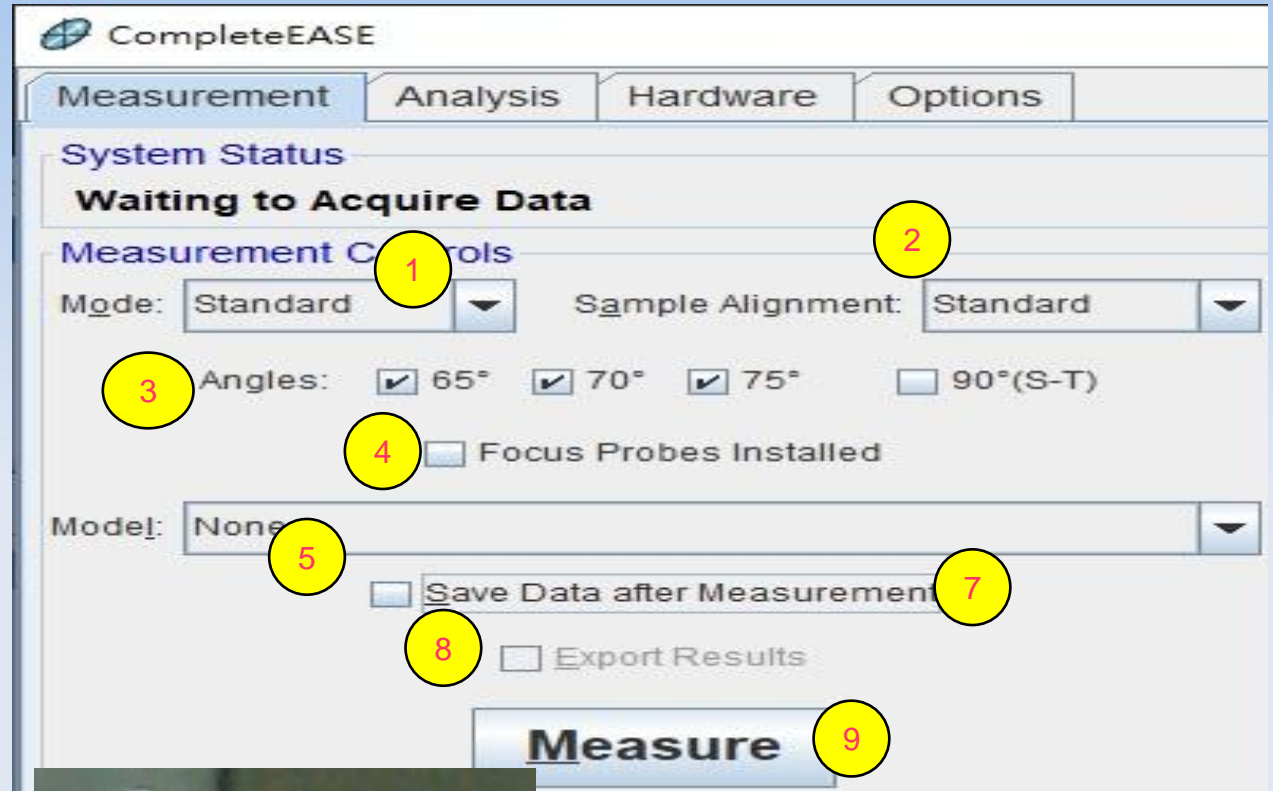
- 1) 單擊 <Measure>開始量測
- 2) 量測中... (中斷量測 <Cancel Measurement>)
- 3) 檢視並確認

MSE < 3.0 (MSE=Mean Squared Error)

- 如果值超出範圍，可試著重新置放JAW 25nm樣品並檢查樣品表面是否清潔與樣品台間位置固定良好後，再重新量測一次

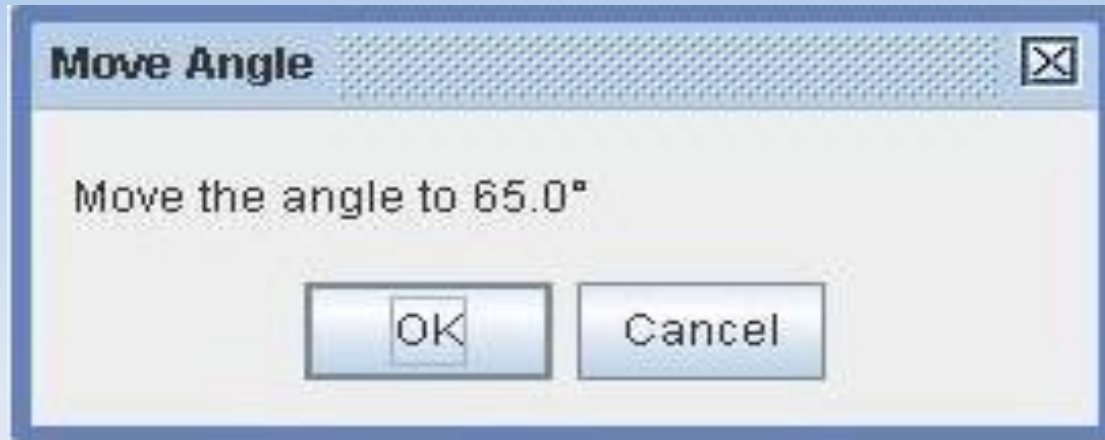


- 1) 選擇Mode
- 2) 選擇Sample Alignment
- 3) 選擇量測角度
- 4) 安裝聚焦鏡(選配)
- 5) 選擇Model
- 6) 置放樣品
  - a. 置放待測樣品
  - b. 開啟真空吸氣開關
- 7) 每次量測資料存檔
- 8) 產生txt存檔輸出,與量測資料存儲相同路徑
- 9) 開始量測<Measure>
- 10) 確認Fits結果

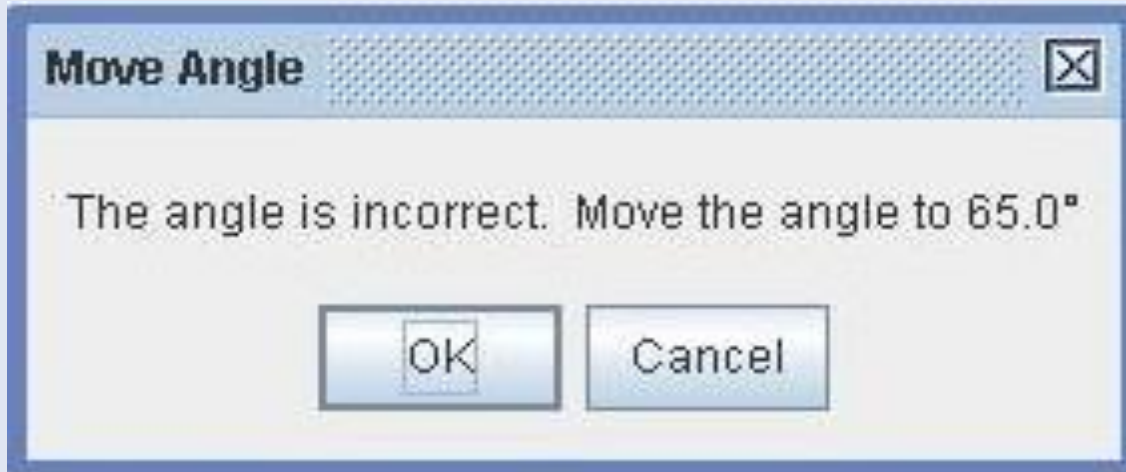


# 硬體角度調整

量測前提醒使用者將硬體角度調整至量測角度



量測角度與硬體角度不相符（角度未修正無法量測）



## A) Mode :

### 1) Fast

適用於快速量測，量測時間約3秒（雜訊可能會稍高）

### 2) Standard

適用於大多數樣品量測，量測時間約10秒

### 3) Long

適用於低反射率樣品或需提高量測準確度，量測時間約30秒

### 4) Transmission

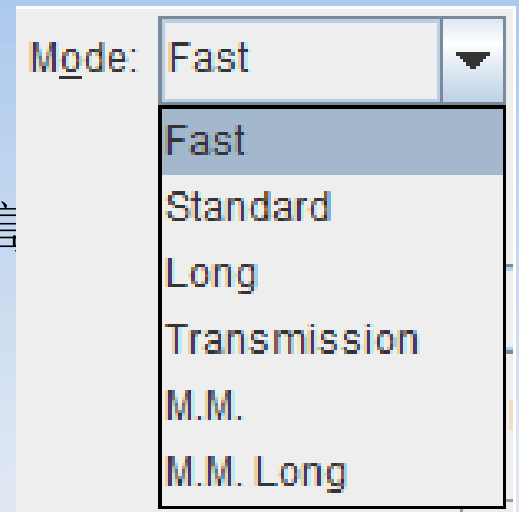
量測樣品之穿透率

### 5) M.M.

Mueller-matrix 量測，適用於各向異性（anisotropic）與消偏極（depolarizing）樣品

### 6) M.M. Long

高精確度之Mueller-matrix 量測



## B) Sample Alignment :

### 1) None

樣品台固定，適用於Straight-Through (90°)  
量測或同一樣品重複量測

### 2) Standard

標準反射量測，此設定在置放樣品後光斑已進入光譜儀入口，能快速調整樣品台高度

### 3) Robust

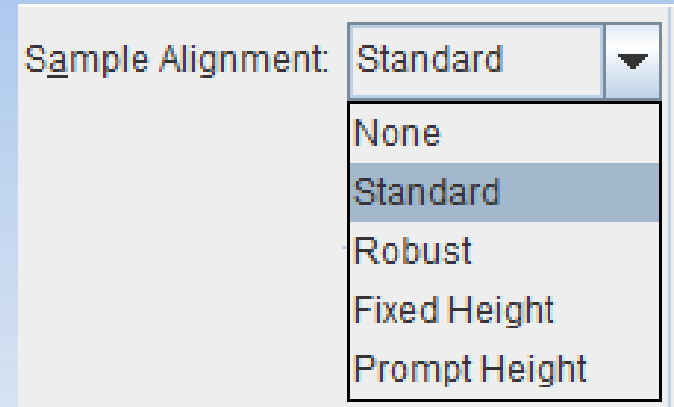
以樣品台最大行程搜尋樣品表面高度使光軸進入光譜儀，適用於玻璃（透明）基底且有多重反射光軸之樣品

### 4) Fixed Height

移動樣品台到hardware.cnf 檔案中所設定之高度

### 5) Prompt Height

由使用者輸入指定之樣品台高度，可搭配”Z-Stage Scan”功能得知最佳高度

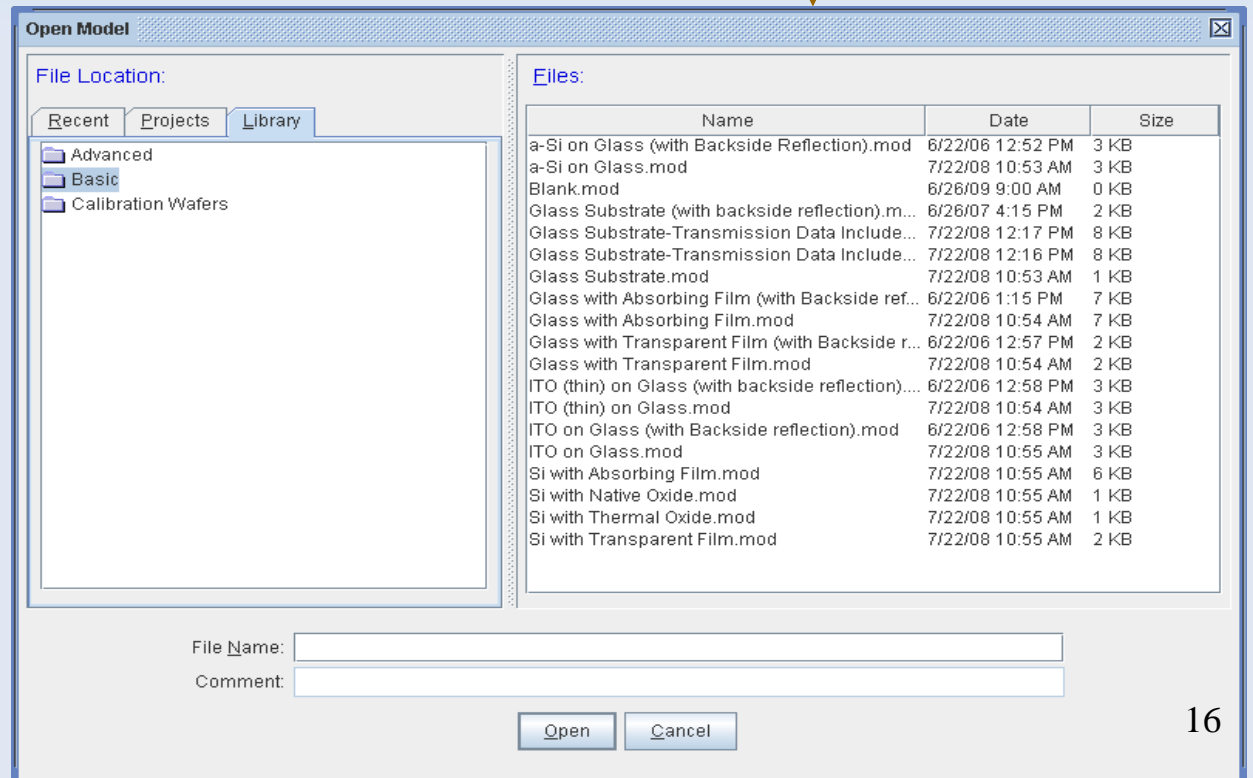
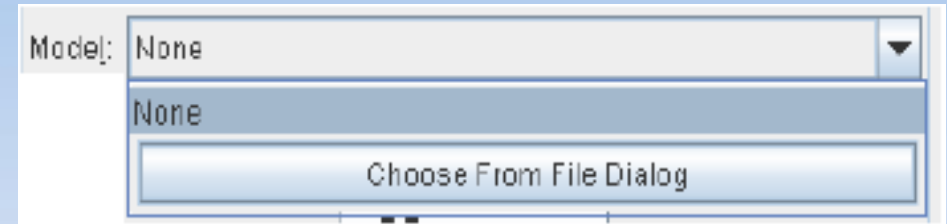


## C) Model :

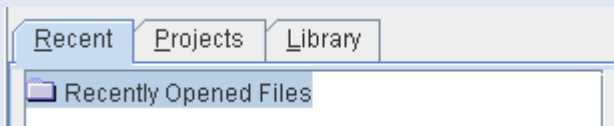
1) 按 “Choose from File Dialog.”

所有Model 檔案存於各不同之目錄中：

Library : Advanced、Basic、Calibration  
Wafers



※最近使用檔案



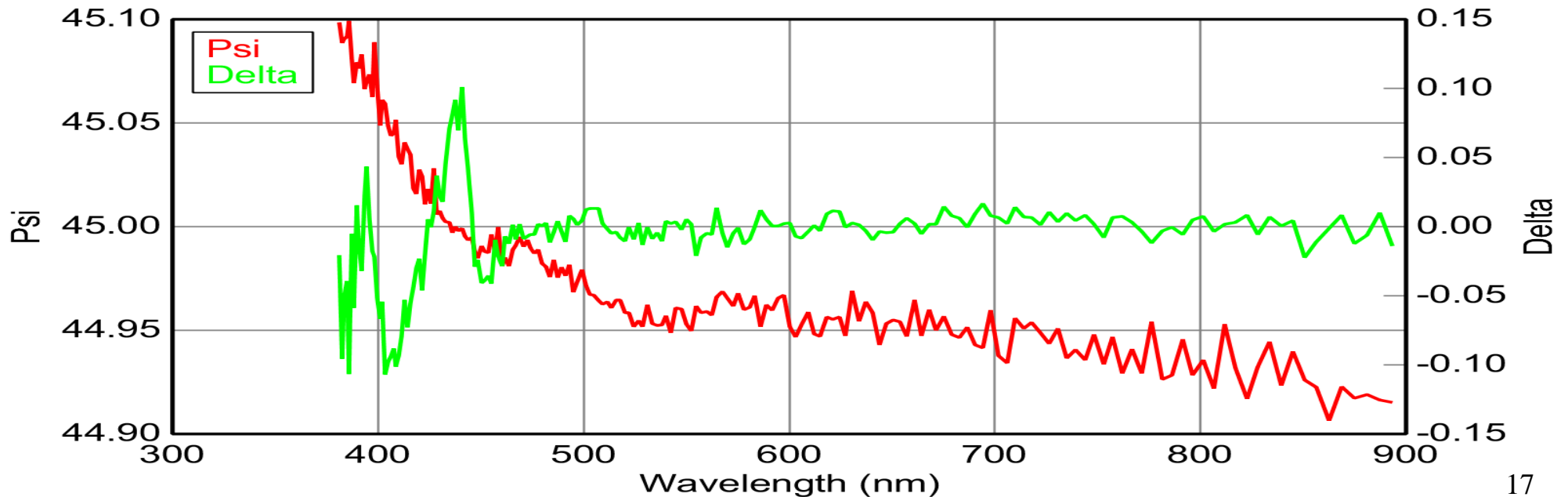




# 測試空氣確認機台性能

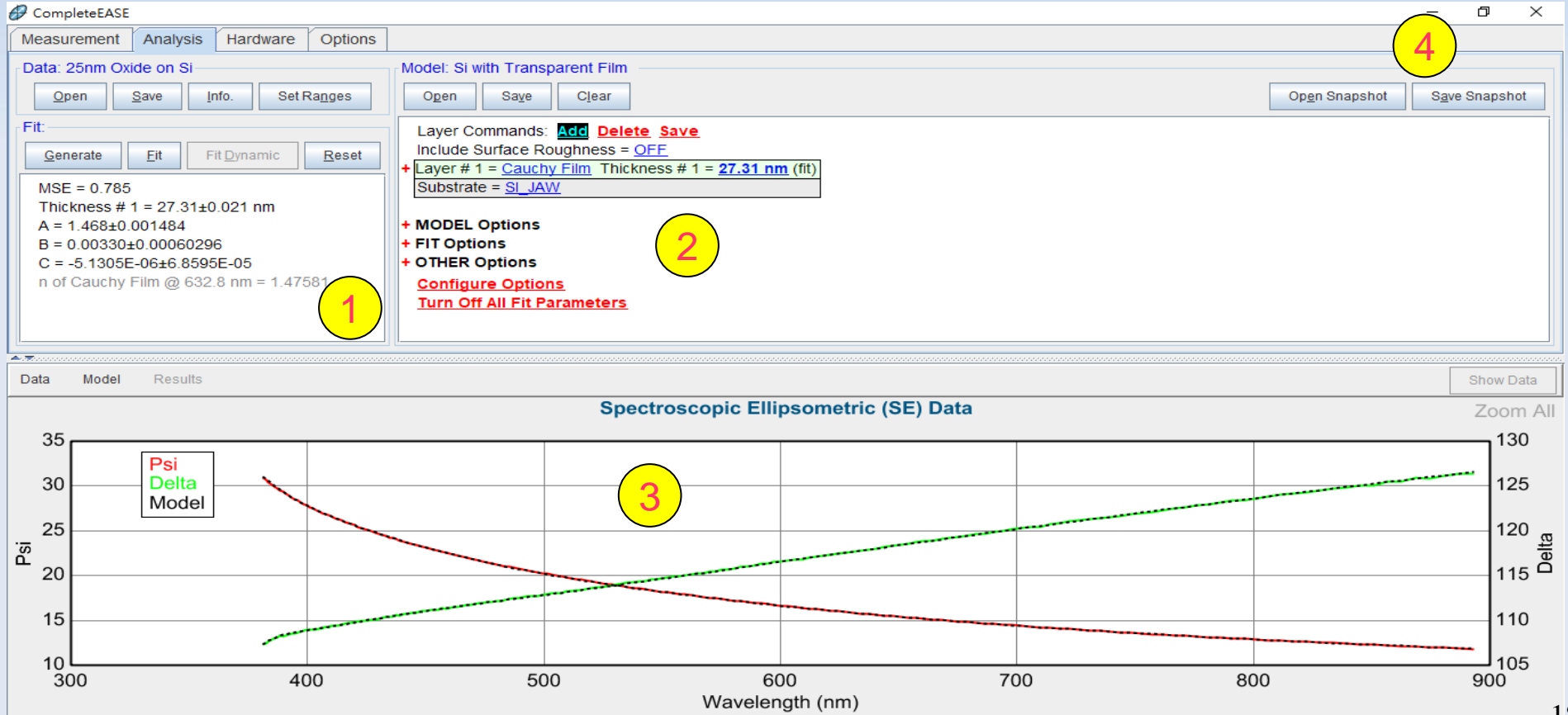
- 1) 量測設定：Mode = Long ， Sample Alignment = None ， Model = None
  - 2) 光源與光譜儀固定於90度位置（水平）
  - 3)  $\text{Psi} = 45 \pm 0.1$  ，  $\text{Delta} = 0 \pm 0.2$
- ◆ 大部分數值應在範圍內，除了在最長和最短波長的雜訊可能會導致數據的準確性略微超出範圍

Spectroscopic Ellipsometric (SE) Data



# Analysis視窗說明

1. Fit結果
2. 建立Model結果
3. 測量與Model的data
4. Save Snapshot：可將1~3視窗中data儲存起來





# 光學常數(N & K值)

在SiO<sub>2</sub>\_JAW中以滑鼠右鍵選Graph Layer Optical Constants

Model: Si with Transparent Film

Open Save Clear

Layer Commands: **Add Delete Save**  
Include Surface Roughness = **OFF**

+ Layer # 1 = **Cauchy Film** Thickness # 1 = **31 nm (fit)**  
Substrate = **Graph Layer Optical Constants** **1**

- + MODEL Options
- + FIT Options
- + OTHER Options

**Configure Options**  
**Turn Off All Fit Parameters**

- Graph Layer Absorption Coefficient
- Rename Layer and Fit Parameters
- Save Layer Optical Constants
- Parameterize Layer
- View Layer Comment
- Convert To EMA
- Convert To Transparent B-Spline
- Convert To Anisotropic
- Grade Layer
- Start Superlattice

Spectroscopic Ellipson

CompleteEASE

Measurement Analysis Hardware Options

Data: 25nm Oxide on Si Model: 25nm Oxide on Si (25nm Oxide on Si model)

Open Save Info Set Ranges Open Save Clear Open Snapshot Save Snapshot

Fit: Generate Fit Fit Dynamic Reset

MSE = 0.943  
Oxide Thickness = 26.42±0.007 nm  
Angle Offset = 0.00138±0.002307

Layer Commands: **Add Delete Save**  
Include Surface Roughness = **OFF**  
Layer # 2 = **SiO2\_JAW** Oxide Thickness = **26.42 nm (fit)**  
Layer # 1 = **INTR\_JAW** Interface Thickness = **1.00 nm**  
Substrate = **SI\_JAW**

- + MODEL Options
- + FIT Options
- + OTHER Options

**Configure Options**  
**Turn Off All Fit Parameters**

Data Model Results Show Data

Opt. Const. of SiO<sub>2</sub>\_JAW vs. nm

Wavelength (nm)	Refractive Index (n)	Extinction Coefficient (k)
350	1.478	0.00
400	1.472	0.00
500	1.465	0.00
600	1.460	0.00
700	1.458	0.00
800	1.457	0.00
900	1.456	0.00



# Hardware Tab功能說明-1

## Hardware :

Re-initialize : 機台重新初始化

Park Z-Stage : 將樣品台移動至移機位置

## Signal :

Display : 顯示光譜儀訊號

Max Sig. Display : 自動調整機台訊號強度，以90°位置執行（開機後必執行）

Z-Stage Scan : 以樣品台最大行程搜尋功能，得知最佳高度

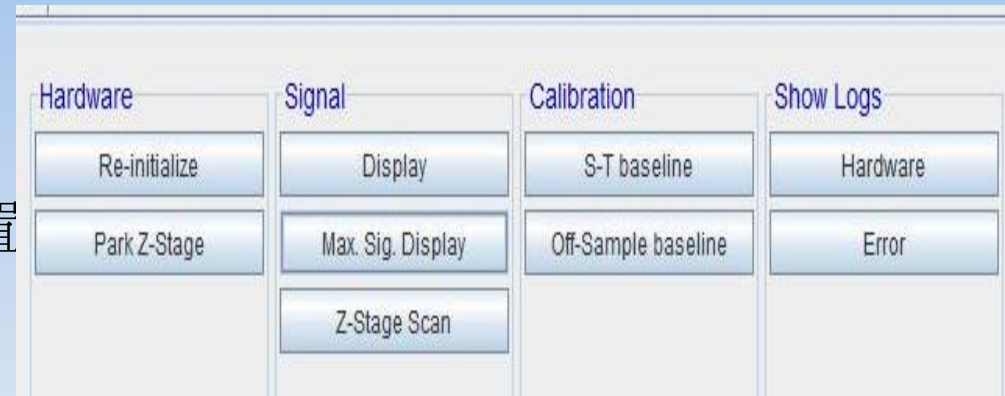
## Calibration :

S-T Baseline : 90°位置，讀取100%穿透率資料

Off-Sample Baseline : Calibrating the Angle of Incidence（以75°測量JAW 25nm參考片）

## Show Logs :

Hardware : Alpha-SE使用紀錄      Error : 錯誤訊息紀錄



## Routine Test Measurement :

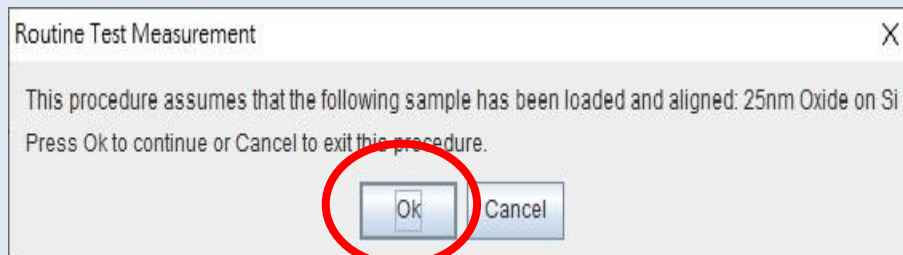
- 1) 放置SiO<sub>2</sub> on Si 25nm樣品
- 2) 角度放置70度
- 3) 點選Measure

### Routine Test Measurement

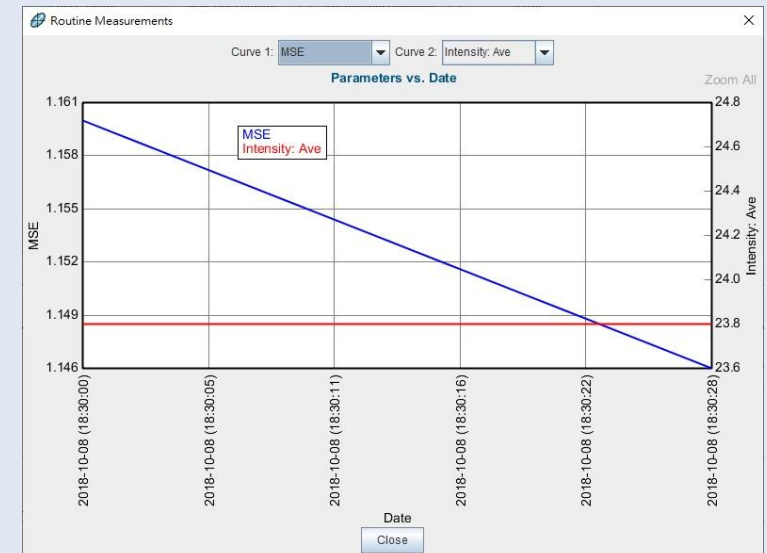
Measure

Show Results

## 4) Routine Test Measurement選擇OK

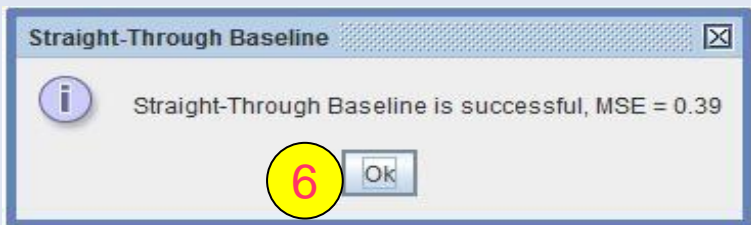
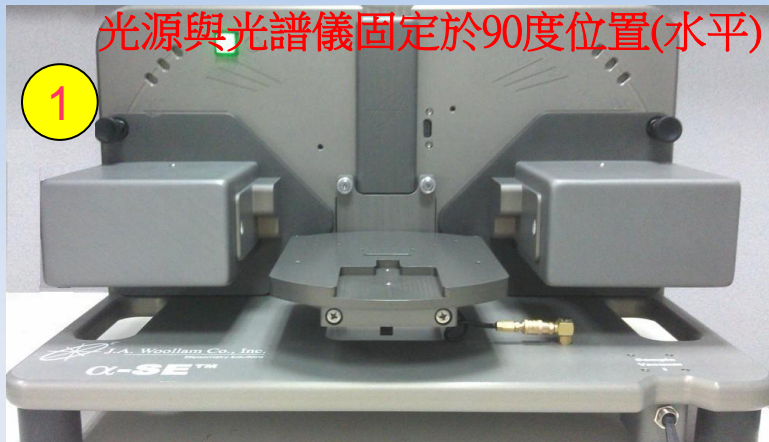


- 5) 點選Show Results呈顯時間  
對應光源強度結果

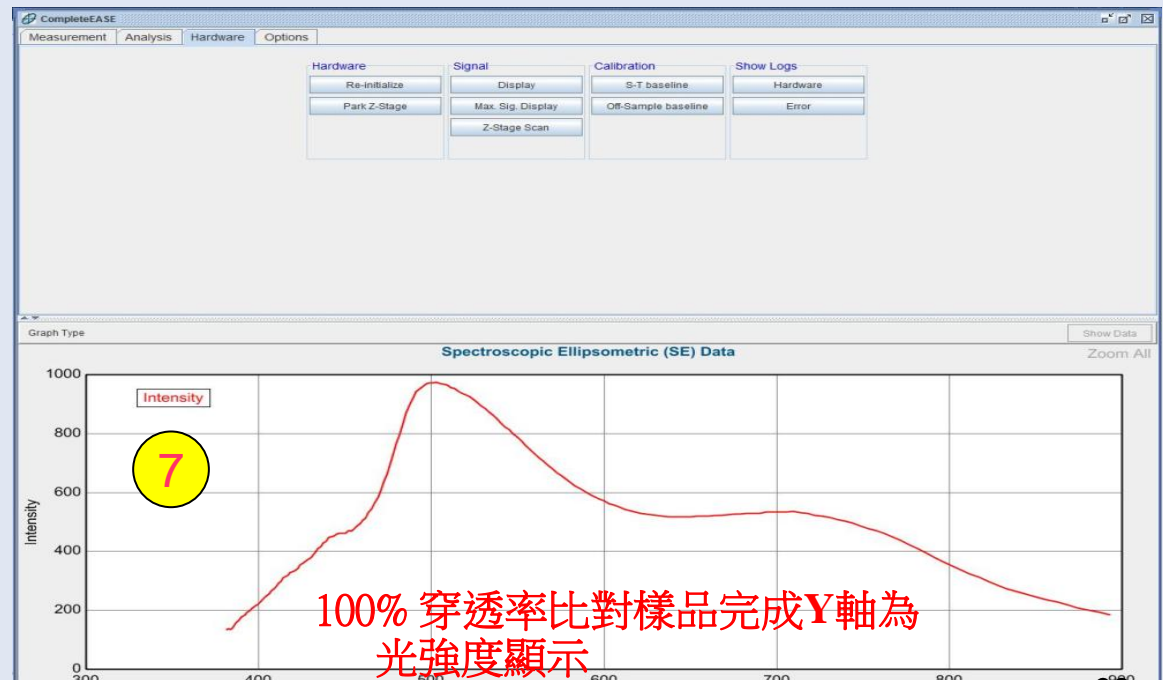


# 測量穿透率步驟-1

## A. 讀取全穿透率樣品 (空氣)



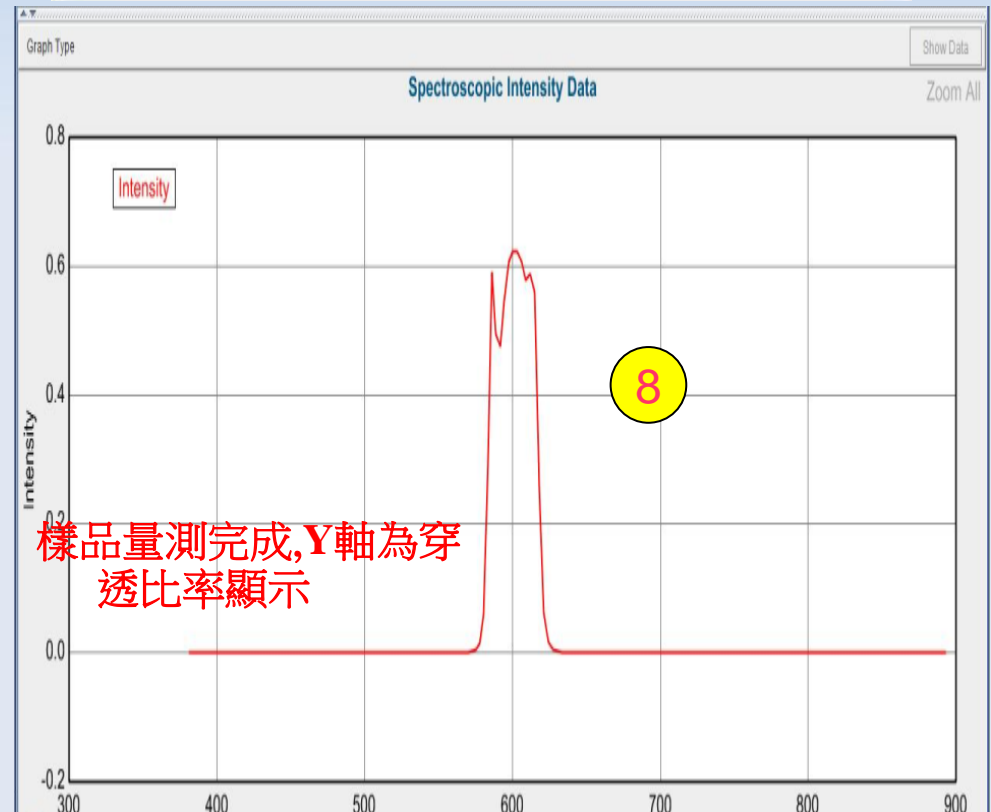
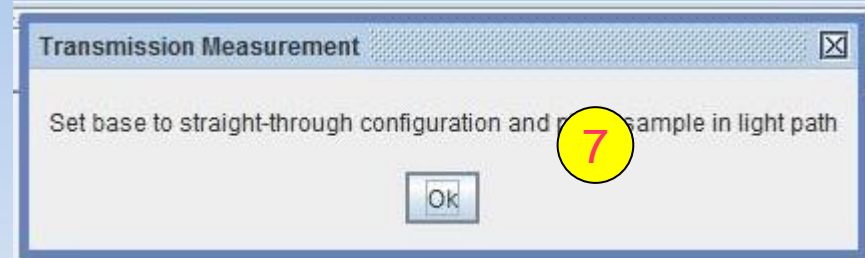
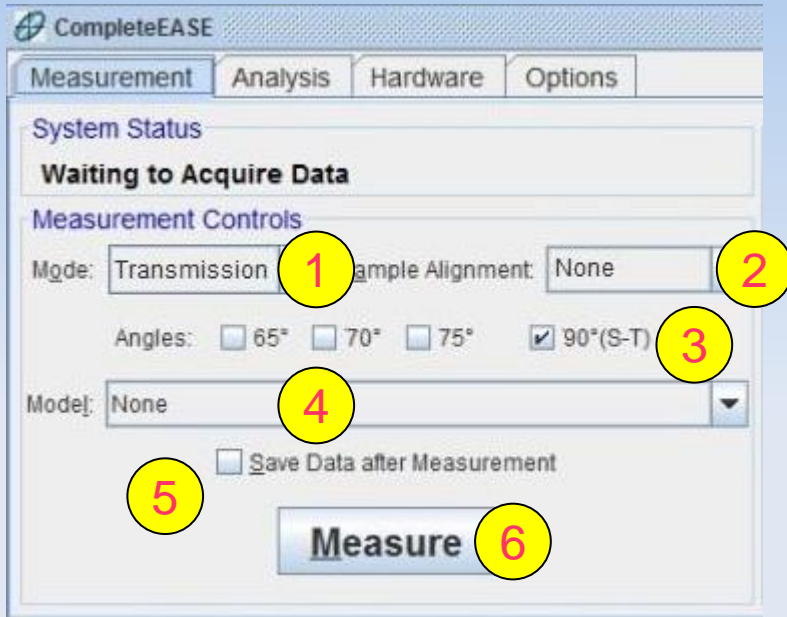
讀取完成, MSE正常, Press<OK>



# 測量穿透率步驟-2

## B. 穿透率樣品量測

將測試樣品放至於光路徑中，**Press <OK>**



- 1) Mode =>Transmission
- 2) Sample Alignment =>None
- 3) Angles=>90°(S-T)
- 4) Model => None
- 5) 選擇是否存檔
- 6) Press<Measure> 開始量測

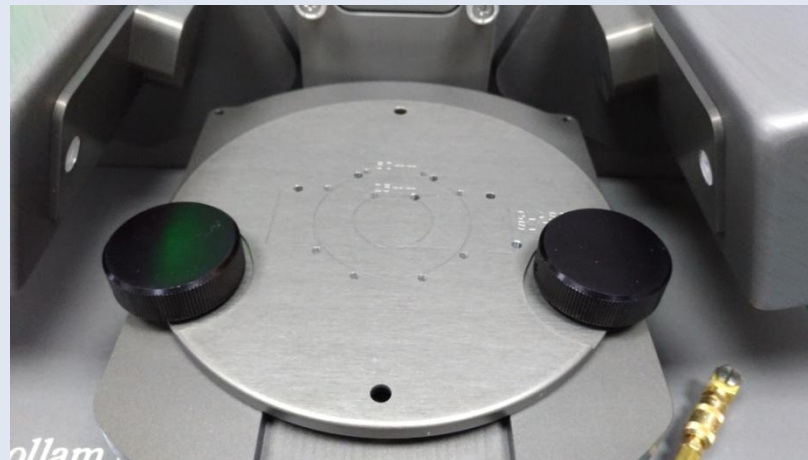
# Liquid Cell使用說明-1(選配)

## 注意項目：

1. 細胞容量：約500 $\mu$ L液體。
2. 細胞材料：不銹鋼(Stainless Steel), PEEK Thermoplastic5, or aluminum coated with Nituff® 6. The base is anodized aluminum.
3. 入射角：只能固定在70°。

## 步驟：

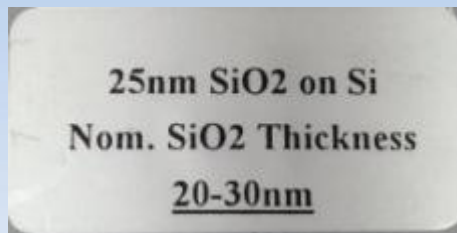
1. 安裝細胞測量樣品台



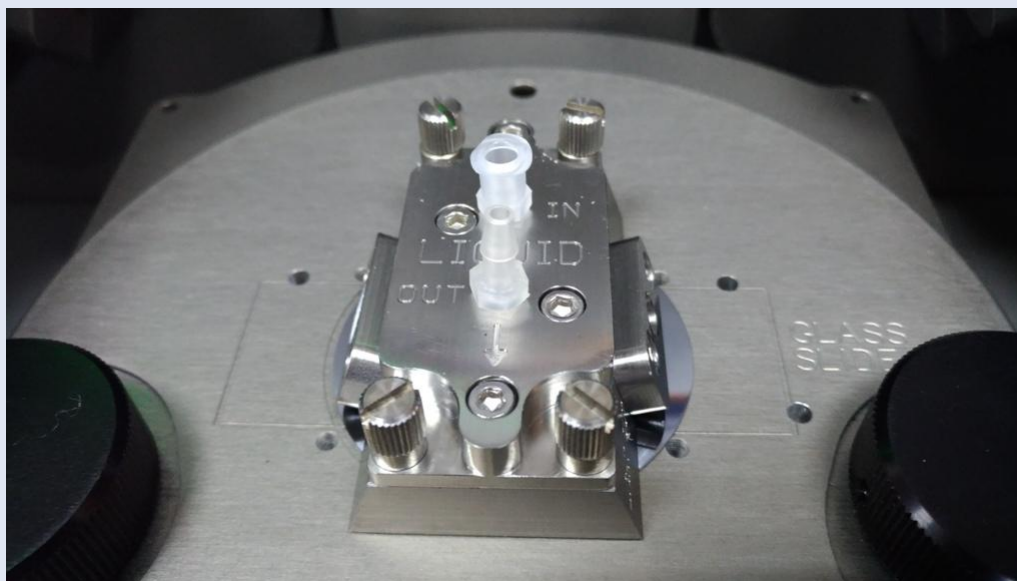


# Liquid Cell使用說明-2 (選配)

2. 測量JAW 提供SiO<sub>2</sub> on Si 25nm 樣品，並且align完成

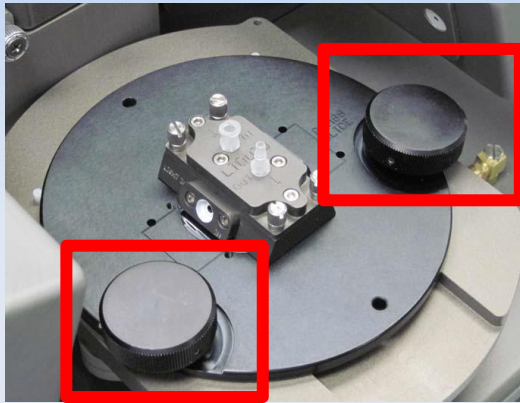


3. 勿移動SiO<sub>2</sub> on Si 25nm 樣品，安裝細胞容器(o-ring安裝於容器下方)，並將4個螺絲鎖緊

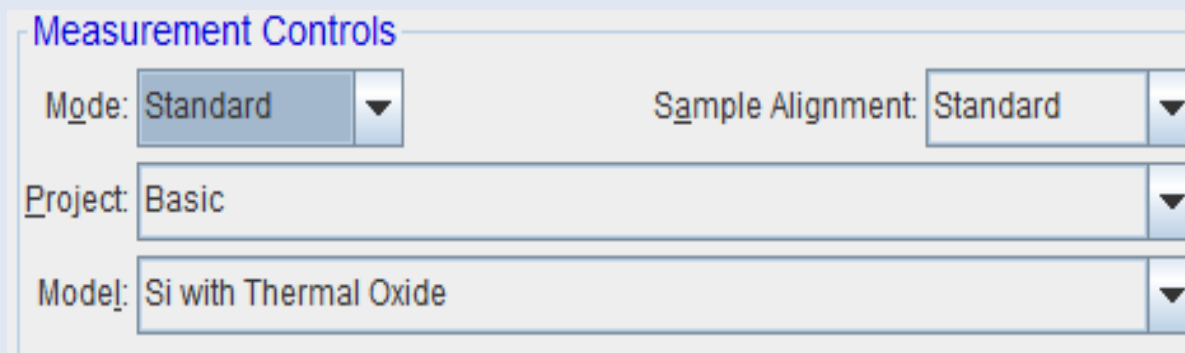


# Liquid Cell使用說明-3 (選配)

4. 調整細胞測量樣品台上兩個黑色旋鈕，將光反射位置調整與出光端相同位置



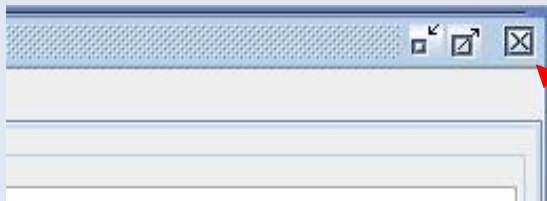
5. 軟體In situ 視窗中參數設定如下，並且開始測量



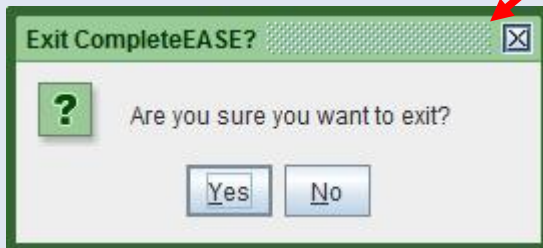
6. 加入細胞溶液（測量需要停止時按下Cancel）

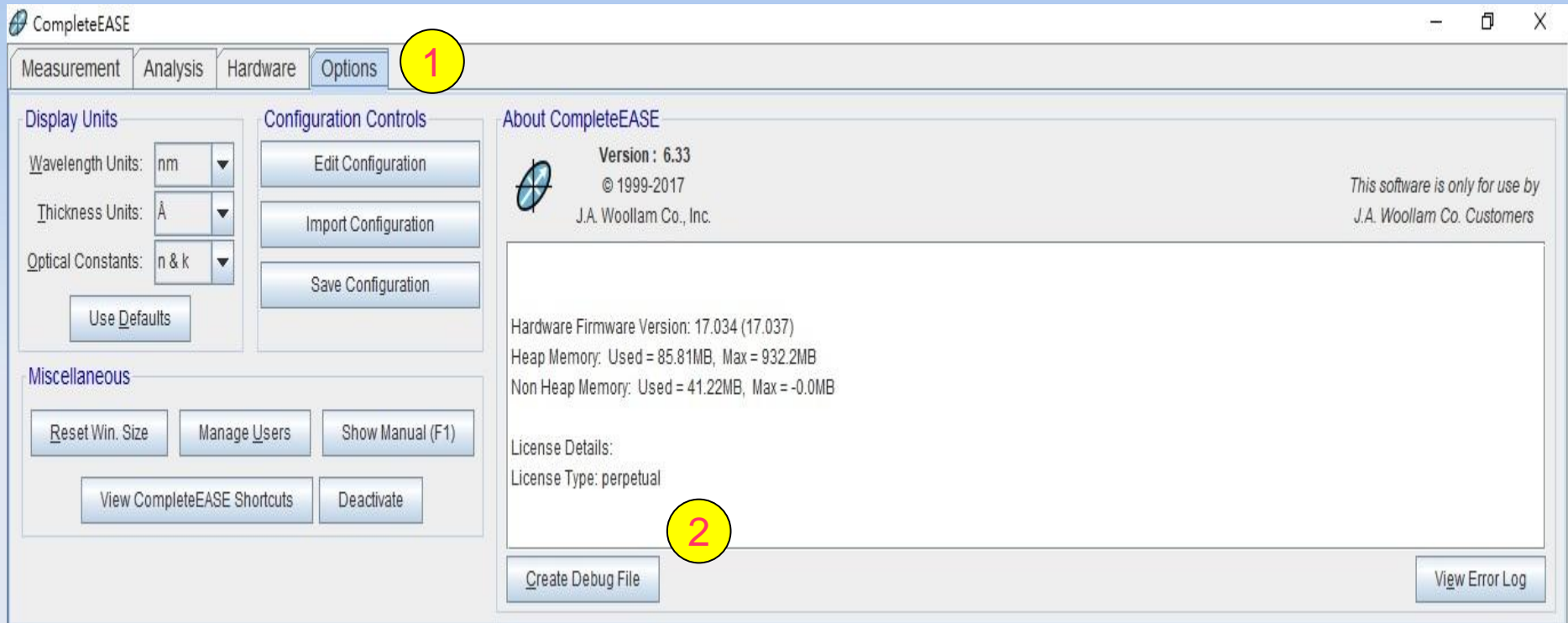
# 關機步驟

- 1) 程式結束
- 2) 關閉Alpha-SE電源（綠燈熄滅）
- 3) 關閉真空泵浦電源（OFF）



1





- 1) 單擊Options分頁
- 2) Press <Create Debug File>
- 3) 將 **C:\CompleteEASE\CompleteEASE\_Debug.zip**  
E-Mail給維修工程師，分析判斷故障原因

# Alpha-SE 耗材

QTH ( Quartz-Tungsten-Halogen ) 燈泡 :

- \* 每個壽命約為1500 小時
- \* 訂購單位為一組 ( 5 個 )

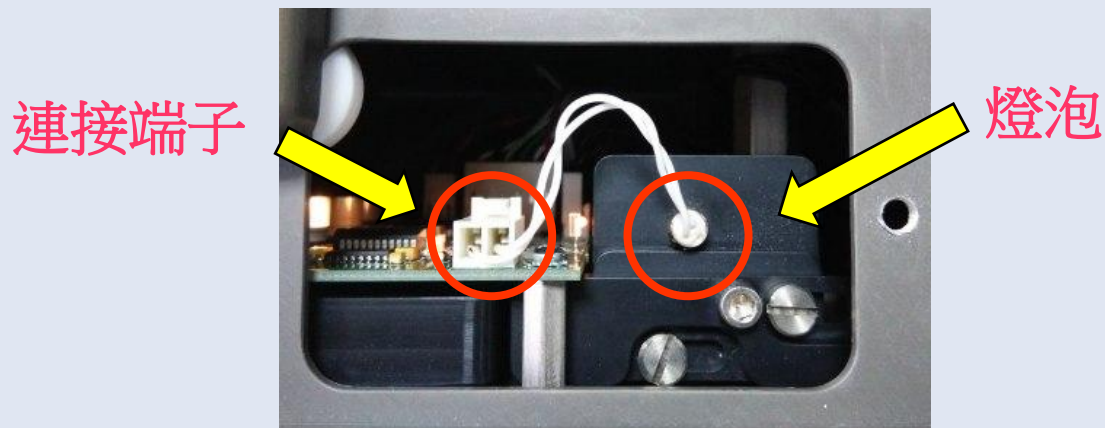


# 燈泡更換步驟-1

1. 關閉CompleteEASE軟體和Alpha-SE儀器電源
2. 開啟燈泡檢修門

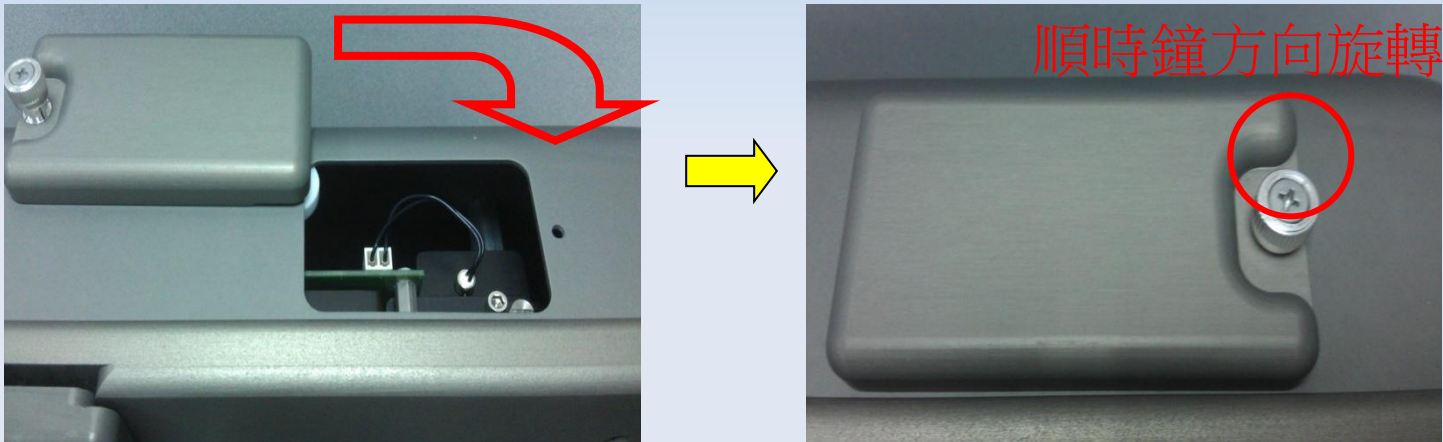


3. 拔出白色的連接端子，並將燈泡取出（注意燈泡可能是熱的）



# 燈泡更換步驟-2

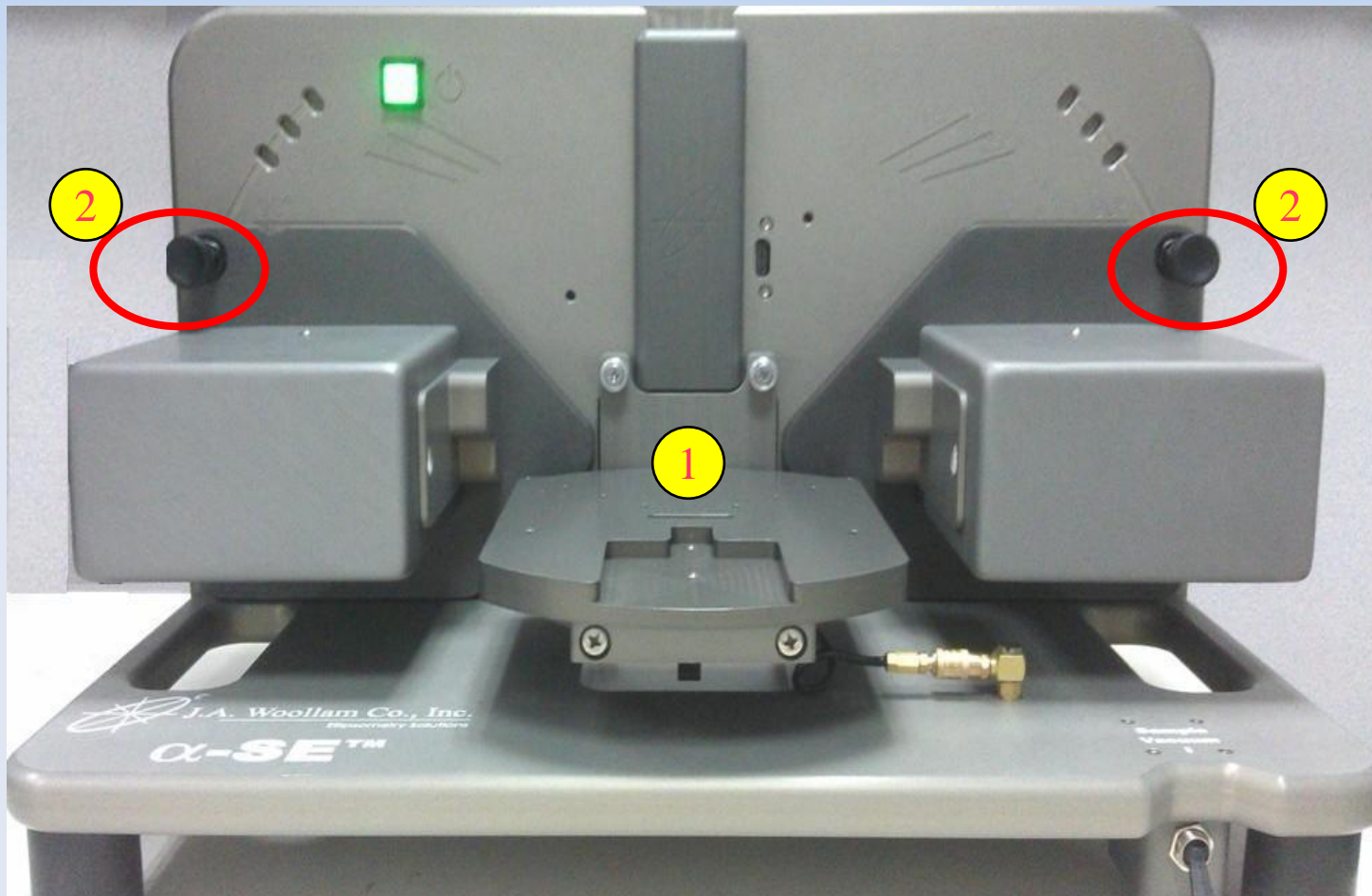
4. 新的和燈泡插入支架（小心不要觸摸燈泡的玻璃區域）
5. 插入白色的連接端子
6. 關閉燈泡檢修門



7. 開啟CompleteEASE軟體和Alpha-SE儀器電源
8. 檢查燈泡光束對準和強度

# 移機步驟說明-1

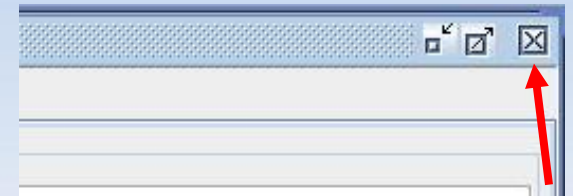
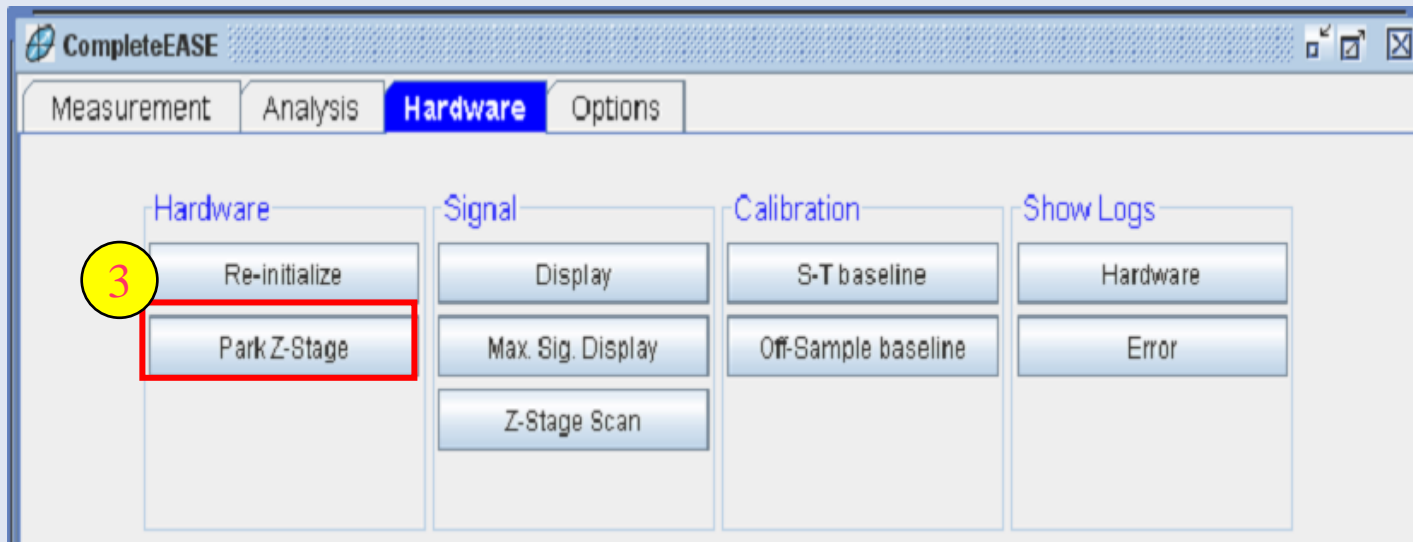
1. 確認樣品台上沒有放置sample
2. 將光源和光譜儀放置90°





# 移機步驟說明-2

3. Complete EASE 軟體中，執行Hardware→ Park Z-Stage（Z軸會產生移動）
4. 關閉Complete EASE軟體
5. 關閉Alpha-SE電源



# 移機步驟說明-3

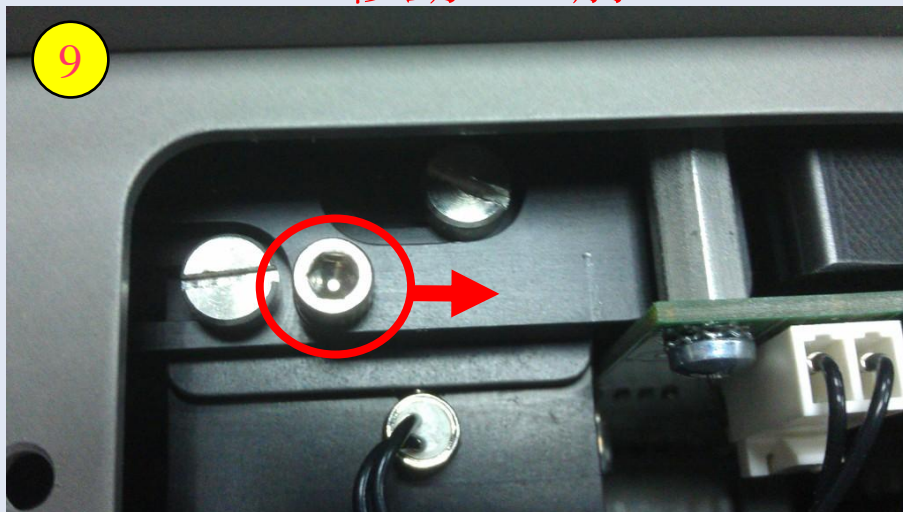
6. 移除USB連接線、電源線、軟管
7. 鬆開移機或更換光源固定螺釘



# 移機步驟說明-4

8. 手放至樣品台下方，將樣品台輕輕往上抬起
9. 手放至六角型螺絲上，往燈源方向移動Park鎖

※抬起樣品台時，必須確認Park鎖固定Z軸才可將樣品台放下  
移動Park前



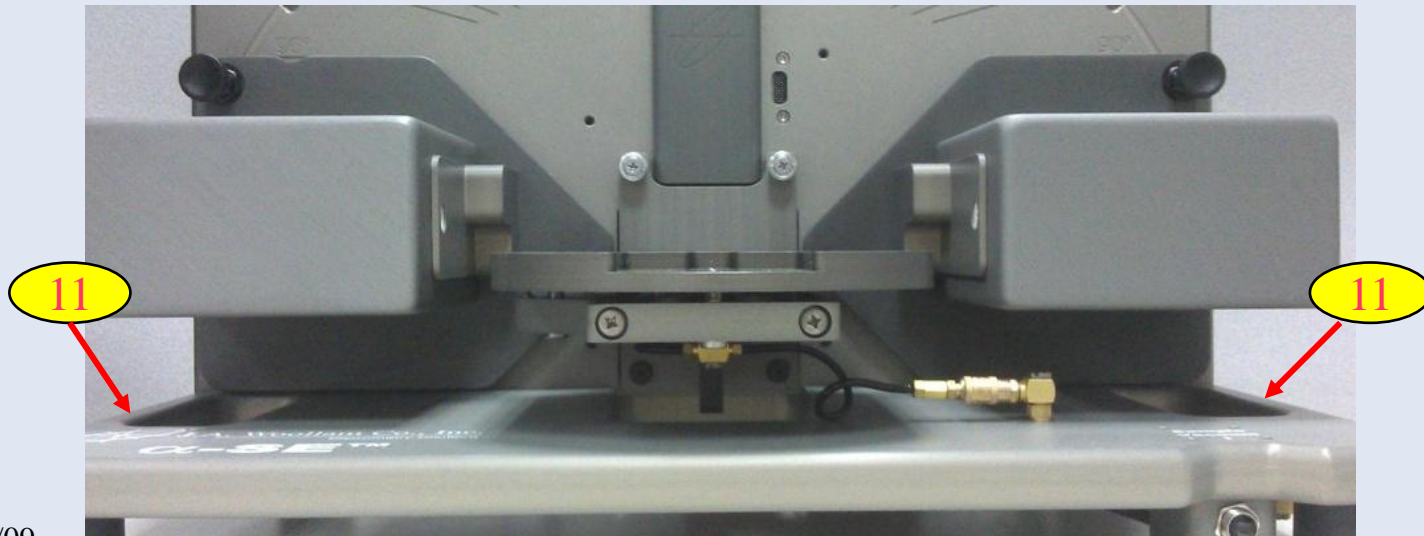
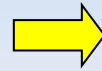
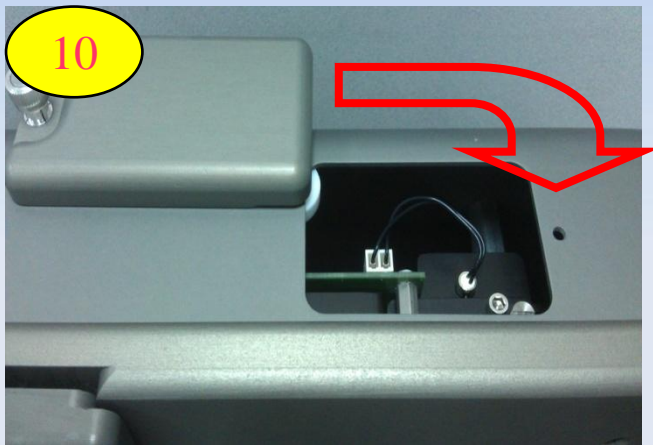
移動Park後



# 移機步驟說明-5

10. 鎖緊移機或更換光源螺釘
11. 移機時握把

※如PC更換將C:\CompleteEASE\CNF  
資料夾複製，貼至另一台PC上的  
C:\CompleteEASE\CNF



# 移機步驟說明-6

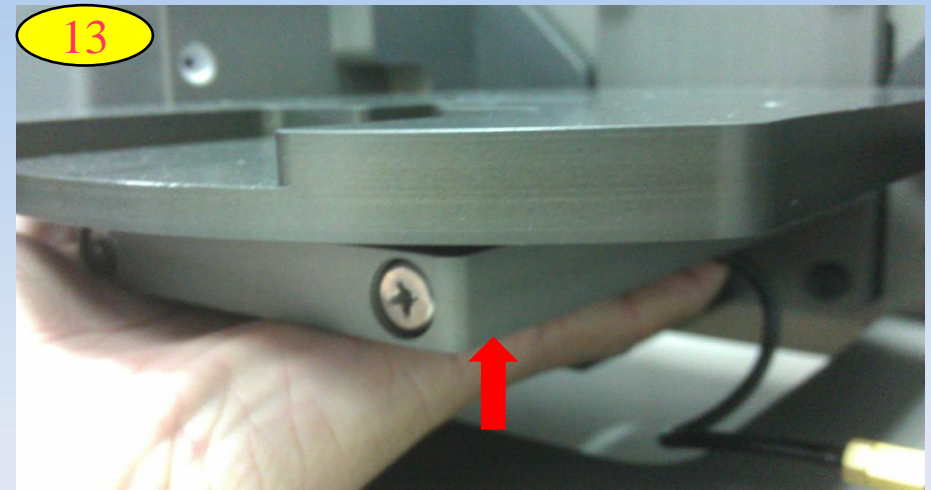
12. 確認儀器放置正確位置，鬆開移機或更換光源固定螺釘（同步驟7.）



# 移機步驟說明-7

13. 手放至樣品台下方，將樣品台輕輕往上抬起（同步驟8.）
14. 手放至六角型螺絲上，往**非燈源**方向移動Park鎖

※抬起樣品台時，必須確認Park鎖鬆開Z軸才可將樣品台放下  
移動Park前

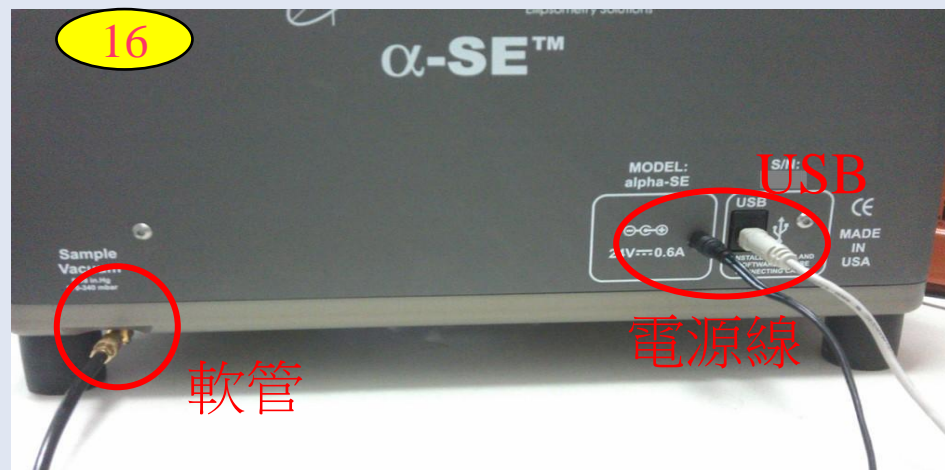
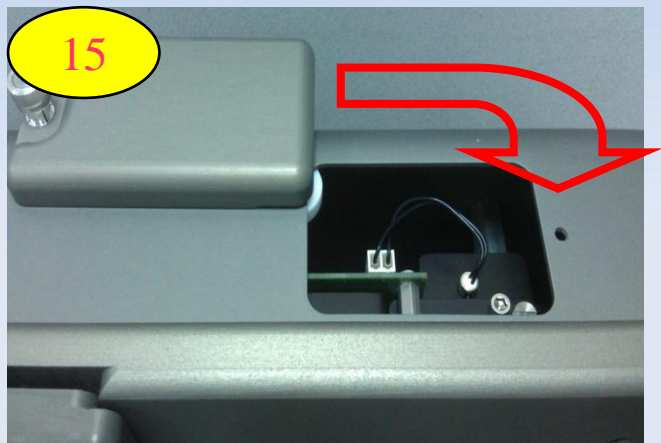


移動Park後



# 移機步驟說明-8

15. 鎖緊移機或更換光源螺釘（同步驟10.）
16. 接上USB連接線、電源線、軟管



# 移機步驟說明-9

17. 執行Complete EASE軟體（確認Park鎖以移除才可執行）

