

Next experiment – L2

35 RLC resonance circuit

Question
1

SLM3 -

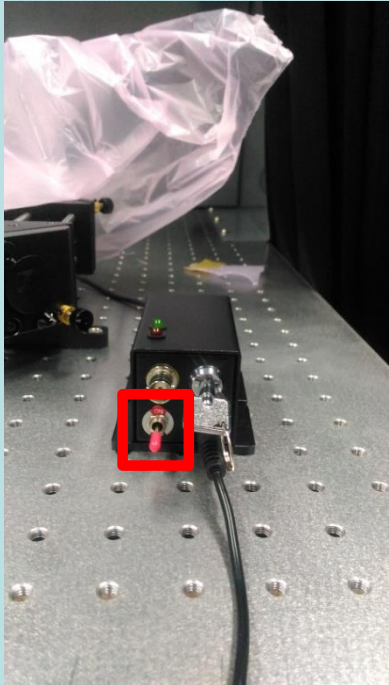
Slit Diffraction and Interference

C1

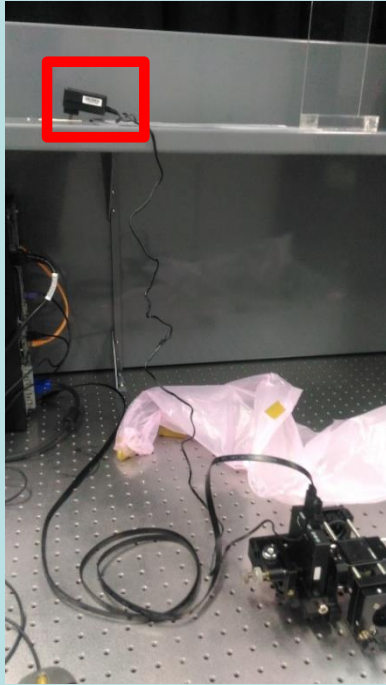
SLM 光調製器使用維護清單

編號	組別	儀器有無缺漏? (編號片*2, 透鏡*2, 十字校準片*2)	桌面零件是否收回原處? (螺絲, 光學元件, 量測用儀器)	電腦, SLM, 雷射, 桌燈是否關閉? (若助教指示不關, 則打△)	桌面垃圾是否清乾淨?	壓克力罩子有無罩上? (罩的時候不要壓到儀器)	簽名
光學一組(儀器)	陳	✓	✓	✓	✓	✓	王怡如
光學二組	陳	✓	✓	✓	✓	✓	王怡如
光學三組	陳	✓	✓	✓	✓	✓	王怡如
光學四組	陳	✓	✓	✓	✓	✓	王怡如
光學五組	陳	✓	✓	✓	✓	✓	王怡如
光學六組	陳	✓	✓	✓	✓	✓	王怡如
光學七組	陳	✓	✓	✓	✓	✓	王怡如
光學八組	陳	✓	✓	✓	✓	✓	王怡如
光學九組	陳	✓	✓	✓	✓	✓	王怡如
光學十組	陳	✓	✓	✓	✓	✓	王怡如

請記得於實驗完後，依照清單清單點確認儀器後再離開



1



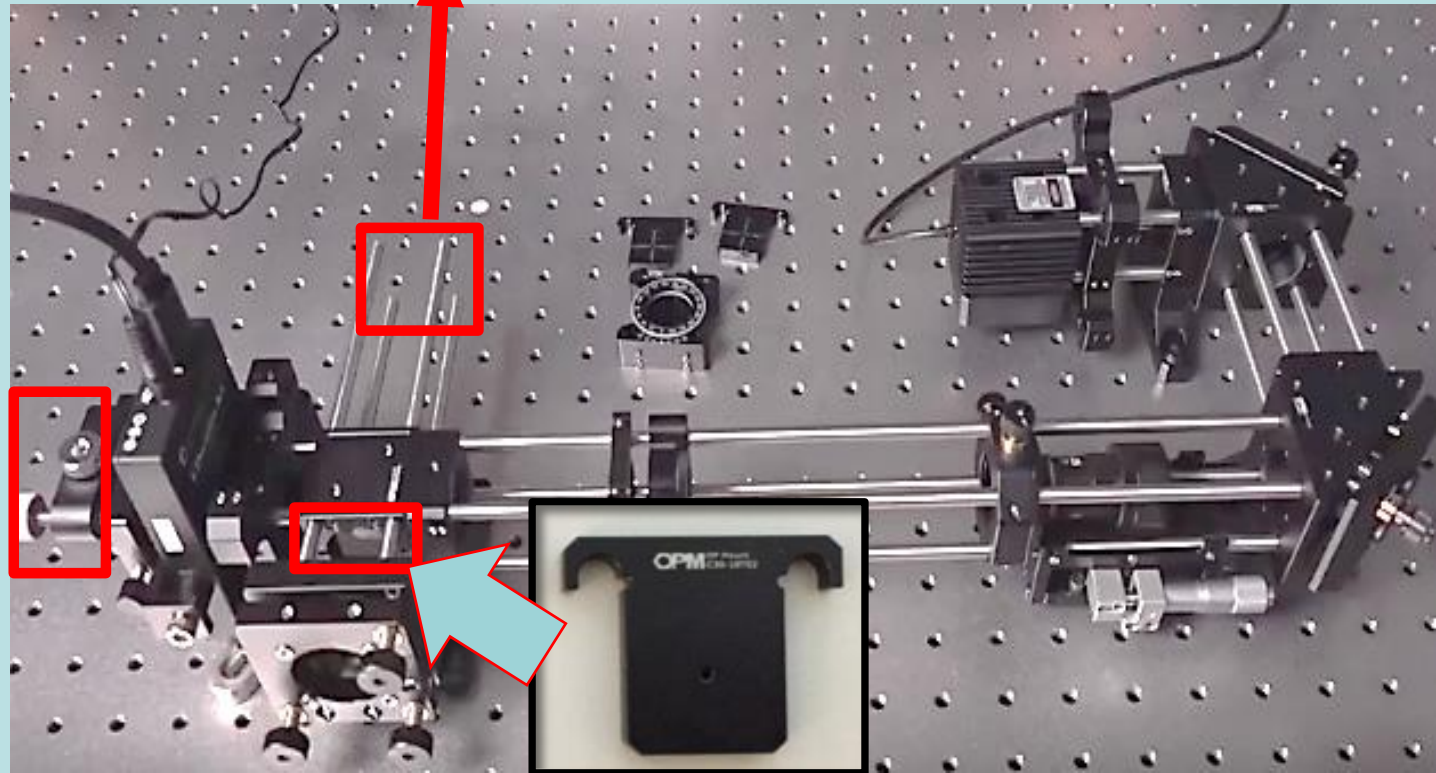
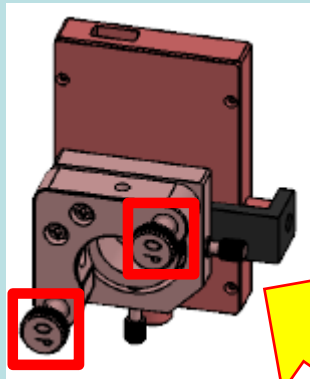
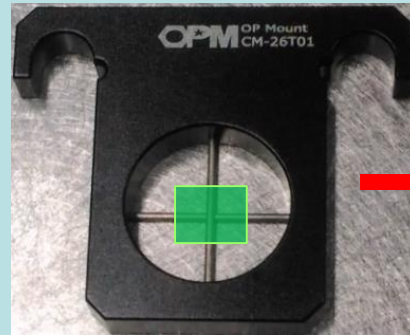
2



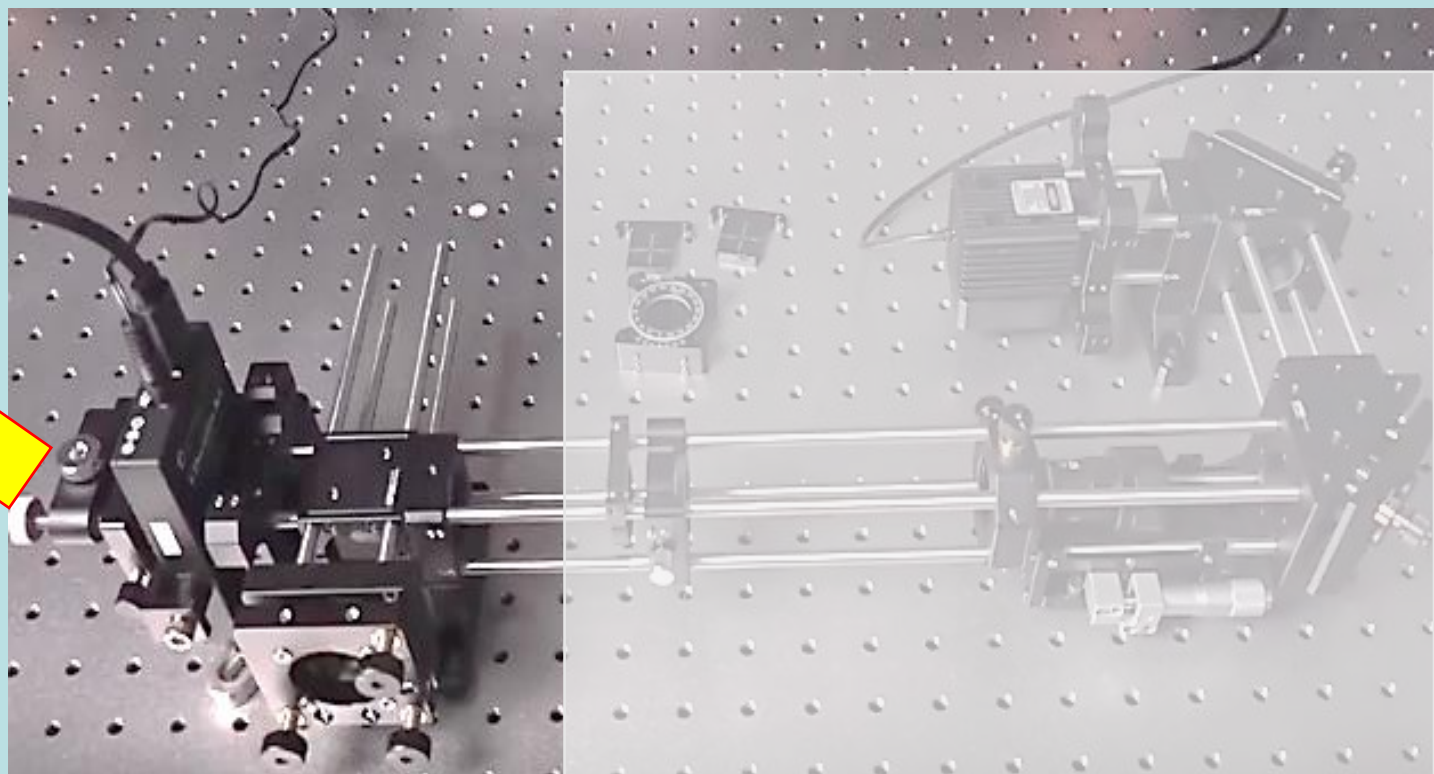
3

Calibration

Adjust 2 screws behind SLM until the dark cross is in the center of the rectangle

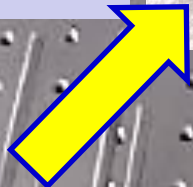


Do NOT touch wires after calibration

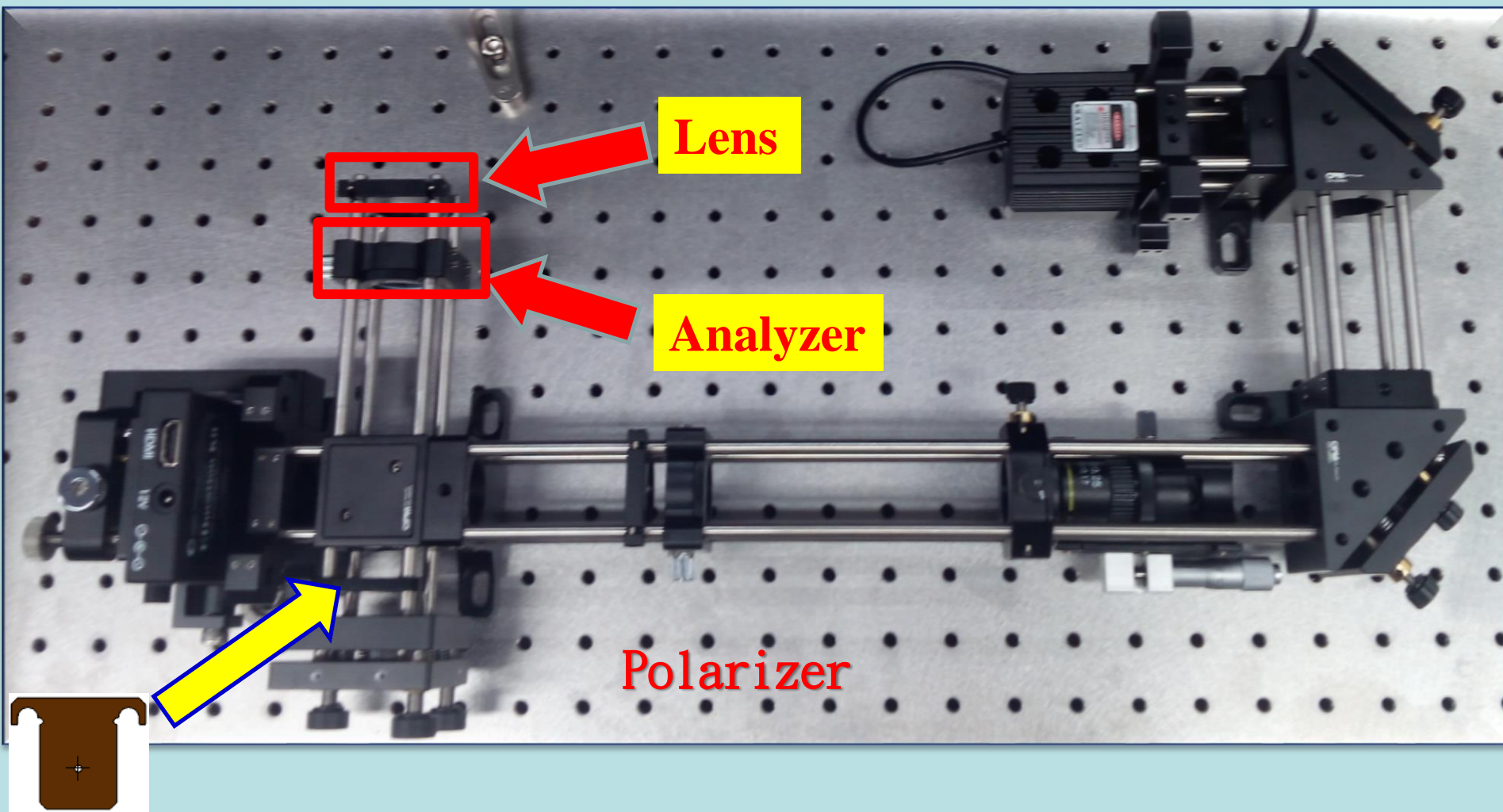


Do NOT touch

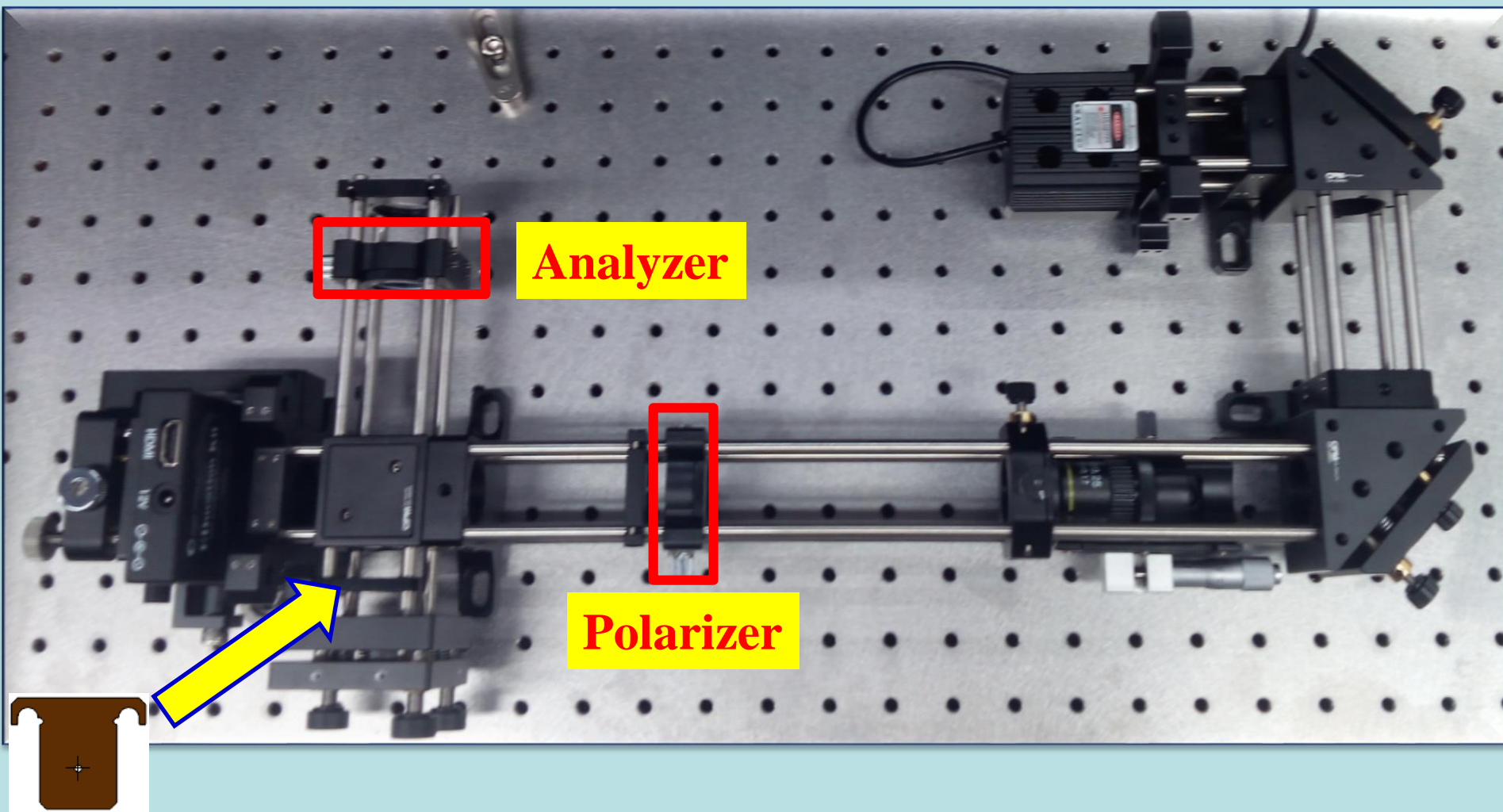
Remove
the cross



Install lens and analyzer



Verify the angles of polarizer
and analyzer



SLM3. Slit Diffraction and Interference

SLM2 Amplitude Modulation

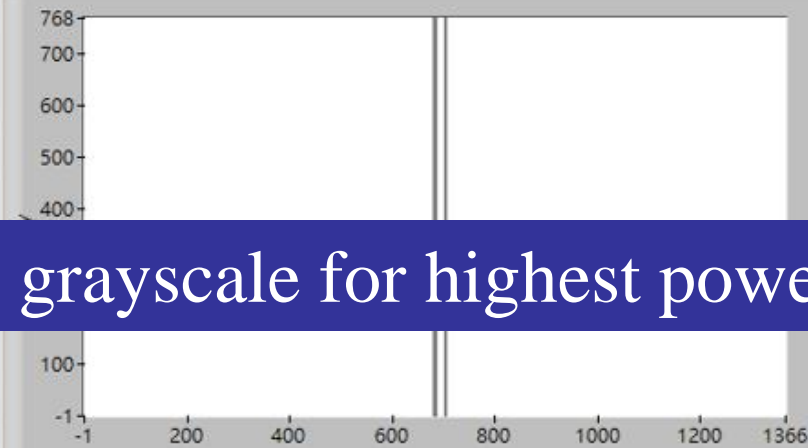


- Grayscale for highest power = _____ Grayscale for lowest power = _____
- SLM number : _____ Polarizer angle= _____ Analyzer angle= _____
- Focal length f 12.5 cm
- CCD pixel size 3.45 μm
- SLM pixel size 6.4 μm
- Wavelength theoretical value 532 nm

Software settings- single slit

5. Diffraction and Interference

JDC Education Kit
File Help



grayscale for highest power

grayscale for lowest power

Wave nature of light can be easily observed from the interference and diffraction phenomenon. Young's experiment is a simple device to show these phenomenon and it's different from Michelson interferometer, it's wavefront-splitting interference. Wave is sampled by two slits, each slit can be seen as new light source. We use SLM in amplitude mode as tunable slit and change its width and spacing. Because amplitude modulator can easily and precisely set the slit size, try to increase slit size gradually in this experiment to see its effect on double slit. Drag the width and spacing slide bar to set your slit, and gray level slide bar for high slit contrast.

General Beam Shifting Reset Imager Display Monitor index 1

Select Experiment 5. Diffraction and Interference

Single Slit Double Slit Slit Pattern Import

Slit size (pixel) 10

Rotation angle (deg) 0

x shift (pixel) 0

y shift (pixel) 0

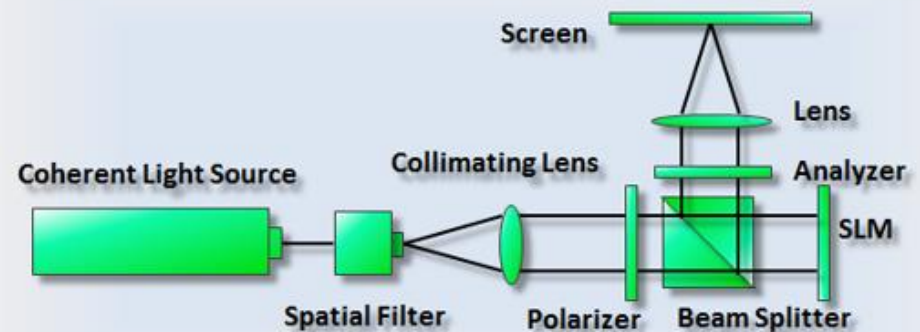
Inner grayscale 128

Outer grayscale 255

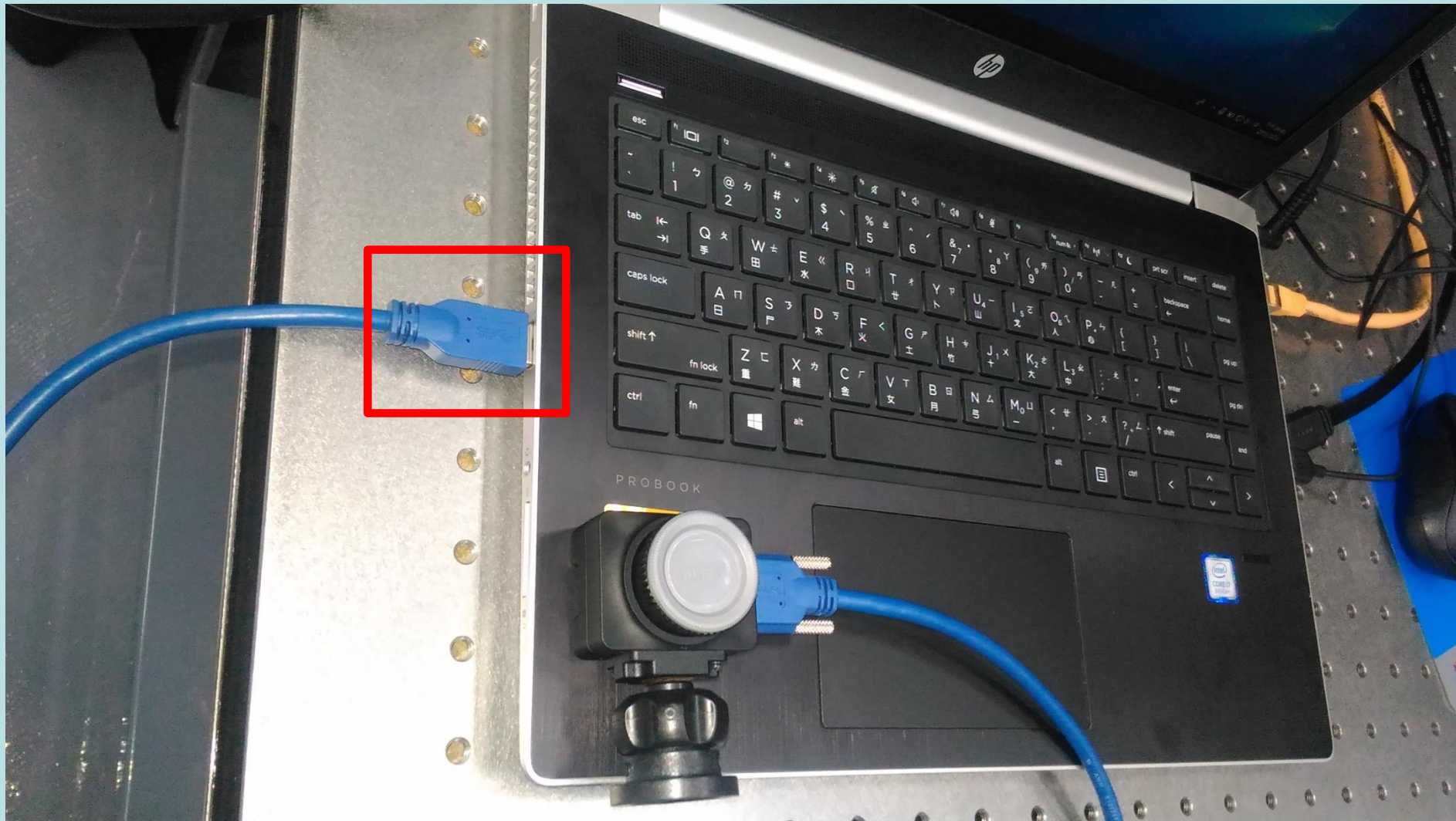
Generate Zoom In Send to LCOS

10 pixels

SLM2 record



Connect CCD to Laptop



CCD Software

The screenshot displays the SpinView software interface on a Windows desktop. The desktop background is the standard Windows 7 blue logo wallpaper. The taskbar at the bottom shows the Start button, search icon, and several application icons including DVD player, JD, App, Google Chrome, Office, 3ds Max 2017, SLM實驗用途, Autodesk 桌面應用程式, and internet.

The SpinView application window is open, showing a dark blue interface. The 'Devices' panel on the left lists discovered devices. One device, 'Chameleon3 CM3-U3-31S4C' with serial number '17532217', is highlighted with a red rectangle. The 'Features' panel is currently empty. The 'Log View' panel at the bottom shows a list of log messages.

Devices Panel:

Serial	IP Address
Chameleon3 CM3-U3-31S4C	17532217

Log View Panel:

* Priorit	Timestamp	Logger	Component	Message	D
① NOTICE	20-05-2018 04:46:41.526	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.CameraSelectionControl	2 interfaces and 1 device have been discovered.	Nc
① NOTICE	20-05-2018 04:46:41.487	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.CameraSelectionControl	"Chameleon3 CM3-U3-31S4C [SN:17532217]" has been c	Nc
① NOTICE	20-05-2018 04:46:39.891	SpinnakerNETGUI	SpinView.SpinView_WPF	SpinView_WPF.exe 1.10.0.31 64-Bit has been started.	Nc

The status bar at the bottom of the application window shows: Idle | Active Loggers: 1 | Total Messages: 3 | DEBUG: 0 | INFO: 0 | WARN: 0 | ERROR: 0 | UNKNOWN: 0 | Last Updated On: 5/20/2018 4:46:41 PM. The system clock in the bottom right corner shows 下午 04:46, 2018/5/20.

CCD Software

The screenshot displays the CCD Software interface. The 'Devices' panel on the left lists 'USB Interface 0' with 'Chameleon3 CM3-U3-31S4C' at serial '17532217'. The 'Settings' panel for this device shows options for 'Search description area', 'Match whole search word' (checked), and 'Match case'. The 'Log Viewer' at the bottom shows a list of messages, including device initialization and software startup. The 'Settings' tab is highlighted in the bottom panel. The 'Chameleon3 CM3-U3-31S4C 17532217' window on the right shows a large 'S' logo. The status bar at the bottom indicates 'Idle', 'Active Loggers: 1', 'Total Messages: 4', and 'Last Updated On: 5/20/2018 4:47:14 PM'.

File View Help

Devices

Serial IP Address

USB Interface 0

Chameleon3 CM3-U3-31S4C 17532217

Chameleon3 CM3-U3-31S4C 17532217

Settings

XML Search

☐ Search description area ☒ Match whole search word ☐ Match case

Chameleon3 CM3-U3-31S4C

Transport Layer

Stream Parameters

Chameleon3 CM3-U3-31S4C

Information Settings Image Format Processing GPIO Features

Log Viewer

Export Filter View Search Search Options

*	Priorit	Timestamp	Logger	Component	Message	D
①	NOTICE	20-05-2018 04:47:13.844	SpinnakerNETGUI	SpinView.SpinView_WPF	[SN:17532217] Device Initialized	Nc
①	NOTICE	20-05-2018 04:46:41.526	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.CameraSelectionControl	2 interfaces and 1 device have been discovered.	Nc
①	NOTICE	20-05-2018 04:46:41.487	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.CameraSelectionControl	"Chameleon3 CM3-U3-31S4C [SN:17532217]" has been c	Nc
①	NOTICE	20-05-2018 04:46:39.891	SpinnakerNETGUI	SpinView.SpinView_WPF	SpinView_WPF.exe 1.10.0.31 64-Bit has been started.	Nc

Idle Active Loggers: 1 Total Messages: 4 DEBUG: 0 INFO: 0 WARN: 0 ERROR: 0 UNKNOWN: 0 Last Updated On: 5/20/2018 4:47:14 PM

Cursor Position: Zoom Level: Processed FPS: Received FPS: Pixel Format:

下午 04:47 2018/5/20

CCD Software Settings

Exposure Auto – Off

Adjust Exposure Time

Gain Auto – Off

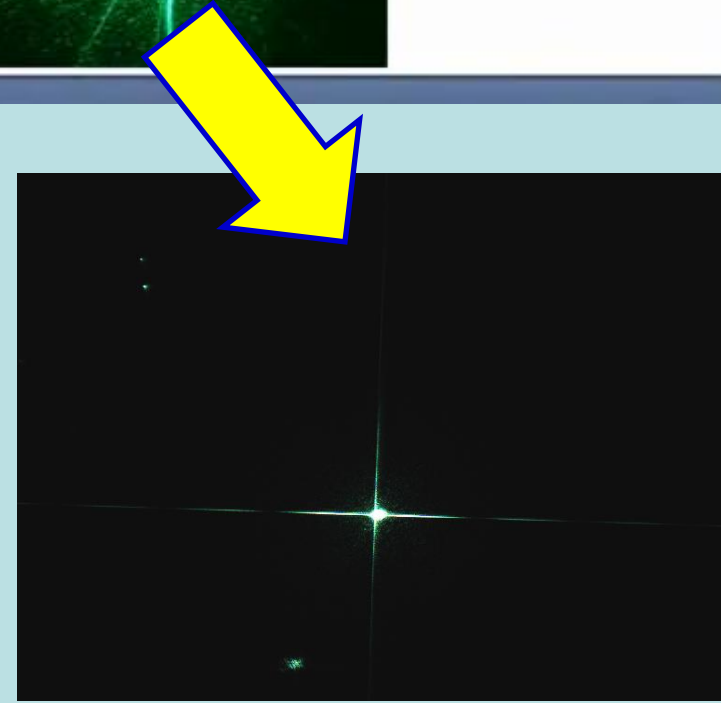
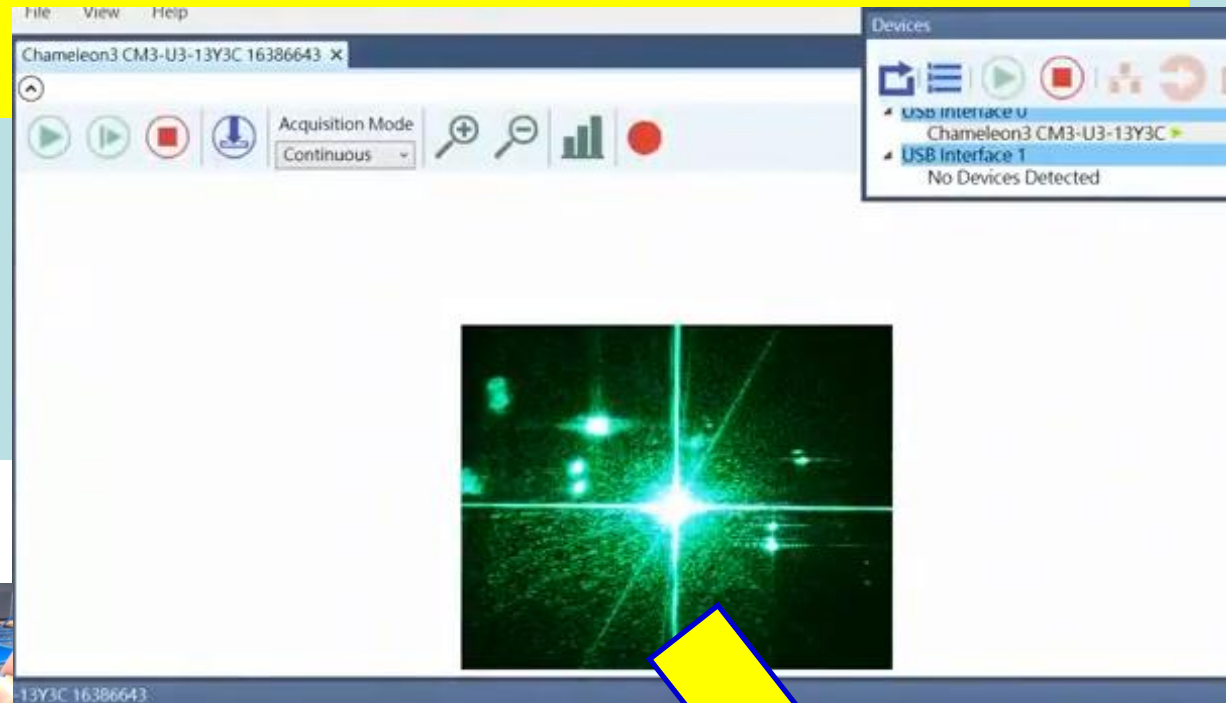
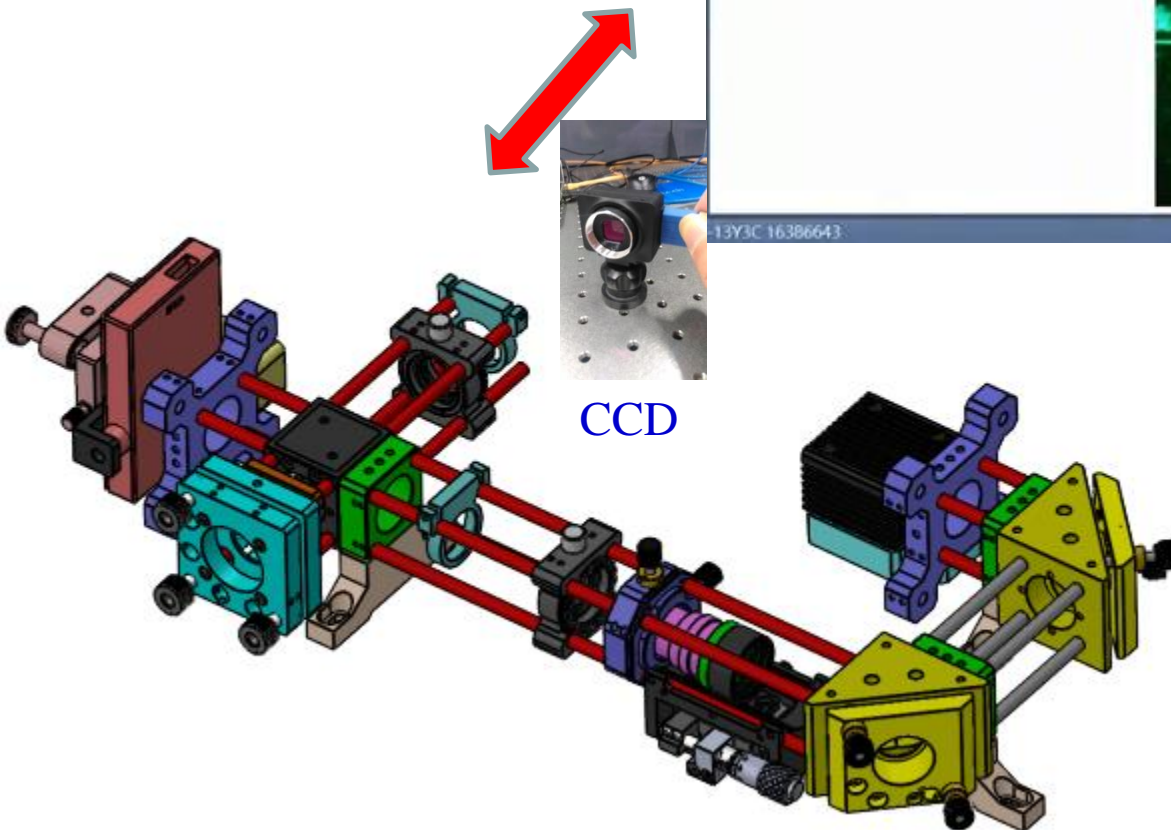
Settings

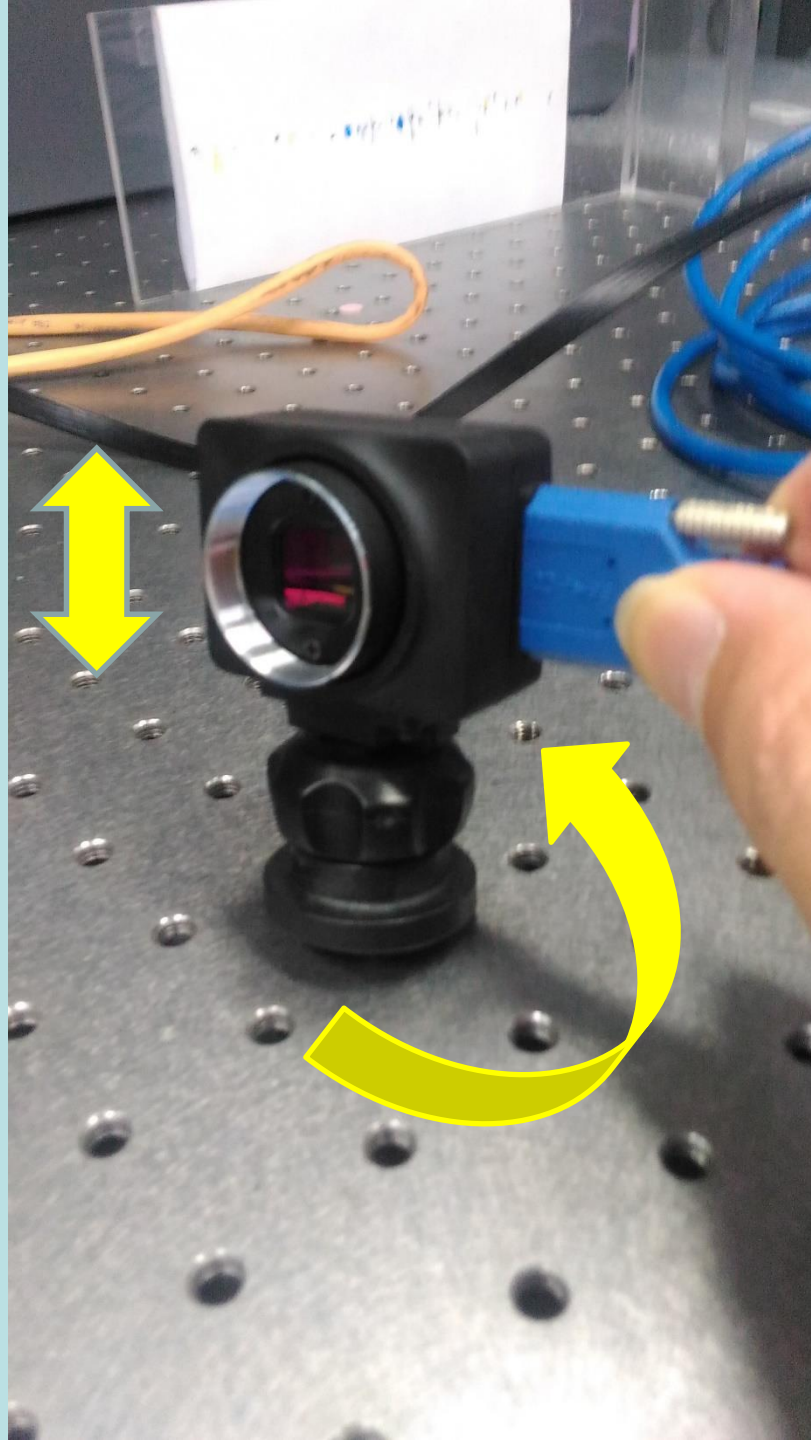
* Priorit	Timestamp	Logger	Component	Message	D
① NOTICE	20-05-2018 04:47:57.716	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.ImageDrawingControl	[SN:17532217] Begin Acquisition.	Nc
① NOTICE	20-05-2018 04:47:13.844	SpinnakerNETGUI	SpinView.SpinView_WPF	[SN:17532217] Device Initialized	Nc
① NOTICE	20-05-2018 04:46:41.526	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.CameraSelectionControl	2 interfaces and 1 device have been discovered.	Nc
① NOTICE	20-05-2018 04:46:41.487	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.CameraSelectionControl	"Chameleon3 CM3-U3-31S4C [SN:17532217]" has been c	Nc
① NOTICE	20-05-2018 04:46:39.891	SpinnakerNETGUI	SpinView.SpinView_WPF	SpinView_WPF.exe 1.10.0.31 64-Bit has been started.	Nc

Idle | Active Loggers: 1 | Total Messages: 5 | DEBUG: 0 | INFO: 0 | WARN: 0 | ERROR: 0 | UNKNOWN: 0 | Last Updated On: 5/20/2018 4:47:58 PM

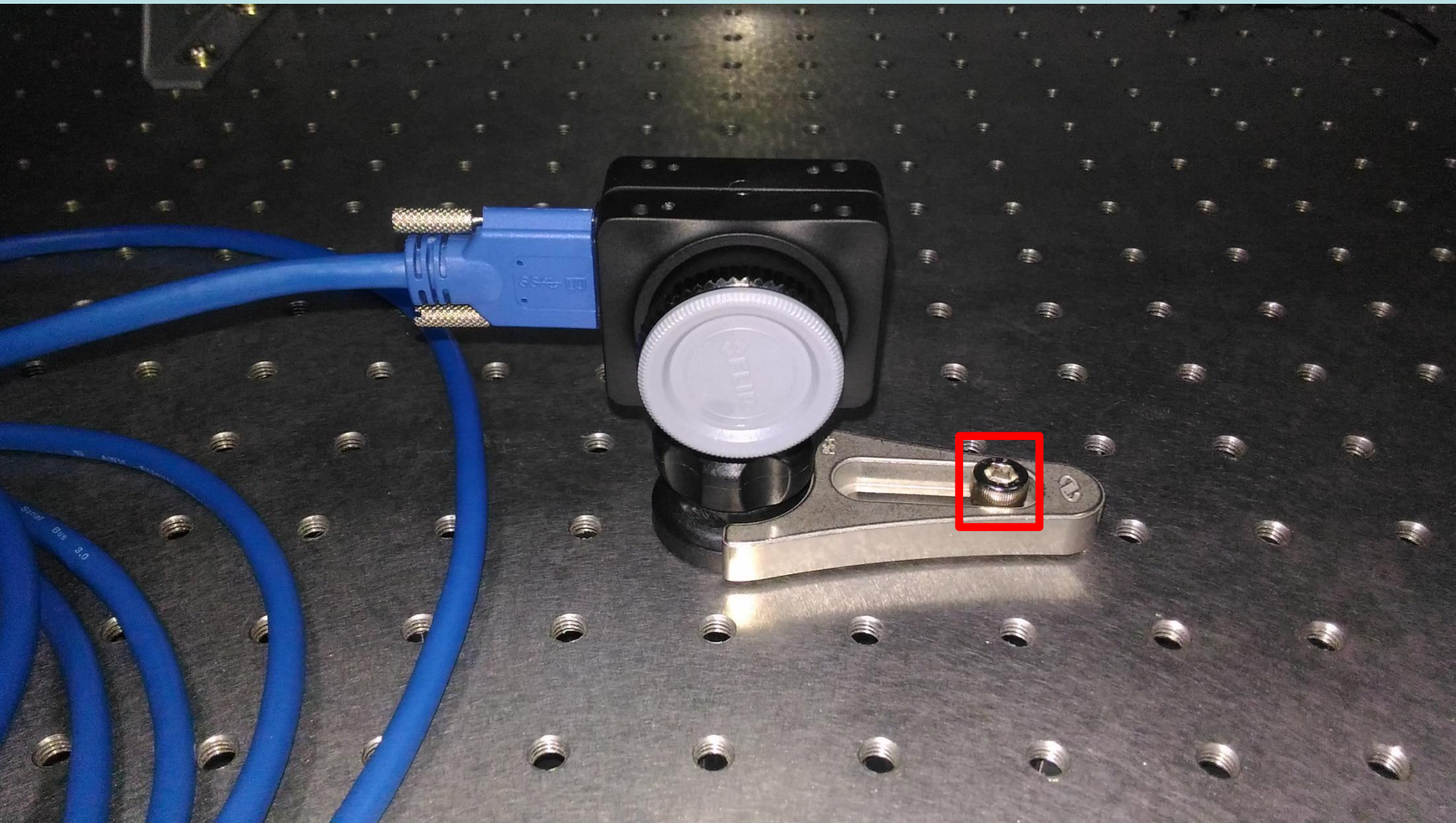
下午 04:48
2018/5/20

Adjust CCD position to make live image clear

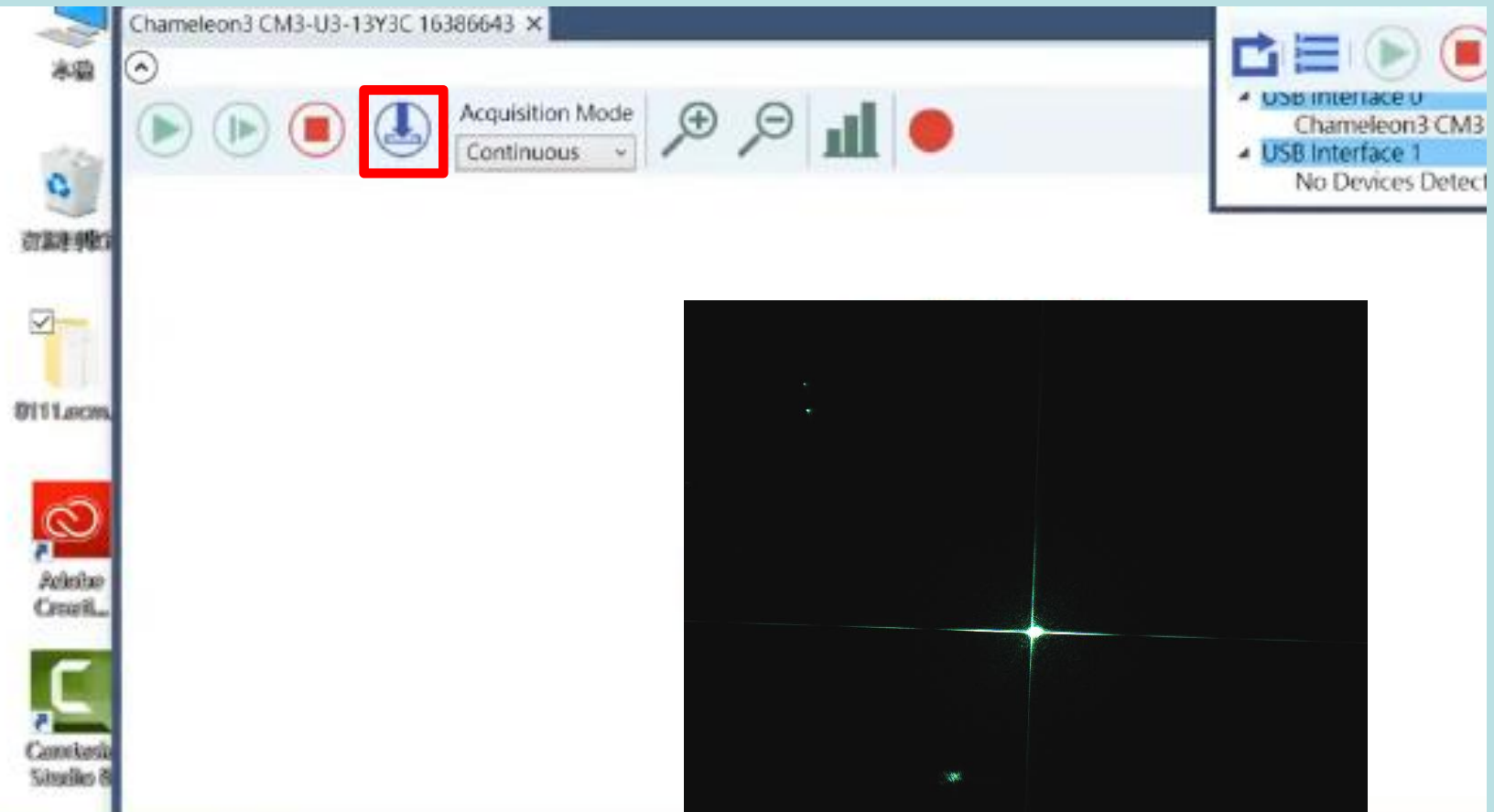




Secure CCD on the table



Save as .bmp file



Save as .bmp file in this folder

The screenshot shows a Windows desktop with a blue background. On the left, there is a taskbar with icons for user, DVD player, JD, Appl, 本機, Google Chrome, Office, 資源回收筒, MATLAB R2017b, Spi, 控制台, Optical Power Me..., 3ds Max 2017, SLM實驗用途檔, Adobe Reader XI, 軟體, and Autodesk 桌面應用程式. The main window is a file save dialog titled "另存新檔" (Save As). The path is "本機 > 桌面 > SLM實驗用途檔" (This PC > Desktop > SLM experimental folder), which is highlighted with a red rectangle. The file type is "Bitmap files (*.bmp)". The file name is empty. The "Save" button is labeled "存檔(S)".

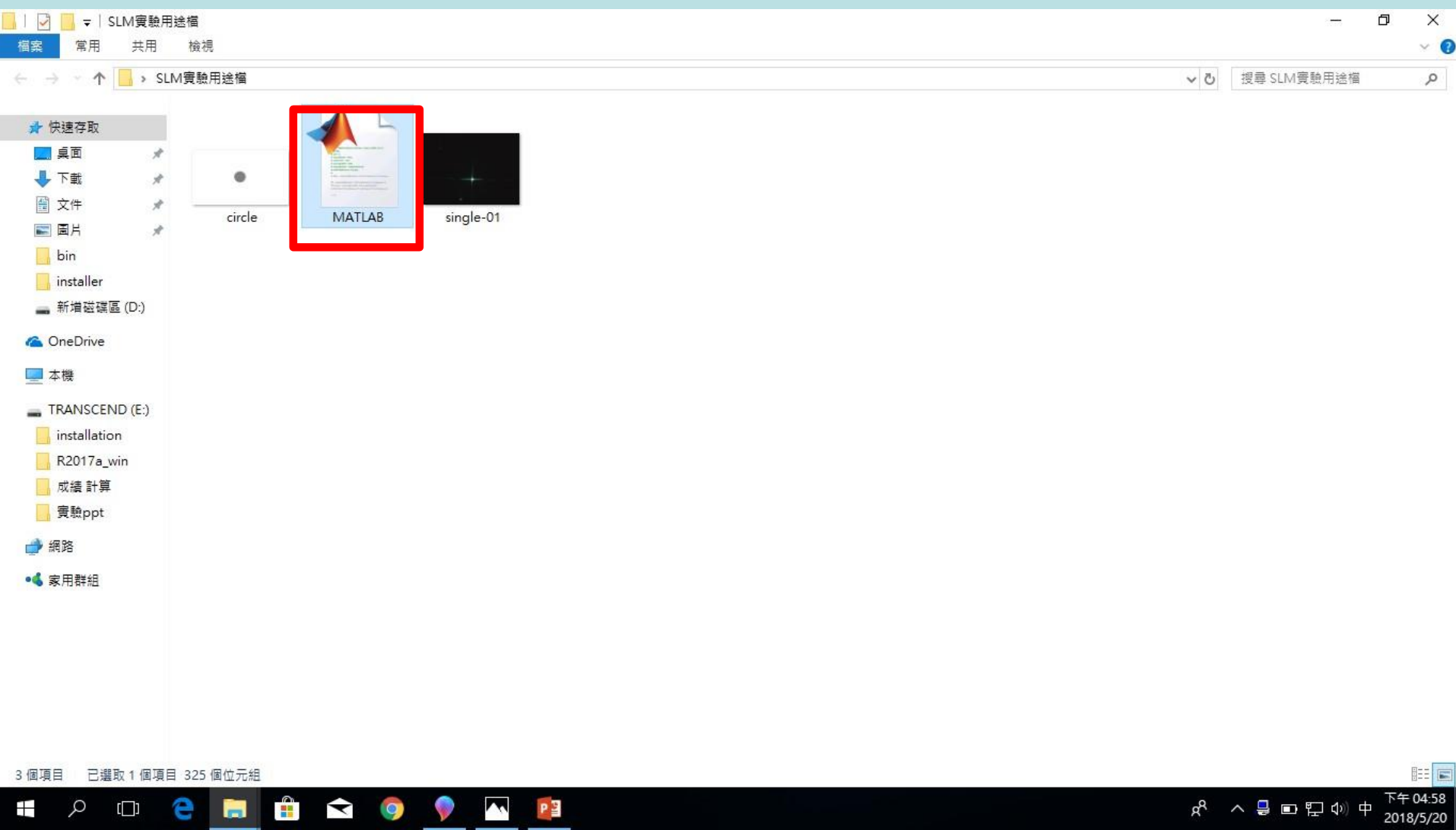
Below the dialog, there is a software interface with a menu bar: "Balance White Auto", "Continuous", "Device Link Throughput Limit", "Information", "Settings", "Image Format", "Processing", "GPIO", "Features". The "Settings" menu is open, showing "Log Viewer". The "Log Viewer" window displays a table of log messages:

* Priorit	Timestamp	Logger	Component	Message	D
① NOTICE	20-05-2018 04:47:57.716	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.ImageDrawingControl	[SN:17532217] Begin Acquisition.	Nc
① NOTICE	20-05-2018 04:47:13.844	SpinnakerNETGUI	SpinView.SpinView_WPF	[SN:17532217] Device Initialized	Nc
① NOTICE	20-05-2018 04:46:41.526	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.CameraSelectionControl	2 interfaces and 1 device have been discovered.	Nc
① NOTICE	20-05-2018 04:46:41.487	SpinnakerNETGUI	SpinnakerNET.GUI.WPFControls.CameraSelectionControl	"Chameleon3 CM3-U3-31S4C [SN:17532217]" has been c	Nc
① NOTICE	20-05-2018 04:46:39.891	SpinnakerNETGUI	SpinView.SpinView_WPF	SpinView_WPF.exe 1.10.0.31 64-Bit has been started.	Nc

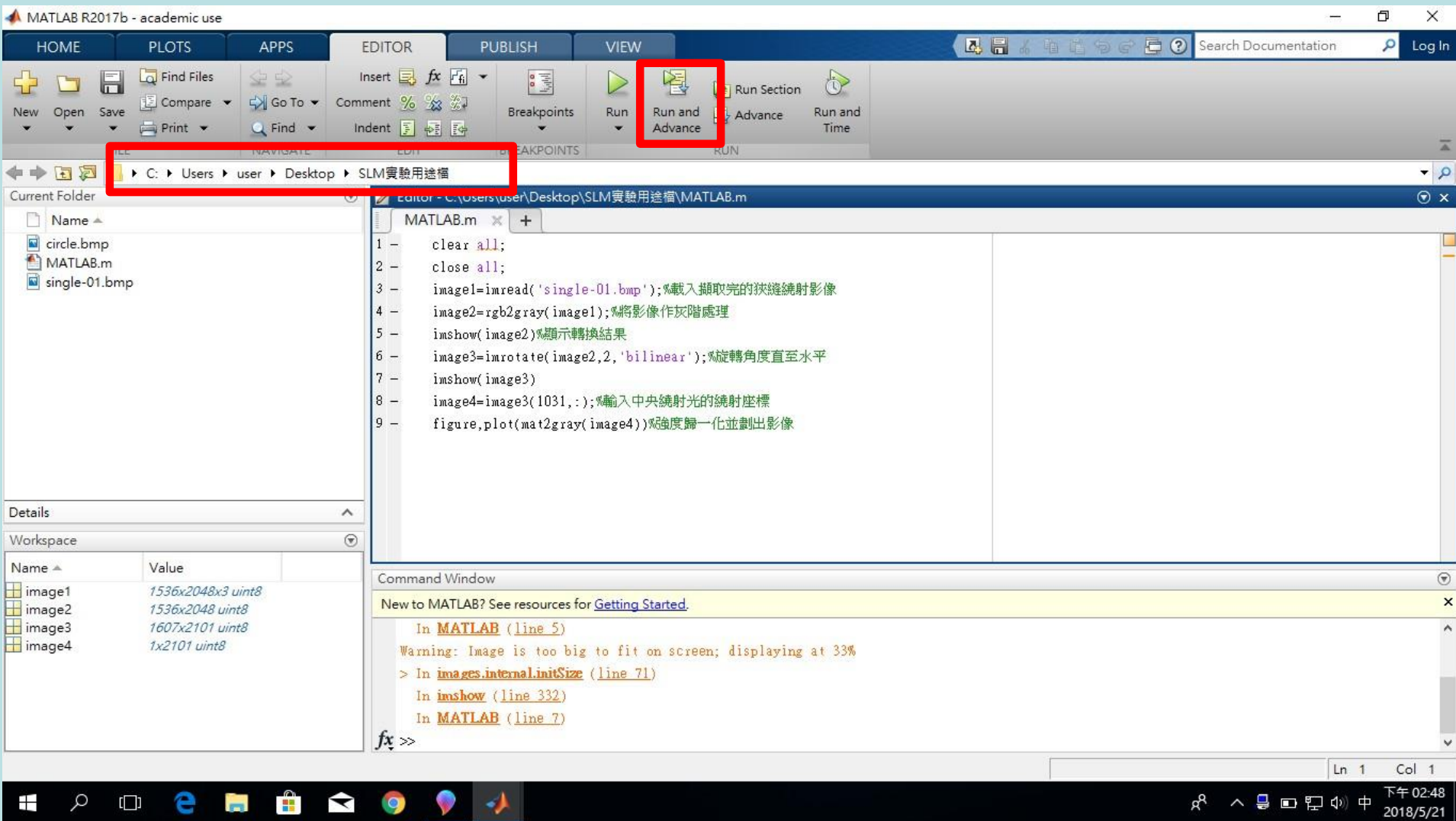
At the bottom of the log viewer, it says "Idle | Active Loggers: 1 | Total Messages: 5 | DEBUG: 0 | INFO: 0 | WARN: 0 | ERROR: 0 | UNKNOWN: 0 | Last Updated On: 5/20/2018 4:47:58 PM".

The taskbar at the bottom shows the Windows Start button, search icon, task view icon, and several application icons. The system clock in the bottom right corner shows "下午 04:48 2018/5/20".

Execute Matlab .M file in the same folder



Matlab Software



Matlab - single slit

```
image1=imread('single_slit_0.064mm.bmp');
```

Read image from graphics file.

```
image2=rgb2gray(image1);
```

Convert RGB image to grayscale.

```
imshow(image2)
```

 Displays image in a figure.

```
image3=imrotate(image2,0.3,'bilinear');
```

Rotate image by angle degrees in a counterclockwise direction

```
imshow(image3)
```

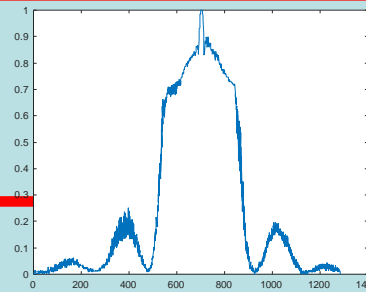
 Displays image in a figure.

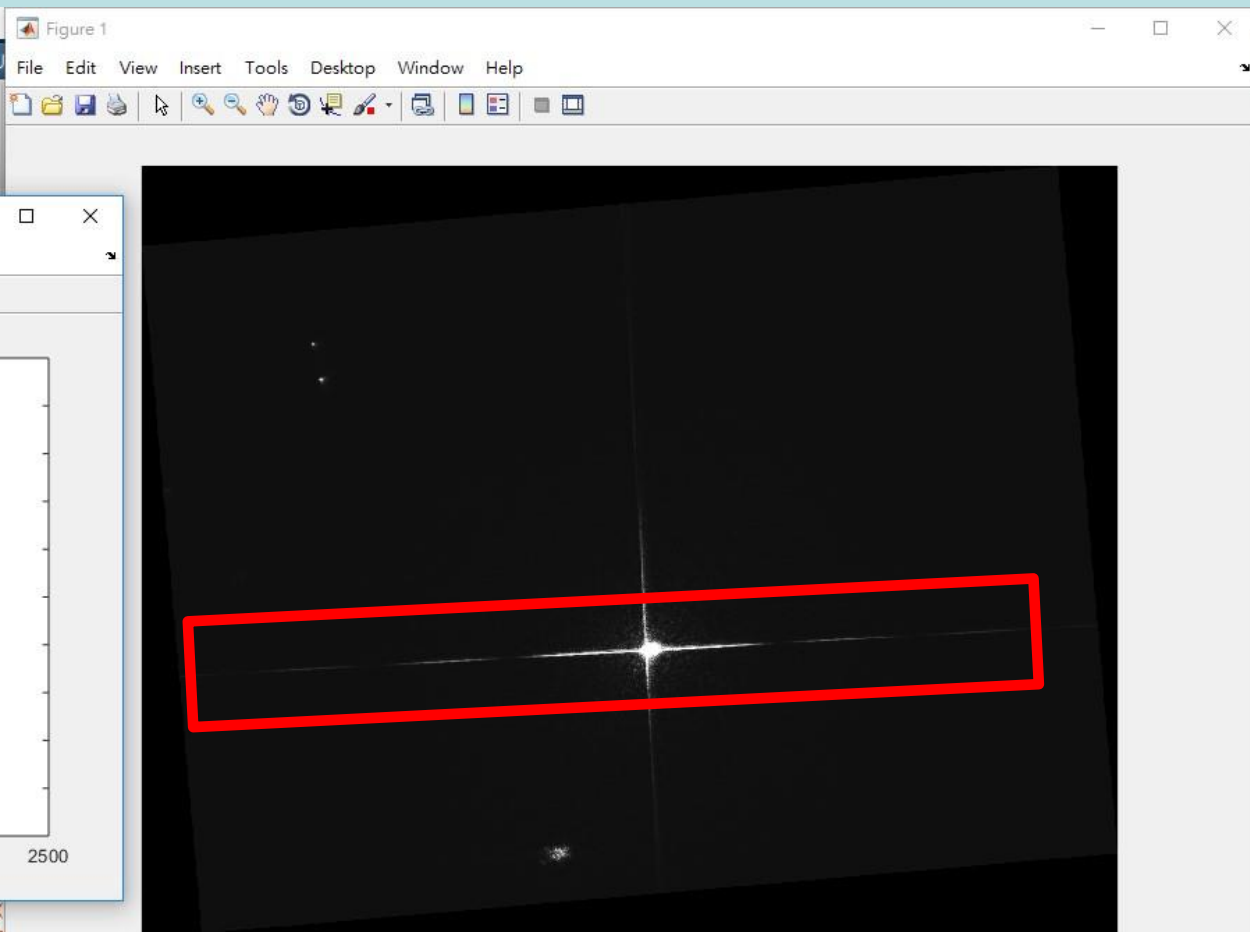
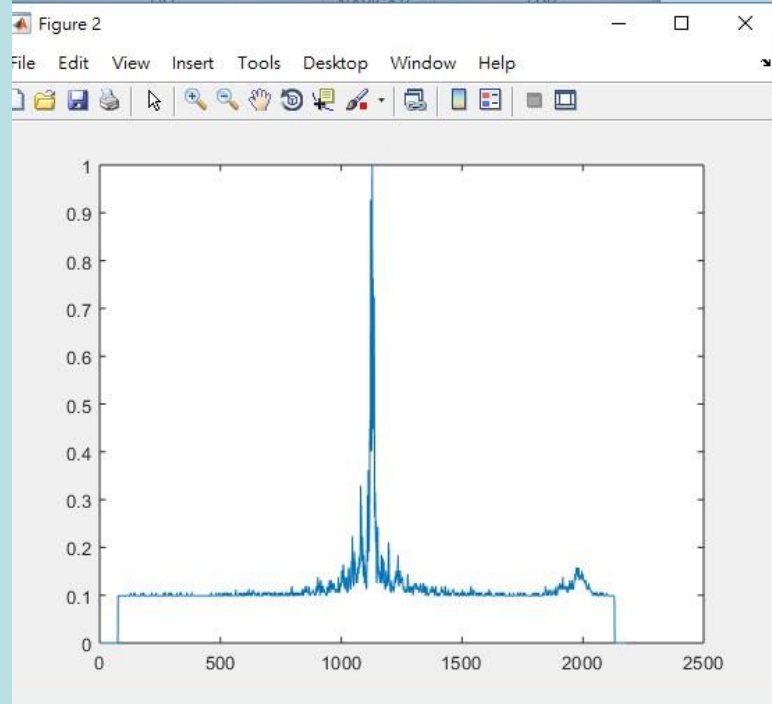
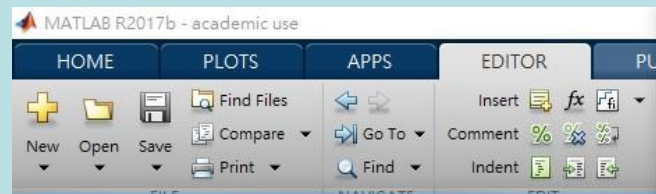
```
image4=image3(506,:);
```

Capture image at Y=506.

```
figure,plot(mat2gray(image4))
```

Convert matrix to grayscale image and plot the image.





In `imshow` (
In `MATLAB`
`fx >>`



Edit Plot

Zoom In

Zoom Out

Pan

Rotate 3D

Data Tips

Brush

Link

Restore View

Options >

Pin to Axes

Snap To Layout Grid

View Layout Grid

Smart Align and Distribute

Align Distribute Tool ...

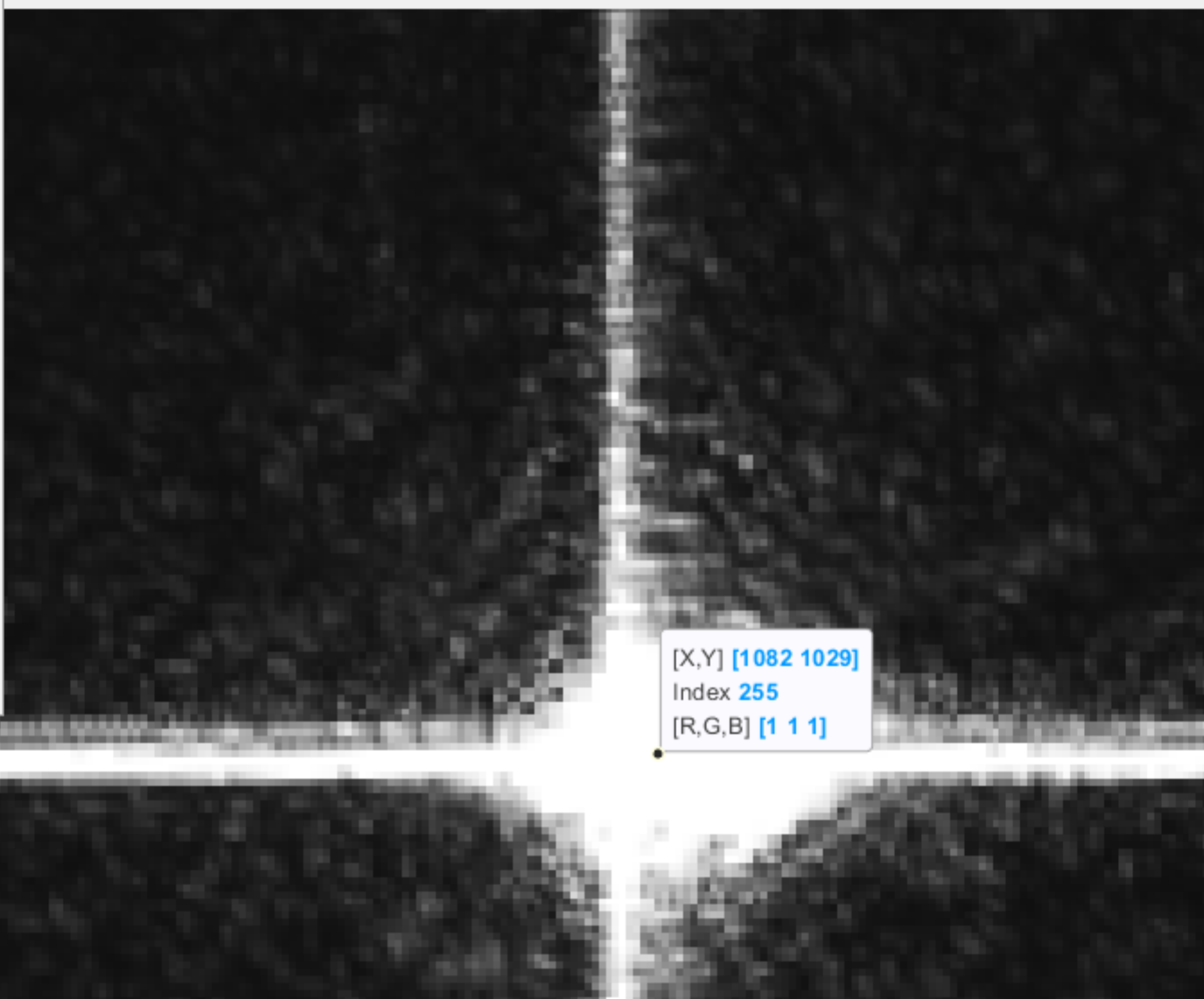
Align >

Distribute >

Brushing >

Basic Fitting

Data Statistics



- Edit Plot
- Zoom In
- Zoom Out
- Pan
- Rotate 3D
- Data Tips
- Brush
- Link
- Restore View
- Options >
- Pin to Axes
- Snap To Layout Grid
- View Layout Grid
- Smart Align and Distribute
- Align Distribute Tool ...
- Align >
- Distribute >
- Brushing >
- Basic Fitting
- Data Statistics

Enter Y value into the code.

[X,Y] [1082 1029]
Index 255
[R,G,B] [1 1 1]

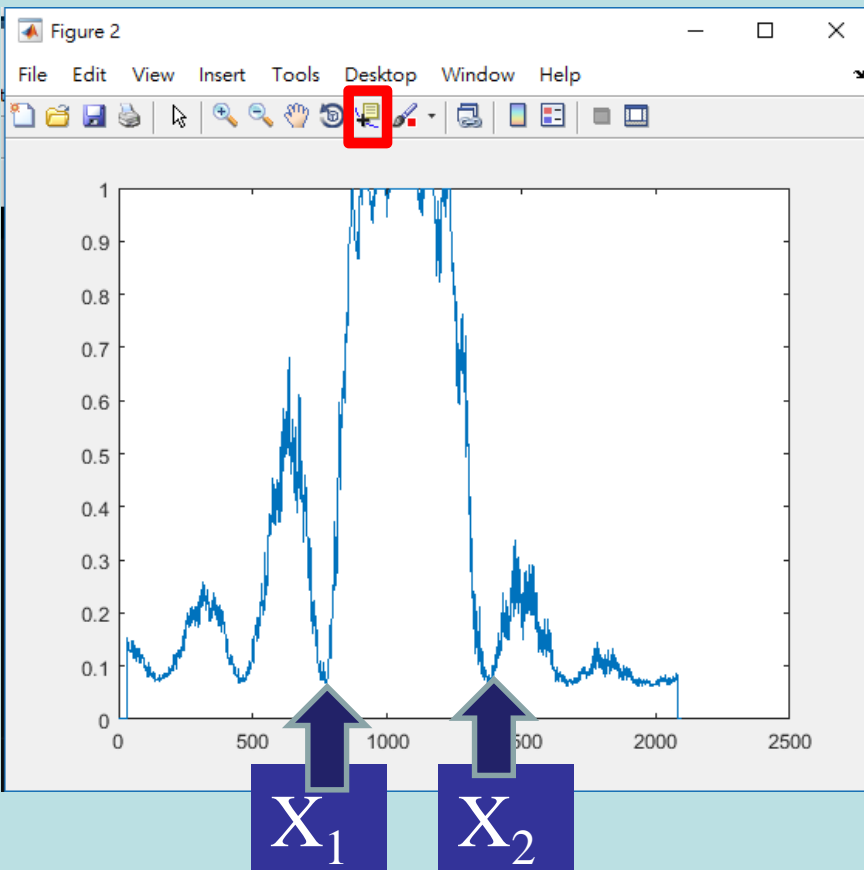
Matlab - single slit

Wavelength $\lambda = \left(\frac{a\Delta y_s}{2F}\right)$

$\Delta y_s = (X_2 - X_1) \cdot (\text{CCD pixel size})$

slit width $a = 10 \cdot (\text{SLM pixel size})$

Focal length $F = 12.5 \text{ cm}$

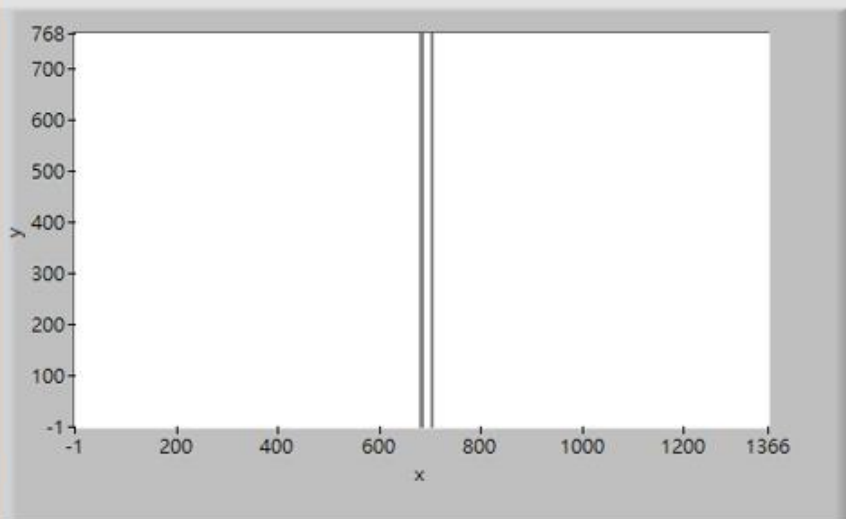


CCD pixel size 3.45 μm
SLM pixel size 6.4 μm

Software settings- double slit

JDC Education Kit

File Help



768
700
600
500
400
300
200
100
-1

-1 200 400 600 800 1000 1200 1366

x

y

General Beam Shifting Reset Imager Display Monitor index 1

Select Experiment 5. Diffraction and Interference

Single Slit **Double Slit** Slit Pattern Import

Double slit size (pixel) 10 10 pixels

Rotation angle (deg) 0

Spacing (pixel) 20 20 pixels

x shift (pixel) 0

y shift (pixel) 0

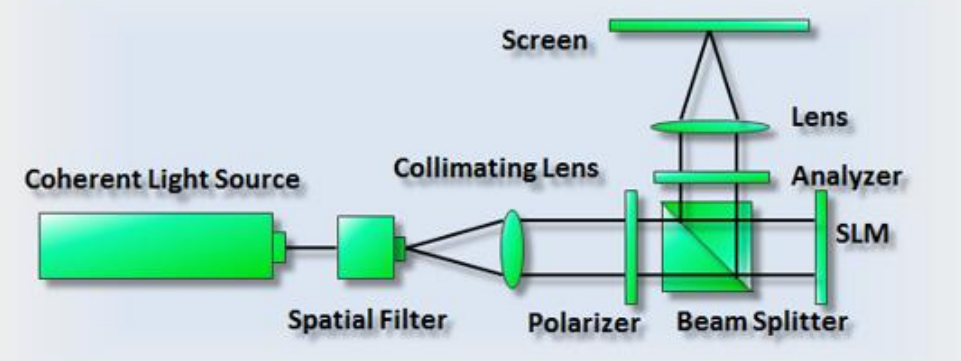
Inner grayscale 128

Outer grayscale 255

Generate Zoom In Send to LCOS

Description

Wave nature of light can be easily observed from the interference and diffraction phenomenon. Young's experiment is a simple device to show these phenomenon and it's different from Michelson interferometer, it's wavefront-splitting interference. Wave is sampled by two slits, each slit can be seen as new light source. We use SLM in amplitude mode as tunable slit and change its width and spacing. Because amplitude modulator can easily and precisely set the slit size, try to increase slit size gradually in this experiment to see its effect on double slit. Drag the width and spacing slide bar to set your slit, and gray level slide bar for high slit contrast.



Screen

Lens

Analyzer

SLM

Beam Splitter

Polarizer

Collimating Lens

Spatial Filter

Coherent Light Source

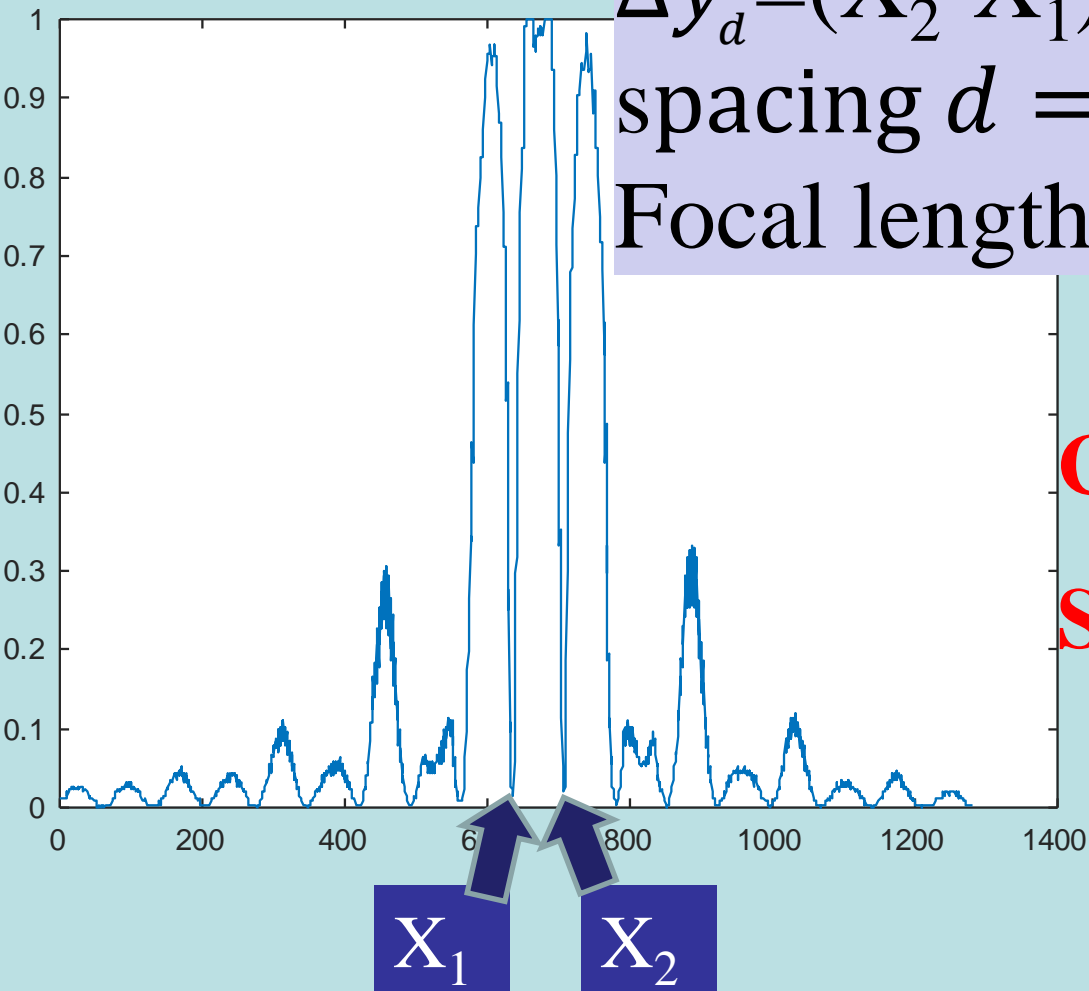
Matlab - double slit

Wavelength $\lambda = (\frac{d\Delta y_d}{F})$

$\Delta y_d = (X_2 - X_1) \cdot (\text{CCD pixel size})$

spacing $d = 20 \cdot (\text{SLM pixel size})$

Focal length $F = 12.5 \text{ cm}$



CCD pixel size 3.45 μm

SLM pixel size 6.4 μm

(1) Single slit

Slit width a 64 μm

Distance between +1 and -1 bright stripes Δy_s μm

Wavelength experimental value nm

Percent error

$$\Delta y_s = (X_2 - X_1) \cdot (\text{CCD pixel size})$$

Wavelength experimental value $\lambda = \frac{a \Delta y_s}{2f}$

CCD pixel size 3.45 μm

f=12.5cm



$$\Delta y_d = (X_2 - X_1) \cdot (\text{CCD pixel size})$$

(2) Double slit

Slit width a 64 μm

Distance between +1 and -1 dark stripes Δy_d μm

Spacing d 128 μm

Wavelength experimental value nm

Percent error

Wavelength experimental value $\lambda = \frac{d \Delta y_d}{f}$

Wavelength theoretical value 532 nm