



Fu Dan
High School

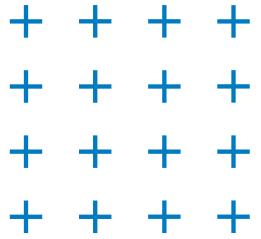


雙狹縫干涉實驗

組別: 334-2
報告日期: 6/12(日)



內容大綱



1.
實驗內容

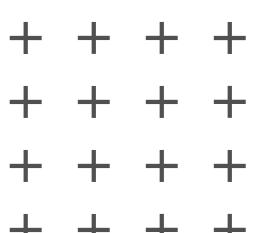
2.
行前實驗

3.
正式實驗

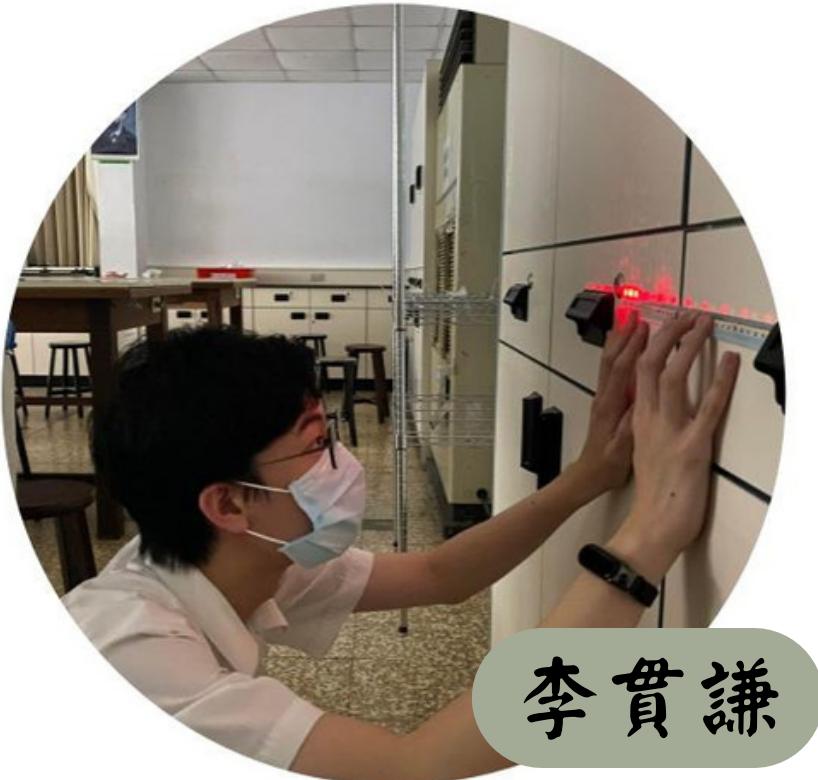
4.
數據分析

5.
數據誤差

6.
心得分享



報告組員



李貫謙



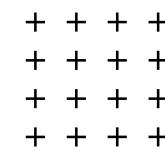
許家銘



傅興



蕭定岳



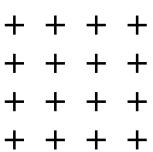
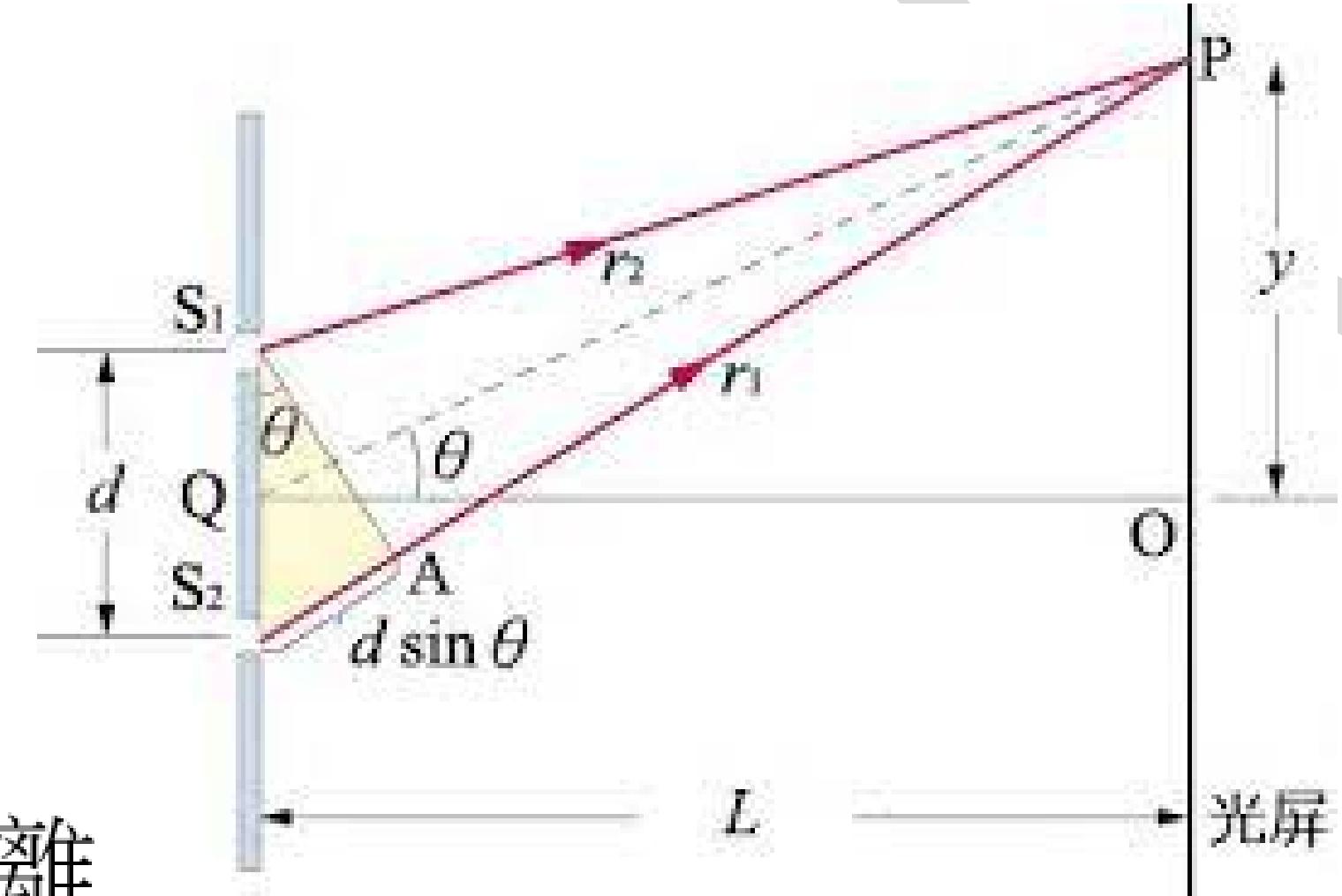
雙狹縫實驗原理

- θ 很小 $\sin\theta \approx \tan\theta$
- 光程差 $d\sin\theta = dtan\theta = d \frac{y}{L}$

- 相鄰亮紋寬 $\Delta y = \frac{L\lambda}{d}$

d : 狹縫間距 L : 與屏幕距離

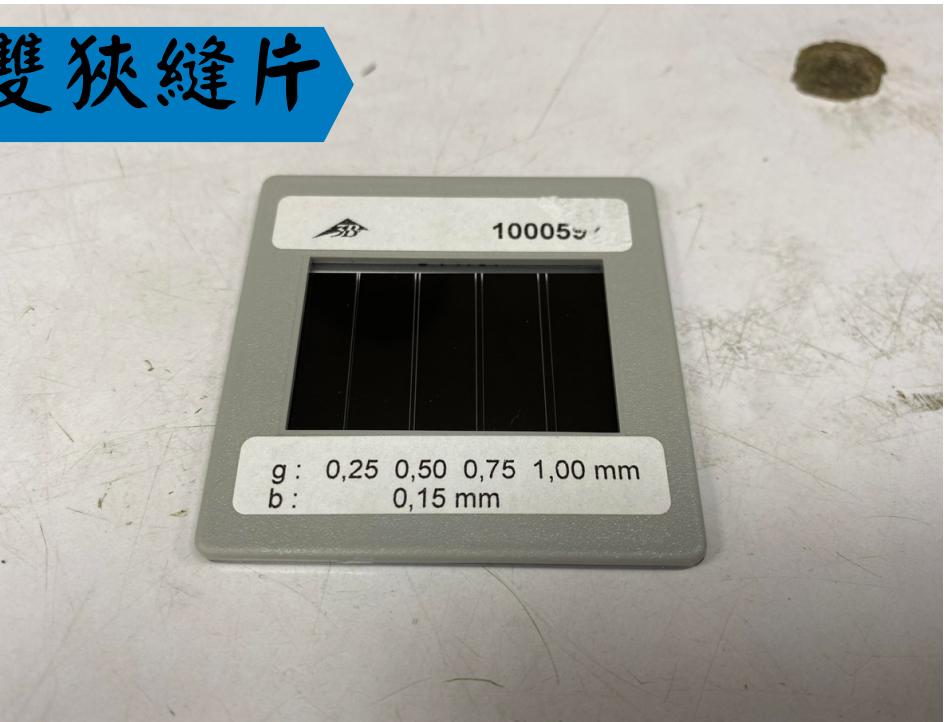
λ : 光源波長 Δy : 亮紋間距



實驗器材

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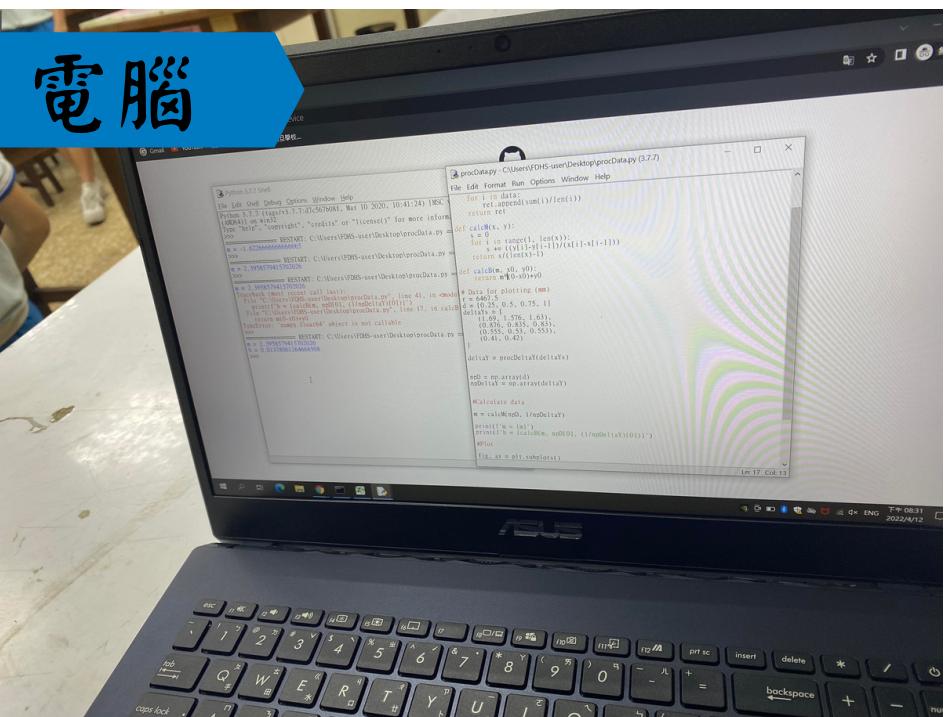
雙狹縫片



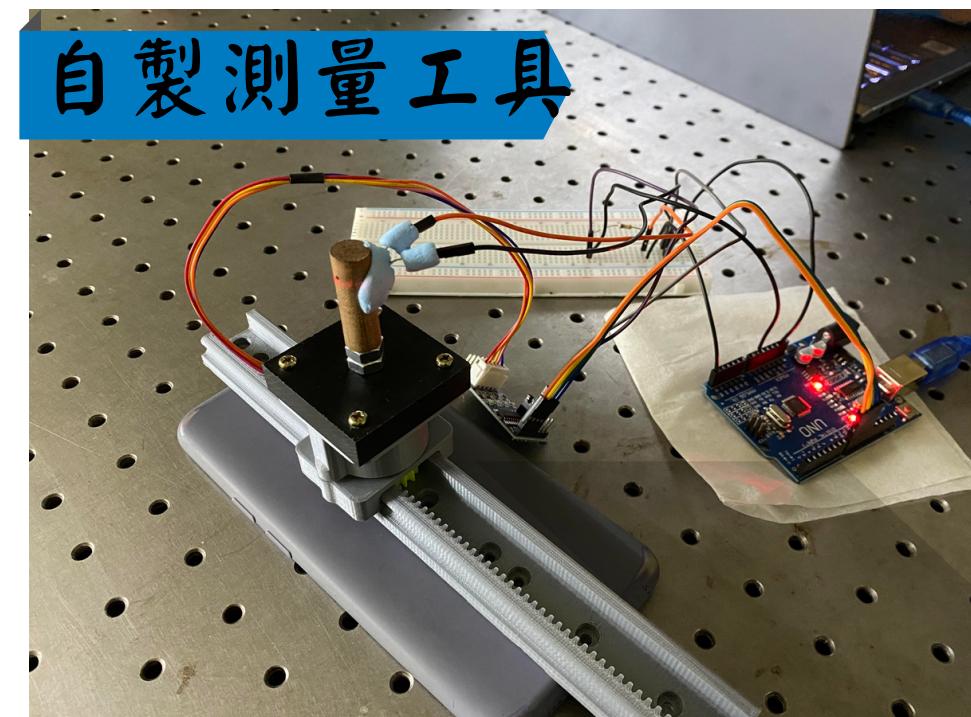
雷射



電腦



自製測量工具



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行前實驗

目標：證明y與 $1/d$ 成正比

1. 僅利用簡單的器具
2. 測得L、y、d
3. 利用python分析數據

$$\Delta y = \frac{L\lambda}{d}$$



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行前實驗數據

L : 6467.5mm

d Y	實驗者1	實驗者2	實驗者3	測得λ
1mm	0.45cm	0.42cm	0.41cm	641.7nm
0.75mm	0.553cm	0.53cm	0.555cm	633.3nm
0.5mm	0.835cm	0.83cm	0.876cm	654.8nm
0.25mm	1.576cm	1.63cm	1.69cm	630.8nm

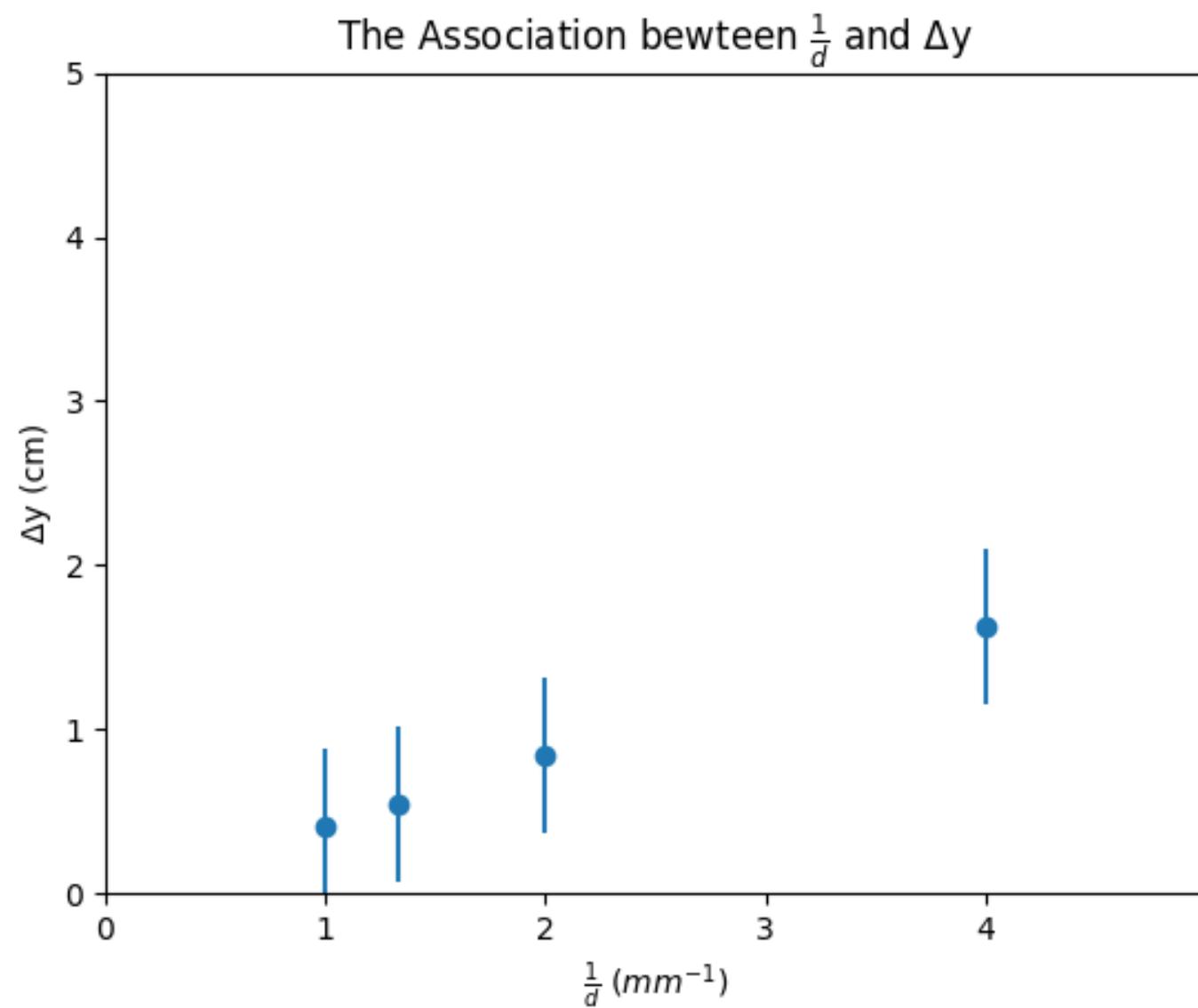
結論 : y 和 $1/d$ 成正比 (誤差 0.01mm)

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m = 0.4058461538461538
b = 0.014487179487179702
>> double-slit git:(master) 15:01 >
```

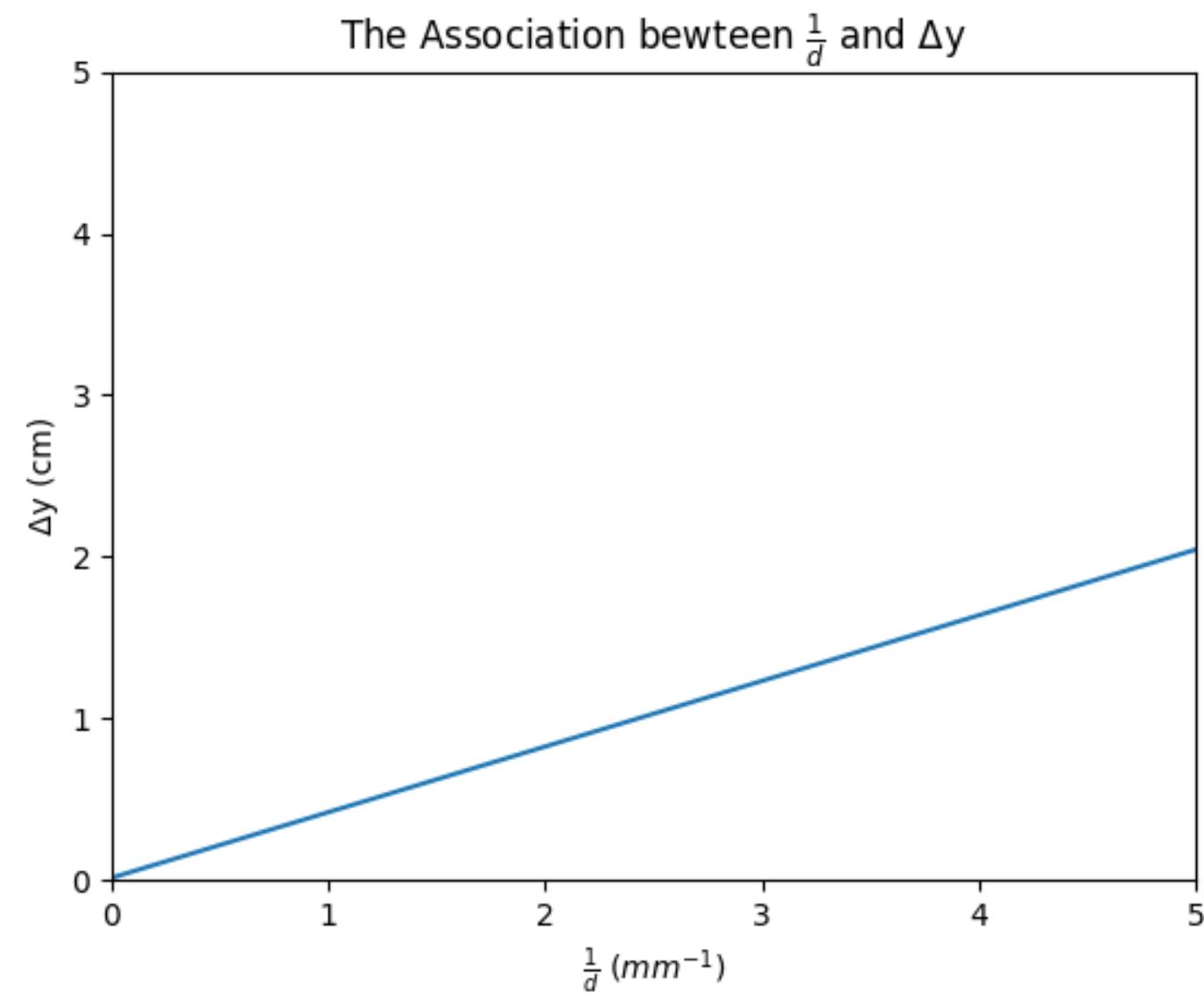
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行前實驗數據

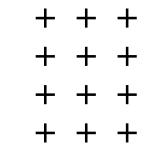
不確定度:0.47cm



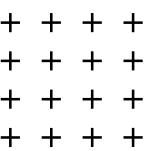
截距:0.01cm



正式實驗內容



1. 利用氮氣雷射製造出點光源
2. 使雷射通過雙狹縫片的狹縫
3. 透過自製的機器測量雷射圖形
4. 將數據導入程式中
5. 利用python轉換成平面波形
6. 比較光源跟屏幕之距離與兩狹縫距離不同所造成的圖形差異
7. 推導



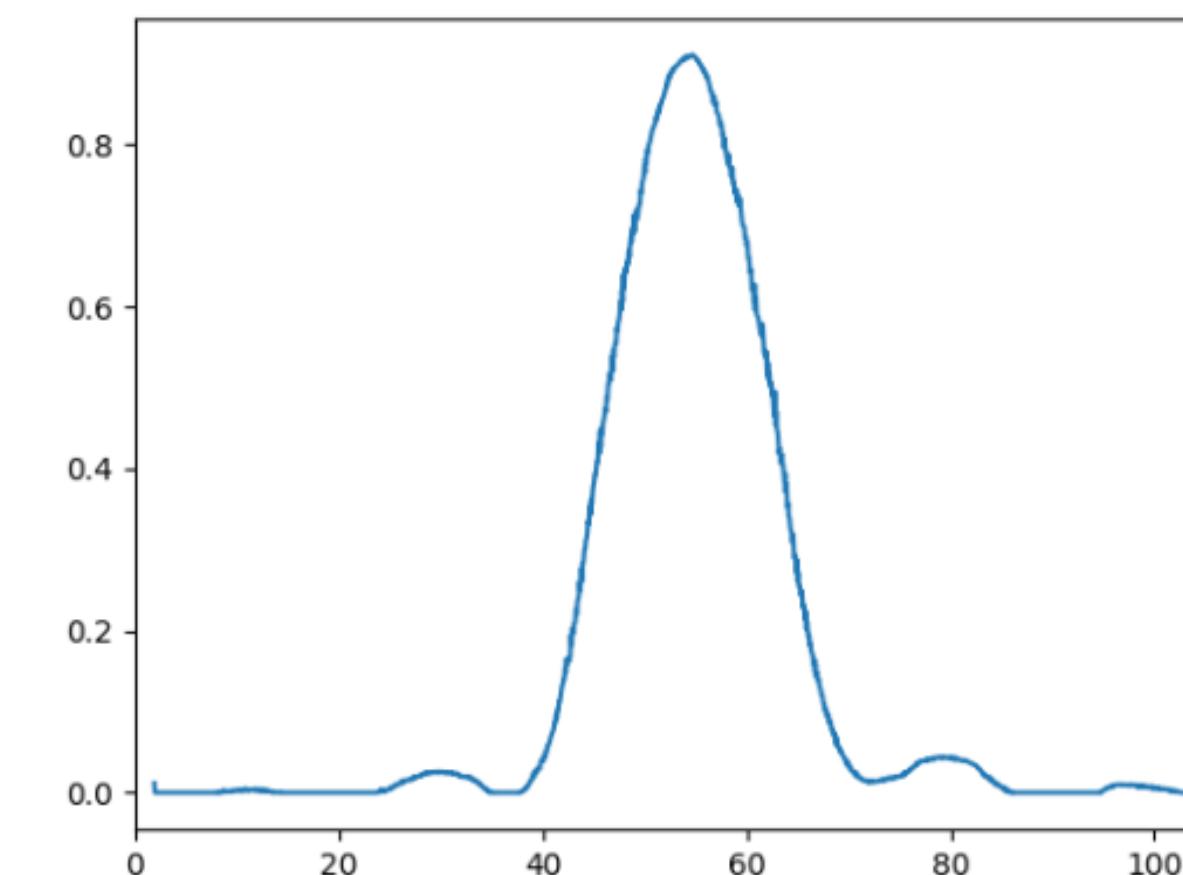
數據分析 實驗結果

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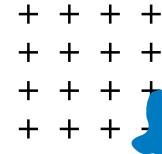
Double Slit Experiment

Data Graph

Singe Slit

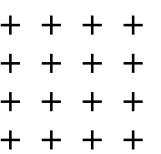


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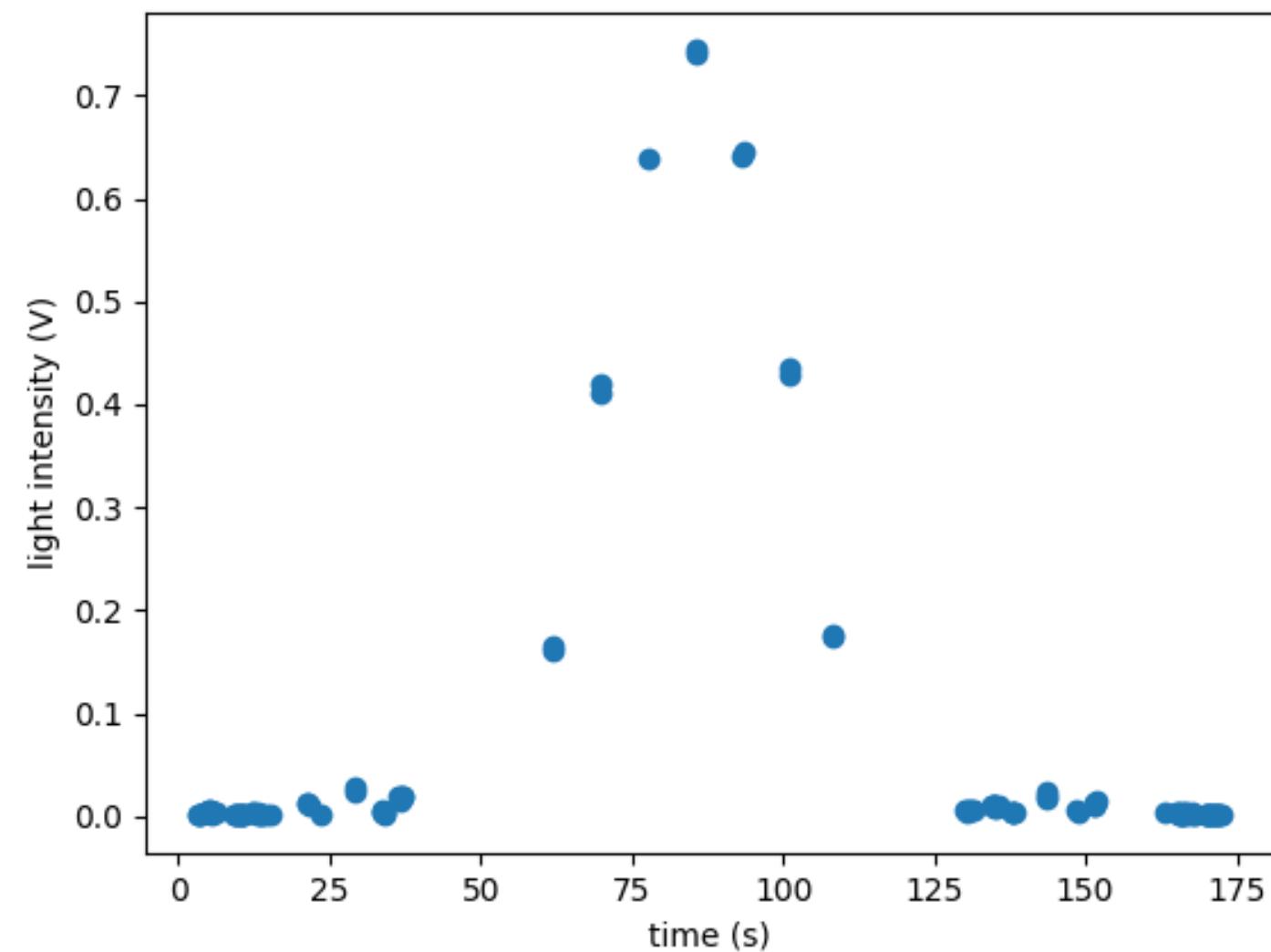
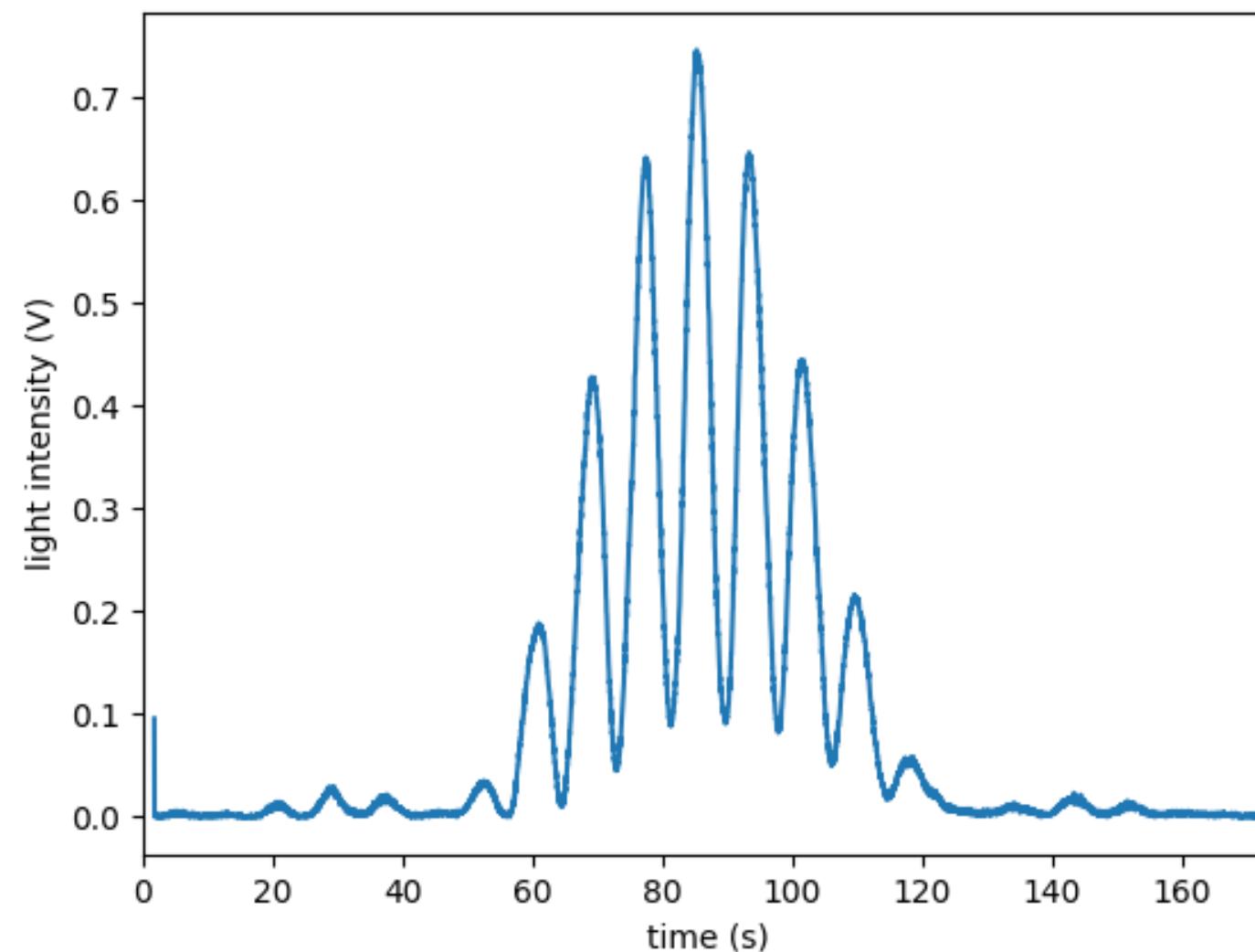
數據分析

1. 利用測得的干涉圖形繪製出大致的繞射圖形
 - a. 立用微分的原理找出干涉圖形中每一個點的斜率
 - b. 斜率接近零且左邊斜率大於零、右邊斜率小於零的點就是繞射圖形的點（允許0.001的誤差）
2. 立用繞射圖形推估出亮紋寬
3. 分析狹縫間距的倒數與亮紋寬是否成正比



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數據分析

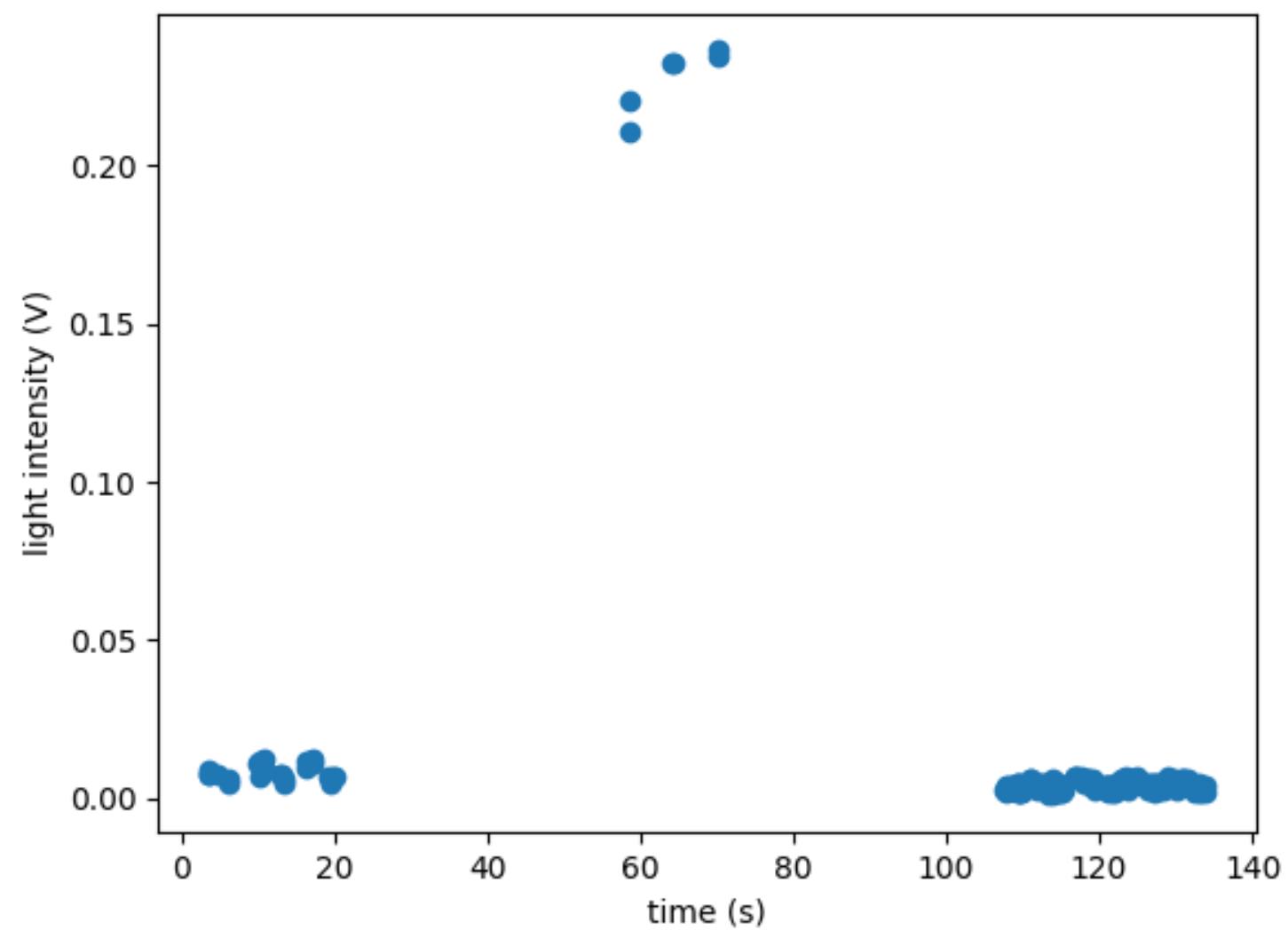
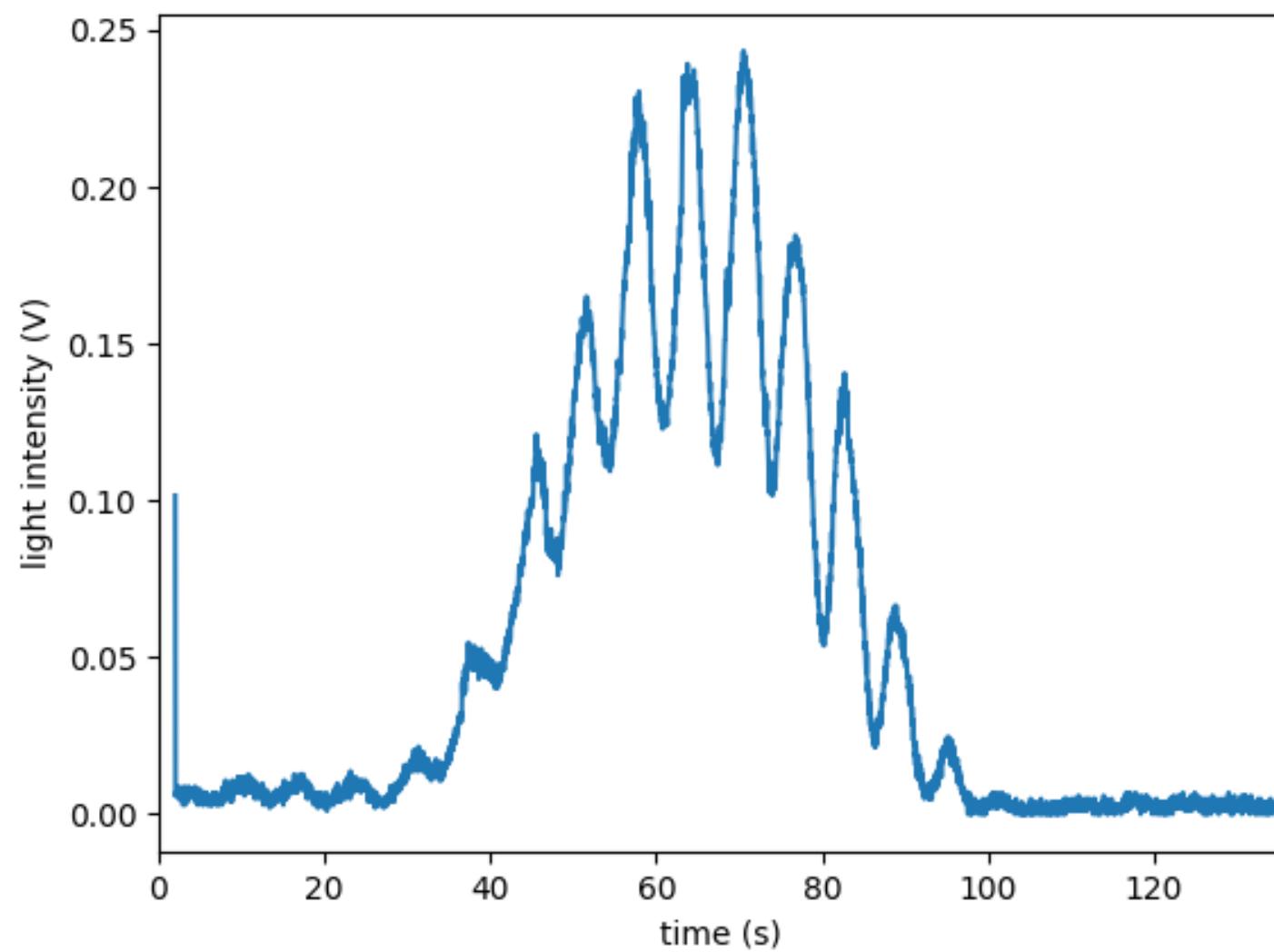


$d=0.75\text{mm}$

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數據分析

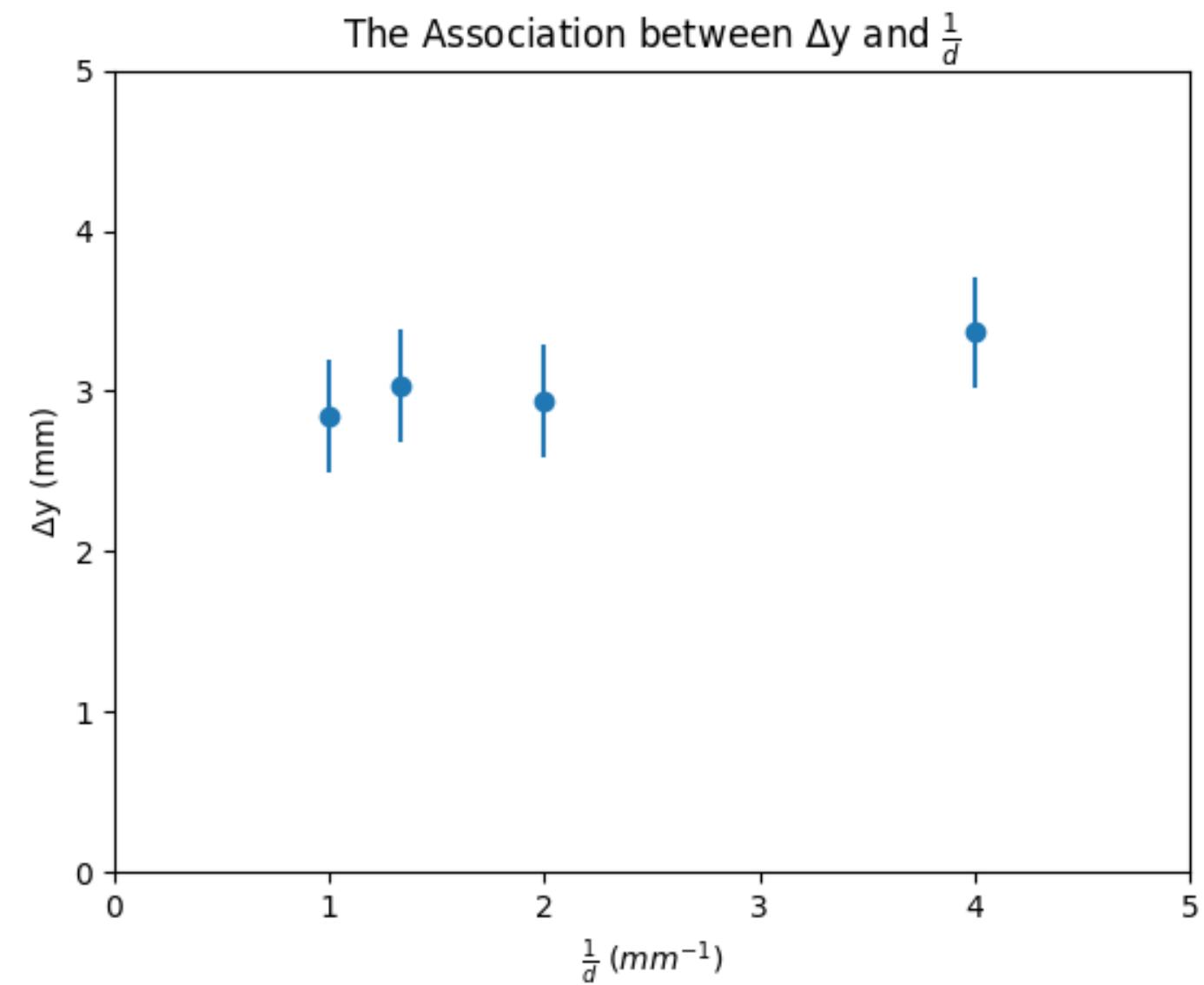


$d=1\text{ mm}$

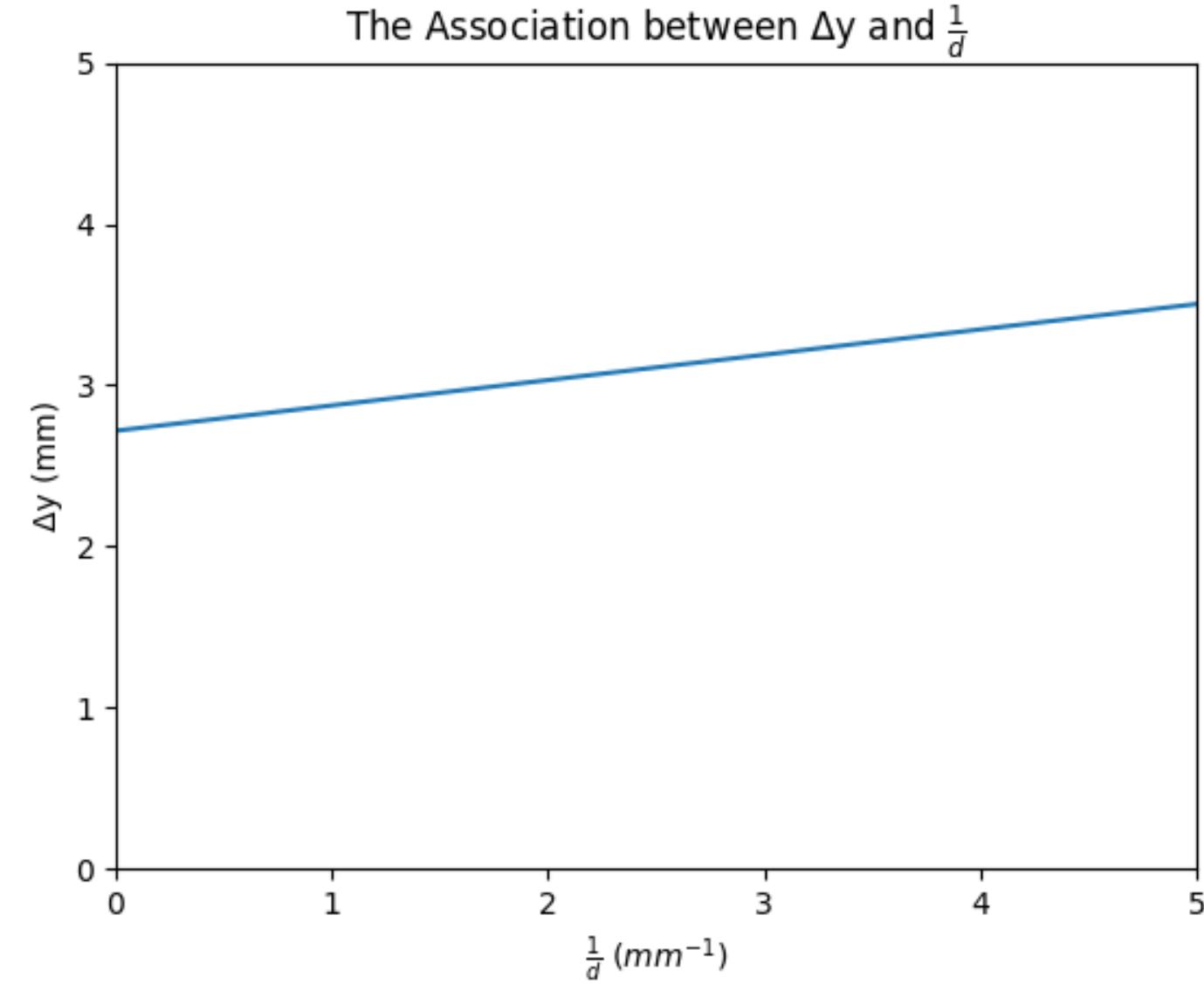
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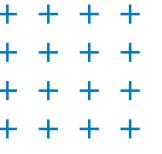
數據分析

不確定度: 0.35mm



截距: 2.72mm





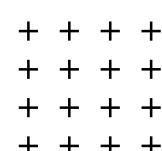
數據誤差

系統誤差

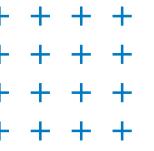
1. 測量之精準度
2. 光線是否平行
3. 測量工具多次使用後的耗損
4. 測量工具中的電阻影響準確度
5. 實驗環境光線過亮

誤差修正

1. 製作自動化工具、利用電腦輔助
2. 利用水平尺使狹縫、儀器與光線平行
3. 耗損方面較無法改良
4. 嘗試多種電阻，找到最適合的電阻值
5. 將燈都關閉



數據誤差

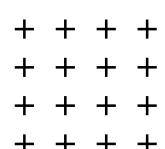


隨機誤差

1. 測量數據不足
2. 每次的數據點間隔時間過長

誤差修正

1. 增加測量次數



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心得分享





THANK YOU