《基础物理实验》课程完整报告

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室温： 20°C　　相对湿度：

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实验 E4. 基于光纤光谱仪的原子发射光谱实验

1　实验目的

(1) 掌握光谱仪的工作原理。

(2) 观测钠原子光谱，了解碱金属原子光谱的一般规律。

(3) 观测汞原子光谱，加深对碱金属原子中外层电子与原子核相互作用的了解。

(4) 观测 LED、氢氘灯、溴钨灯等多种光源的发射光谱，学习光谱的异同。

2　仪器用具

仪器	数量	样式
光纤光谱仪	1	低压汞灯、低压钠灯、氢氘灯、溴钨灯 红、黄、蓝、绿、白色的发光二极管
光源	9	
实验测控用计算机	1	

3　实验原理

3.1　碱金属原子光谱

碱金属原子和氢原子一样，核外只有一个价电子，但在碱金属原子中除了一个价电子外，还有内封闭壳层的电子，这些内封闭壳层电子与原子核统称为原子实。价电子是在原子核和内部电子共同组成的力场中运动。原子实作用于价电子的电场与电荷的电场有显著不同，特别是当价电子轨道贯穿原子实时（称贯穿轨道），这种差别就更为突出。碱金属原子光谱公式为

$$\tilde{\nu} = R\left(\frac{1}{n_2^{*2}} - \frac{1}{n_1^{*2}}\right) = \frac{R}{(n' - \mu'_{l'})^2} - \frac{R}{(n - \mu_l)^2} \tag{E4.1}$$

其中，$\tilde{\nu}$ 为光谱线的波数；R 为里德伯常量；n' 与 n 分别为始态和终态的主量子数；n_2^* 与 n_1^* 分别为始态和终态的有效量子数；l' 与 l 分别为该量子数决定的能级的轨道量子数；$\mu'_{l'}$ 与 μ_l 分别为始态和终态的量子数（也称量子改正数、量子亏损、屏蔽常数）。

根据玻尔理论，电子轨道越接近原子中心，μ 的数值越大；轨道互相贯穿时，μ 的数值更大，此时原子核有效电荷 Z_{eff} 会显著改变。在原子核附近，Z_{eff} 接近核电荷数；距离很远时，$Z_{\text{eff}} \to 1$。因此 s 项的 μ 值最大，p 项次之，d 项更小，以此类推。屏蔽常数 μ 的大小直接反映原子实电场与点电荷电场的偏离程度。

钠原子光谱分以下四个线系：

- 主线系：$\tilde{\nu} = np \to 3s$（$n = 3, 4, 5, \cdots$）
- 锐线系：$\tilde{\nu} = ns \to 3p$（$n = 4, 5, 6, \cdots$）
- 漫线系：$\tilde{\nu} = nd \to 3p$（$n = 3, 4, 5, \cdots$）
- 基线系：$\tilde{\nu} = nf \to 3d$（$n = 4, 5, 6, \cdots$）

对于任一线系，谱线的波数为：

$$\tilde{\nu} = A_{n'l'} - \frac{R}{(n - \mu_l)^2} \tag{E4.2}$$

其中，$A_{n'l'}$ 对一个线系来说为常数，称为**固定项**。

从钠原子光谱中可观察到各线系的明显特征，这些特征也适用于其他碱金属原子光谱：

3.1.1 各线系的共同特点

(1) 同一线系内，越靠近短波方向，相邻谱线的波数差越小，最后趋于连续谱（因能量越高，能级越密，最终趋于连续）。

(2) 同一线系内，越靠近短波方向，谱线光强越小（因能级越高，原子从基态激发至该能级的难度越大）。

3.1.2 各线系的区别

(1) 光谱区域不同：主线系仅 $\tilde{\nu} = 3p \to 3s$ 的两条谱线（钠双黄线）在可见光区，其余在紫外区；锐线系和漫线系除第一条线（$\tilde{\nu} = 4s \to 3p$ 和 $\tilde{\nu} = 3d \to 3p$）在红外区外，其余在可见区；基线系在红外区。主线系的下能级是基态（$3s_{1/2}$ 能级），因此连续光谱通过钠原子蒸气后会出现主线系的吸收光谱，其第一组双线（钠双黄线，波长 589.0 nm 和 589.6 nm）称为**共振线**。

(2) 能级兼并与分裂不同：s 能级无兼并，p、d、f 能级因电子自旋-轨道相互作用发生谱项分裂，为双重兼并，且分裂随能级增高而变小。根据选择定则，主线系和锐线系是双线，漫线系和基线系是复双重线。主线系双线的波数差随短波方向减小（由 p 能级分裂大小决定），而锐线系各双线波数差相等（由内 3p 能级与各 s 能级跃迁决定）。

(3) 主线系谱线的光强较大/锐线系谱线轮廓清晰，漫线系谱线显得模糊，一般复双重线连成一片

3.2 单色仪的色散系统

记录光谱的仪器称为**光谱仪**，其核心部件是**单色仪 (monochromator)**。如图 1所示，若分光元件为棱镜，称为**棱镜单色仪**；若为光栅，称为**光栅单色仪**。

根据**瑞利定理**，两谱线可分辨的判据是：一条谱线波长的中央极大与另一条谱线波长的第一极小刚好重叠。此时分辨能力 R 定义为：

$$R = \frac{\lambda}{\Delta\lambda} \tag{E4.3}$$

其中，λ 为两波长的平均值，$\Delta\lambda$ 为波长差。

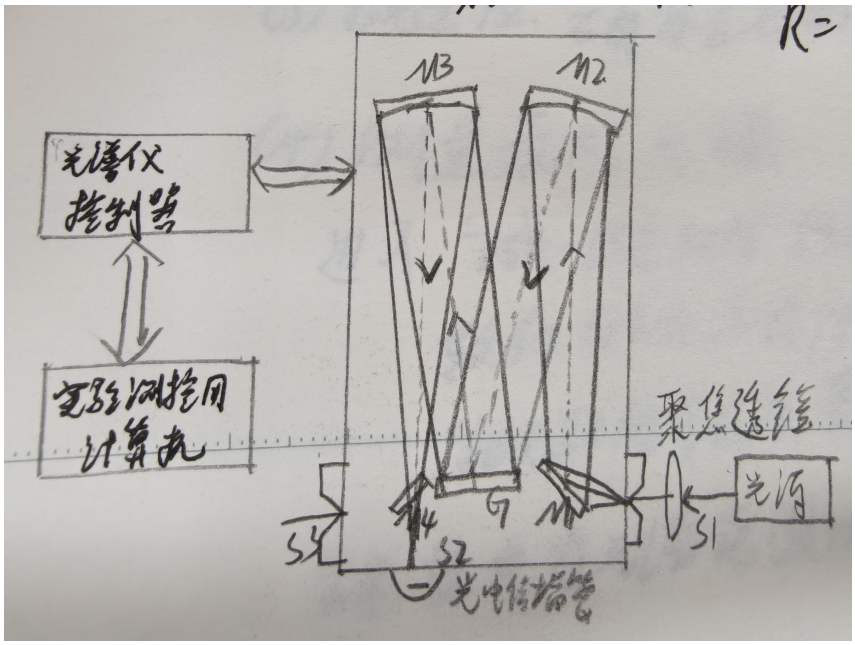


图 1: E4.1

3.2.1 棱镜单色仪

棱镜单色仪的色散元件通常为一块如图 2所示的等边三棱镜（紫外区用石英棱镜，可见光区用玻璃棱镜）。用**角色散** $\frac{\mathrm{d}\theta}{\mathrm{d}\lambda}$ 描述其分光能力，由几何关系近似为：

$$\frac{\mathrm{d}\theta}{\mathrm{d}\lambda} \approx \frac{\Delta\theta}{\Delta\lambda} = \frac{\theta_2 - \theta_1}{\lambda_2 - \lambda_1} \tag{E4.4}$$

进一步可表示为：

$$\frac{\mathrm{d}\theta}{\mathrm{d}\lambda} = \frac{\mathrm{d}\theta}{\mathrm{d}n} \cdot \frac{\mathrm{d}n}{\mathrm{d}\lambda} \tag{E4.5}$$

其中，$\frac{\mathrm{d}\theta}{\mathrm{d}n}$ 由棱镜几何形状决定，$\frac{\mathrm{d}n}{\mathrm{d}\lambda}$ 为**色散率**（随波长变短而增大）。

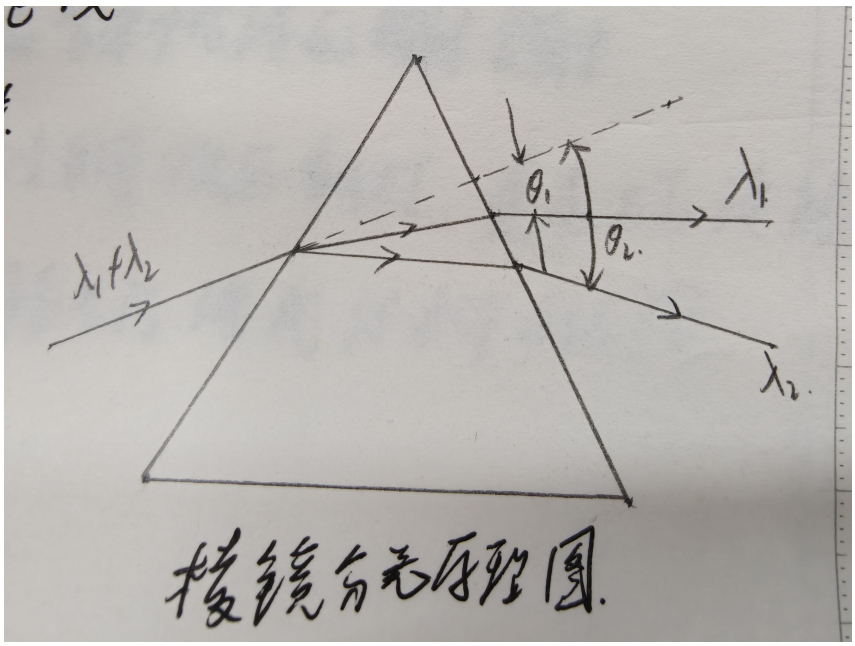


图 2: E4.2

3.2.2 光栅单色仪

如图 3所示，光栅的分光原理基于衍射，平面透射光栅的光栅方程为：

$$k\lambda = d\sin\theta, \quad k = 0, 1, 2, 3, \cdots \tag{E4.6}$$

若入射光与光栅法线成 i 角，光栅方程为：

$$k\lambda = d(\sin\theta + \sin i) \tag{E4.7}$$

对 λ 微分得角色散：

$$\frac{\mathrm{d}\theta}{\mathrm{d}\lambda} = \frac{k}{d\cos\theta} \tag{E4.8}$$

式 (E4.8) 表明:①$d\lambda$ 较小时,$d\theta$ 与 k 成正比, 即衍射的级数越高, 色散越大.②$d\theta$ 与 d 成正比,d 越小 (即总刻线数越多), 色散越大. ③当 $\cos\theta$ 变化不大时,$d\theta/d\lambda$ 近似为一常数, 即光栅的色散近似线性, 不随波长而变. 这给设计带来很大的方便. 不过通常均使用反射光栅, 其原理与透射光栅类似, 同时, 全息照相技术的出现使高密度光栅的制作更为简便.

为区分窄线宽谱线（如钠双黄线），需单色仪具有高色散率（如光栅单色仪一级光谱分辨率可达 0.02 nm）。由于单色仪色散的非线性，测量未知谱线波长时需拍摄**标准光谱**，通过插值法计算未知波长。

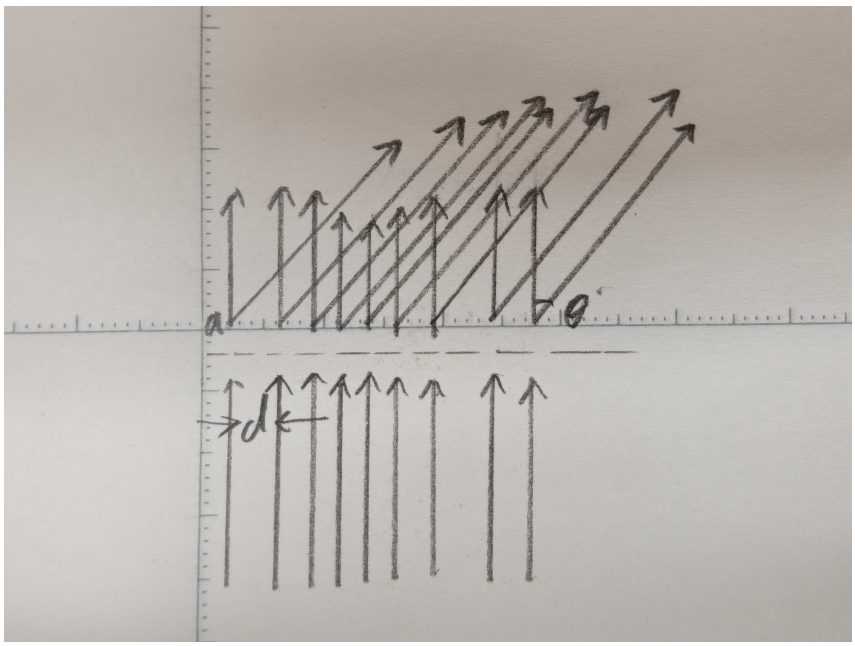


图 3: E4.3

3.3 光谱仪和光学多道分析器

光谱仪由单色仪和记录系统组成：采用棱镜单色仪的称为**棱镜光谱仪**，采用光栅单色仪的称为**光栅光谱仪**。

早期用感光胶片记录光谱（摄谱仪），现多采用光电元件：- 光电倍增管/光电二极管：每次仅记录一条谱线，灵敏度高（接近单光子测量），但速度慢；- 线阵 CCD/CMOS（**光学多道分析器 (OMA)**）：可同时记录一段波长范围内的所有谱线，速度快但灵敏度稍低。

OMA 集光学、机械、电子学和计算机技术于一体，可自动记录光谱强度。典型反射式光栅光谱仪光路（图 E4.1）：光源经入射狭缝 S1、准光镜 M2 后成为平行光，经光栅 G 衍射后，由物镜 M3 会聚到出射狭缝 S2（或经反射镜 M4 到 S3），最终由 CCD 或光电倍增管记录。

3.4 光纤光谱仪

光纤光谱仪内部结构如图 4所示，与光栅光谱仪不同，光纤光谱仪内部的所有结构都是固定的，狭缝宽度不可调节，光栅不可转动，所以出厂的时候就已经确定了光谱响应范围和光谱分辨率，不可调节。本实验拟使用的光纤光谱仪的光谱响应范围为 200nm-850nm，最高光谱分辨率 2nm，无法分辨钠双黄线。

光谱仪测量的原始数据是 CCD 探测器的计数值“S”随波长的变化曲线，再据此计算透射谱（T）、反射谱（R）吸收谱（A），标定后还可以得到光强谱（I）、色度值等。“积分时间”（即 CCD 记录光谱的曝光时间）可调节谱线峰值高度，确保全光谱范围内读数较大且不出现饱和的情况，参考值 1ms；平均次数增加可减小曲线的波动，参考值 3 次。

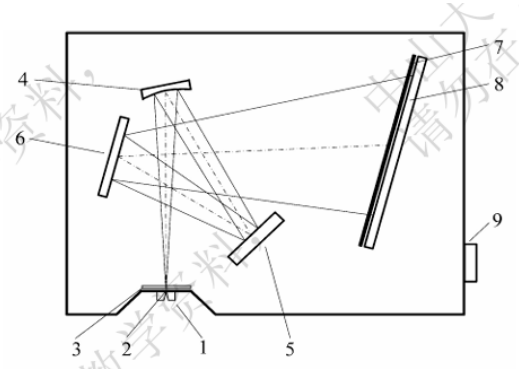


图4 光纤光谱仪结构图

1、光纤连接器，2、入射狭缝，3、滤光片，4、准直镜，5、反射光栅，6、聚焦镜，7、探测器聚光透镜，8、一维 CCD 探测器，9、USB 连接口

图 4: E4.4

4 实验装置

1. 本实验将采用如图 4 所示的光纤光谱仪来测量光源的发射光谱。光谱仪的品牌或型号可能不一样，如海洋光学或杏林睿光，测控程序界面也不一样，但操作方法基本相同，请实验前认真阅读操作说明。中山大学物理实验教学中心教学资料，

2. 采用如图 5 所示的电路来改变 LED 光源的发光强度.

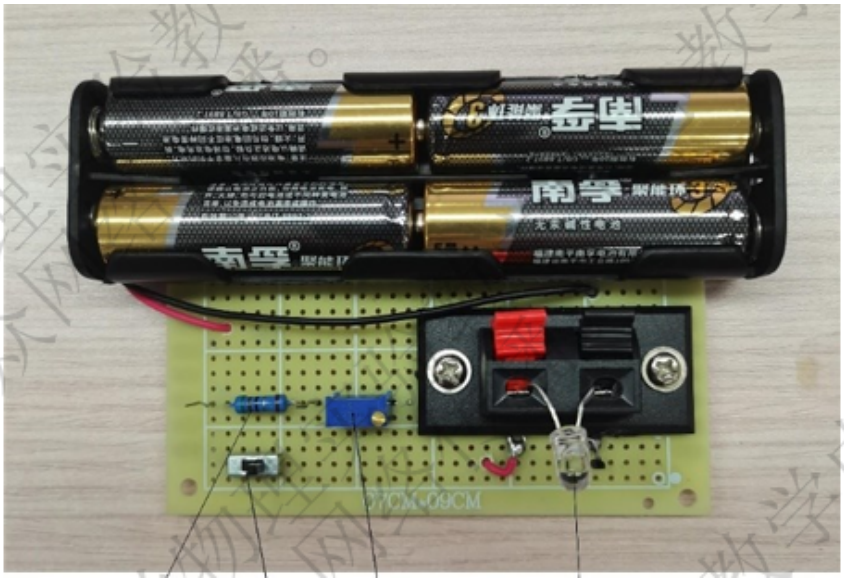


图 5: 待测量 LED 样品线路图

5 实验内容

(1) 测量各种光源的发射光谱，包括低压汞灯、低压钠灯、氢氘灯、溴钨灯、各色 LED 灯。

(2) 测量汞灯在波长 $\lambda = 546nm$、钠灯在波长 $\lambda = 589nm$ 处谱线强度从刚点亮开始随时间逐渐增加过程的变化曲线。

(3) 分别测出白光 LED（$\lambda = 545nm$）、红光 LED（$\lambda = 627nm$）的发光相对强度随工作电流强度 I 变化的曲线，电流强度通过图 5 所示电路的固定电阻两端的电压来计算，该电阻也称为采样电阻。为保护电路，电流的最大值 $I_{max} < 40mA$。

6 操作方法

6.1 使用海洋光学的光纤光谱仪进行测量

6.1.1 测发射光谱

(1) 双击“SpectraSuite”图标，得如图 6所示界面。

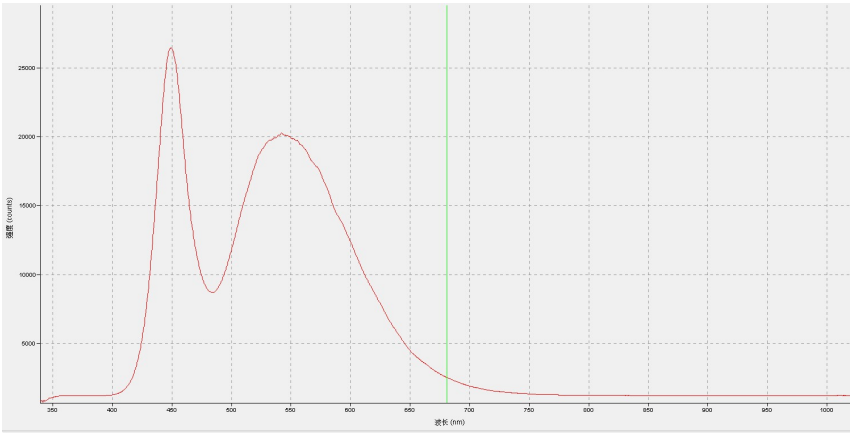


图 6: 海洋光学光谱仪软件界面

(2) 点亮光源，把固定在支撑杆上的光纤指向光源，点击运行“▷”图标采集光谱，并调整光纤入光端与光源的距离、方向，以及积分时间、平均次数等参数，确保全光谱曲线峰值不饱和。

(3) 保存光谱的数据和曲线截图。

6.1.2 测光谱强度随时间变化曲线

(1) 点击工具栏中的“时序图”按钮，出现如图 7所示的界面。



图 7: 时序图界面

(2) 选择测量参数，如“每次扫描后更新”、“One 波长”（单波长）546.18nm 等。最后点击“接受”。

(3) 把光纤头固定在支座上并指向待测的光源，点击“扫描”开始测量，并立刻点亮光源，测量谱线强度随时间变化曲线直至光强稳定（约 3 分钟）。

(4) 点击“暂停扫描”停止测量，保存光谱的数据和曲线截图。

6.1.3 测白光 LED 和红光 LED 峰值光强随电流变化关系曲线

(1) 把 LED 测量电路放在升降台上，光纤固定在支架上，调整高度对准 LED 灯。

(2) 用万用表测量采样电阻（阻值 51Ω）两端电压，计算流过 LED 的电流值。通过精密可调电阻可改变电流的大小。从 $0mA$ 至 $I_{max} = 40mA$，每隔约 $2mA$ 测量图 6 所示曲线峰值光强值并作记录，作出变化关系曲线。

6.2 使用杏林睿光的光纤光谱仪进行测量

操作方法同上，软件界面不同。

(1) 双击“BSV”图标，得如图 8 所示界面。点击菜单栏的“文件 > 导出数据”功能，可把光谱数据导出为 txt 文件。

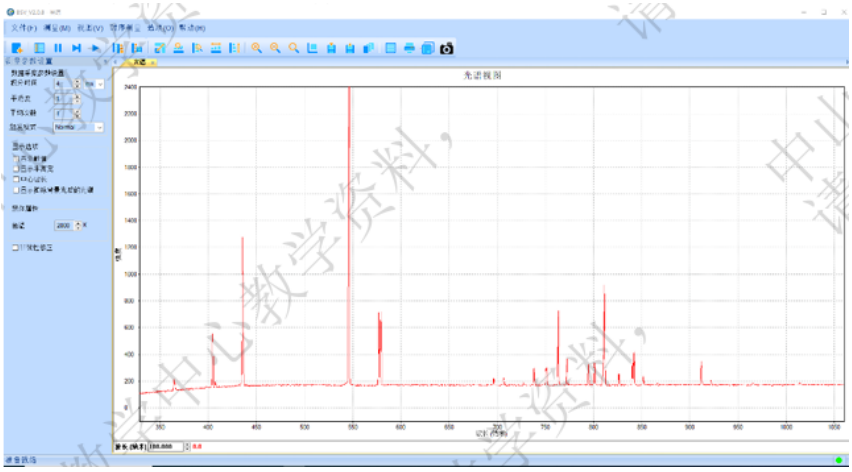


图 8: 杏林睿光光谱仪软件界面

(2) 点击菜单栏的“时序测量 > 时序测量配置”，可得图 9 所示的界面。设置单点波长数据（如 546.18nm）、初始等待时间、保存数据时间间隔、保存数据记录的时间（即测量总时间）等参数，点“确定”接受这些参数后，再点击“时序测量 > 启用”，进行时序测量，数据保存在图 9 界面中配置的文件里。

(3) 改变 LED 工作电流，测量图 8所示曲线峰值光强随电流变化关系数据并画曲线。

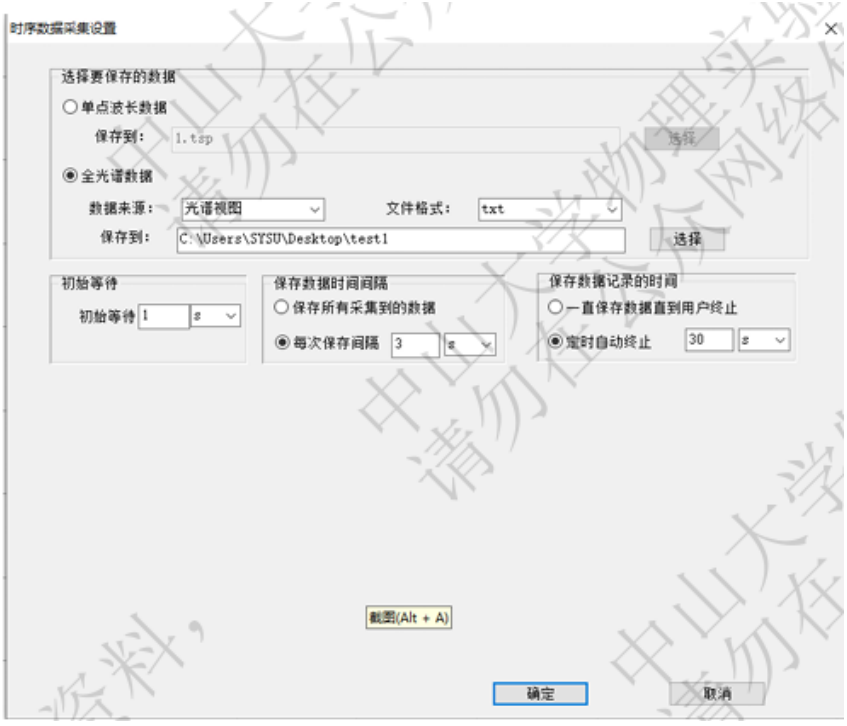


图 9: 时序测量配置界面

7 数据记录及处理

7.1 (1)

- 低压汞灯

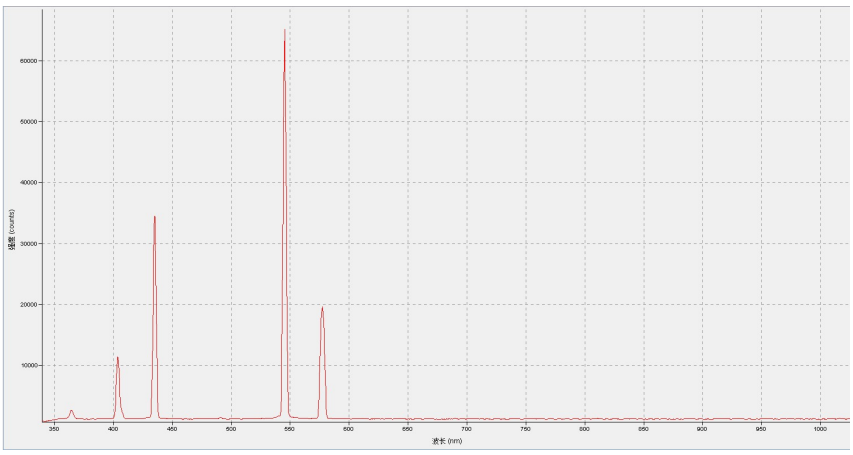


图 10: Hg

- 低压钠灯

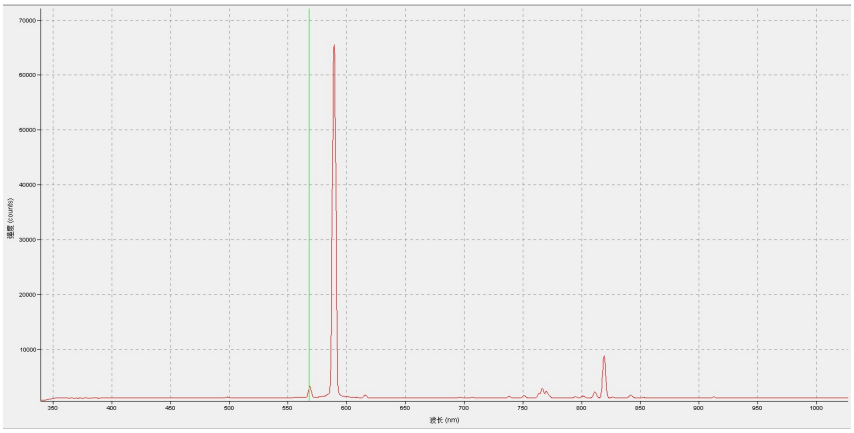


图 11: Na

- 氢氘灯

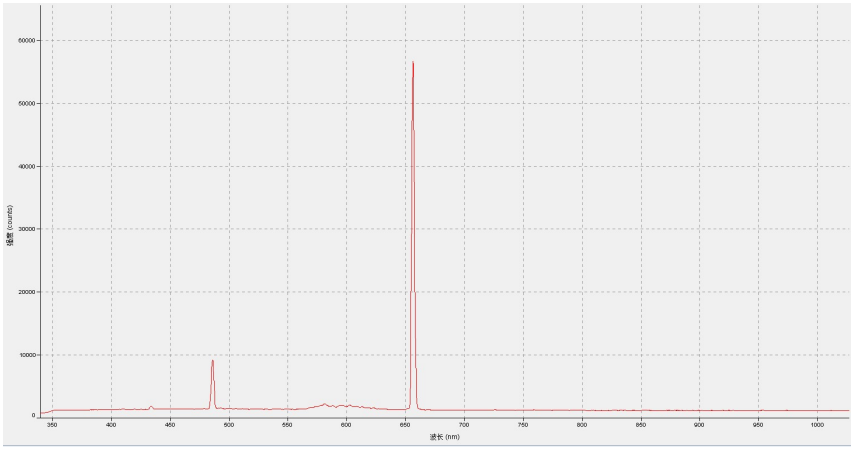


图 12: H

- 溴钨灯

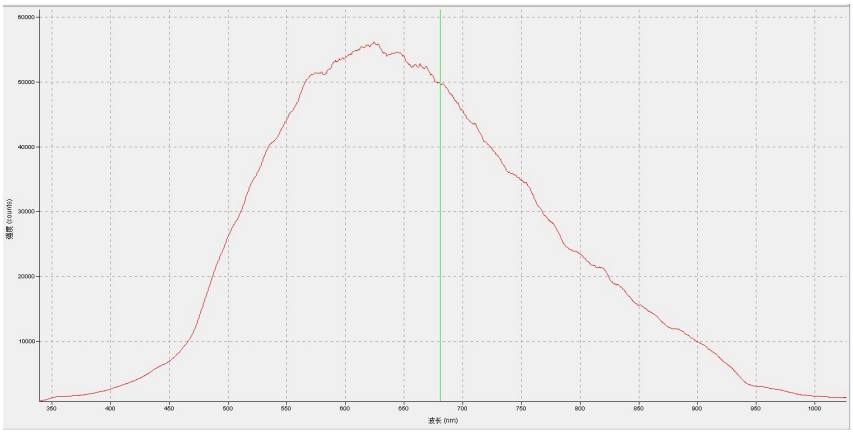


图 13: BrW

- LED
  - 红

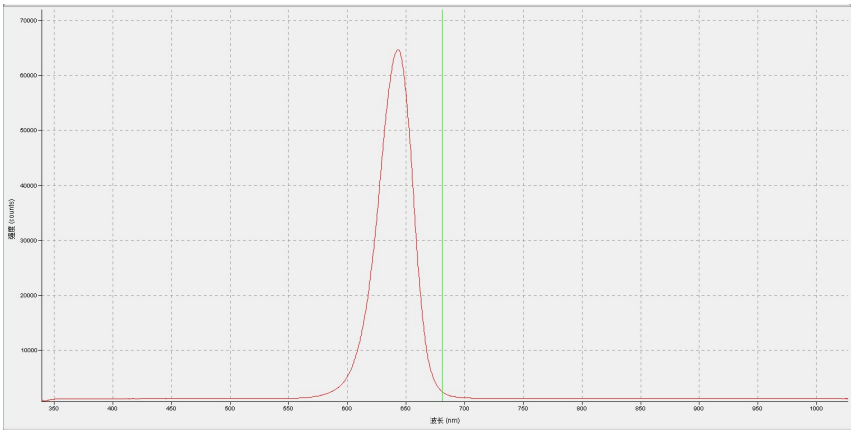


图 14: red

  - 黄

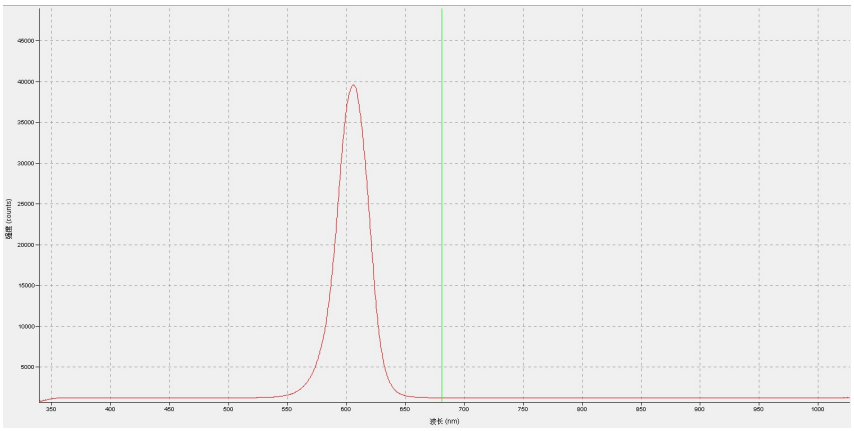


图 15: yellow

  - 蓝

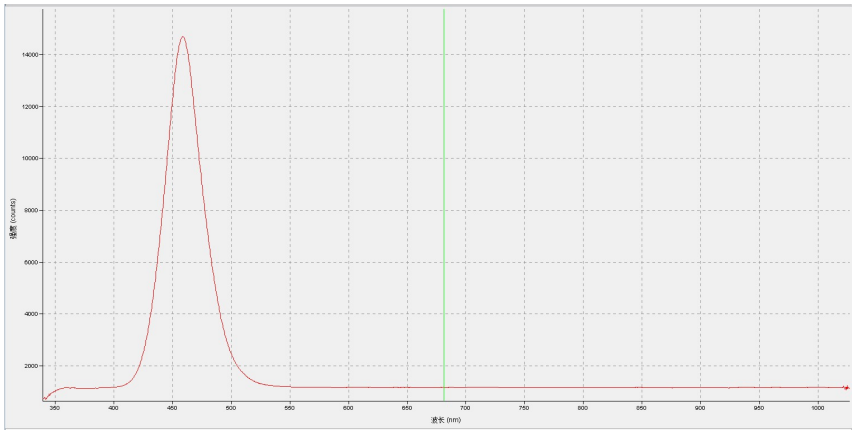


图 16: blue

– 绿

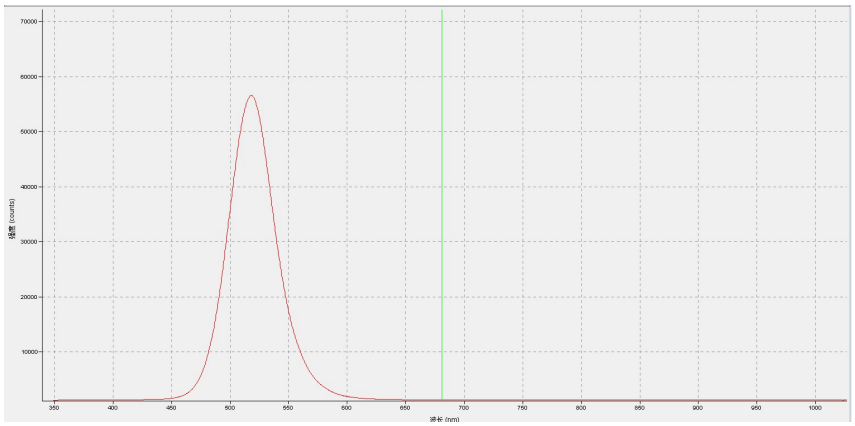


图 17: green

– 白

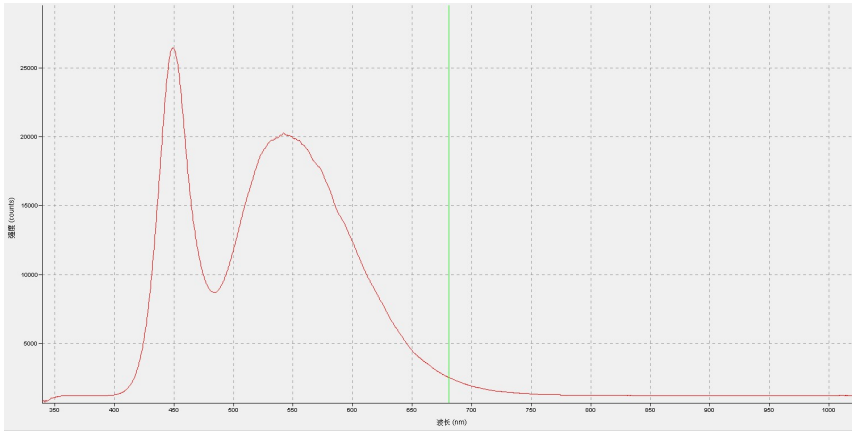


图 18: white

7.2 (2)

- Hg 灯

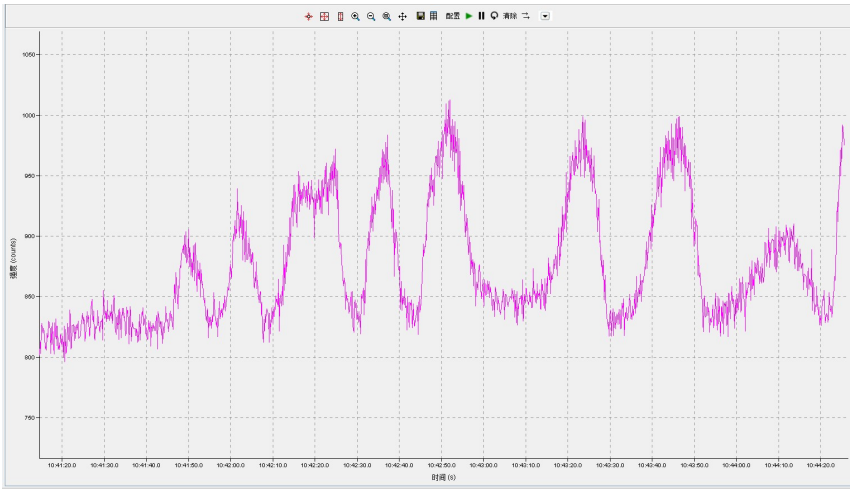


图 19: Hg'

- Na 灯

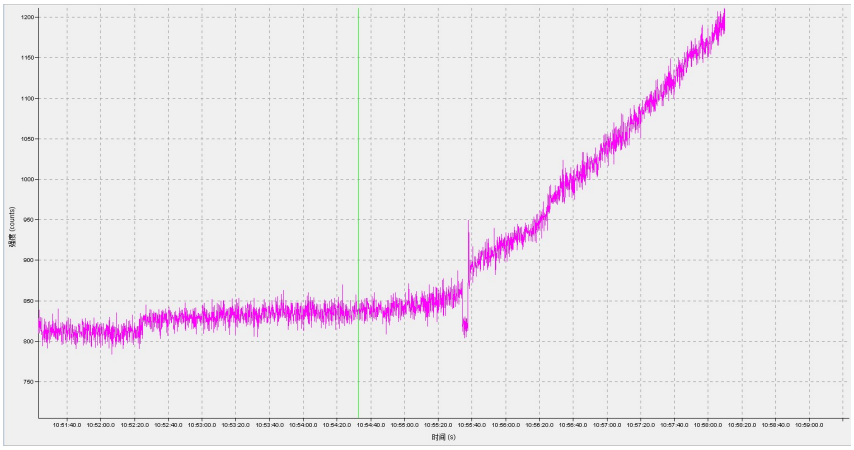


图 20: Na'

7.3 (3)

- 红

I/mA	0	2	4	6	8	10	12	14
光强/counts	0	2745	5032	7501	9768	12248	14584	16814
I/mA	16	18	20	22	24	26	28	30
光强/counts	18564	21514	22814	25224	27024	28484	29364	29664
I/mA	32	34	36	38	40			
光强/counts	30854	31624	36824	38484	40624			

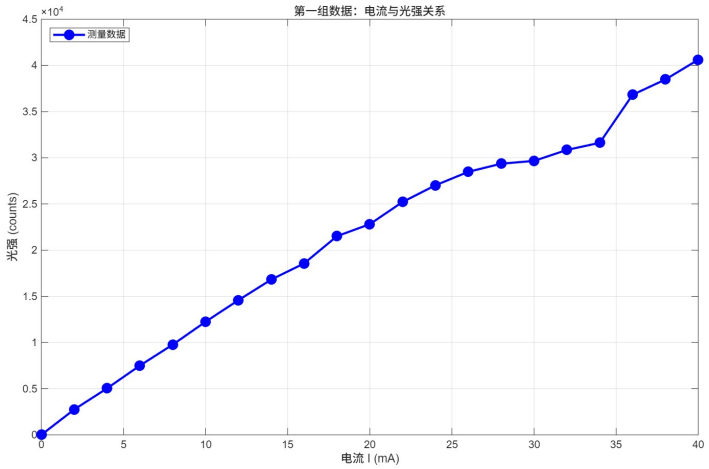


图 21: 红光光强随电流强度变化

- 白

I/mA	0	2	4	6	8	10	12	14
光强/counts	0	1792	2406	3118	3626	4108	4351	5071
I/mA	16	18	20	22	24	26	28	30
光强/counts	5298	5840	6261	6222	6407	6688	6944	7058
I/mA	32	34	36	38	40			
光强/counts	7120	7208	7281	7305	7341			

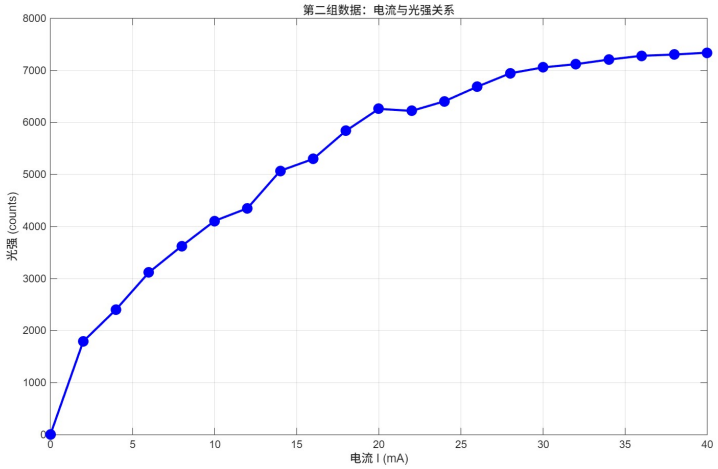


图 22: 白光光强随电流强度变化

8 讨论与分析

本实验利用光纤光谱仪对多种光源（低压汞灯、低压钠灯、氢氘灯、溴钨灯、各色LED）的发射光谱进行了测量，并进一步研究了光谱强度随时间及电流变化的规律。

8.1 光源发射光谱特征分析

- **低压汞灯**：在可见光区观测到多条分立谱线，查阅资料在汞原子理论值附近，说明实验较成功，符合汞原子能级跃迁特征。谱线尖锐，说明原子能级分立性强。
- **低压钠灯**：在 589.0 nm 附近处为峰值，属于主线系的共振线。由于光谱仪分辨率限制，双线未能完全分辨，但仍可见光谱峰形不对称。
- **氢氘灯**：观察到巴尔末线系（如 656 nm、486 nm、434 nm），氢与氘的同位素位移因分辨率限制未能明显区分。
- **溴钨灯**：光谱呈连续分布，符合黑体辐射特征，峰值波长随温度变化，属于热辐射光源。
- **各色 LED**：光谱为连续宽带，峰值波长与发光颜色一致，如红光 LED 峰值在 627 nm 附近，白光 LED 光谱覆盖整个可见光区，具有蓝光激发荧光粉的典型特征。

8.2 光谱强度随时间变化分析

- **汞灯（546 nm）与钠灯（589 nm）**：刚点亮时谱线强度较低，随灯管温度升高、原子激发态布居数增加，强度逐渐上升，约 3 分钟后趋于稳定。说明气体放电光源需预热才能达到稳定发光状态。在钠灯线接近 10:55:40 附近谱线强度突然下降一段，且该段前与该段后上升速率对接有部分偏差，系当时不慎碰到光纤导致变化，但发现并不影响我们发现一般规律，故选择继续完成实验

8.3 LED 光强随电流变化分析

- **红光 LED**：光强随电流近似线性增长，在 0–40 mA 范围内未明显饱和，说明在该范围内 LED 发光效率基本稳定。在 30mA 后曲线波折，是因为系统误差导致，我们所使用的器械，在我们使用螺丝刀调节灵敏度很高，会出现突变状况，同时调完后拿走后，光强会下降，两个效应都在高电流 (接近 40mA) 时更为明显，故出现该波折
- **白光 LED**：光强随电流增长趋势逐渐减缓，尤其在 >30 mA 后增长缓慢，可能由于发热导致效率下降（效率衰减效应），或荧光粉饱和现象。

9 思考题

(1) 钠原子光谱有哪些特征？如何从光谱图判别各谱线所属线系？

①钠原子光谱具有线系结构明确、双线特征显著、光强和分布区域有规律等特点

线系的共同规律:

- 同一线系内，谱线越靠近短波方向（高能级），相邻谱线的波数差越小，最终趋于连续谱（因高能级间距逐渐缩小，直至连续）。
- 同一线系内，越靠近短波方向，谱线光强越小（激发到高能级的概率低）。

各线系的区别特征:

- 主线系：仅两条谱线（钠双黄线，波长 589.0 nm 和 589.6 nm）在可见光区，其余在紫外区；下能级是基态（3s / ），是钠原子的共振线（吸收光谱中最明显的线系）。
- 锐线系：除第一条线在红外区外，其余在可见光区；双线的波数差处处相等（由内 3p 能级与各 s 能级跃迁的特性决定）。
- 漫线系：除第一条线在红外区外，其余在可见光区；谱线较锐线系模糊（复双重线结构）。
- 基线系：全部在红外区；谱线更模糊，是复双重线结构。

②从光谱图判别线系的方法:

可通过光谱区域、双线特征、光强变化三方面综合判断：

- 若谱线在可见光区且有一对强度很高的黄线（钠双黄线），则属于主线系；
- 若谱线在可见光区，且双线的波数差始终相等，则属于锐线系；
- 若谱线在可见光区但结构较模糊（复双重线），则属于漫线系；
- 若谱线在红外区，则属于基线系。

(2) 什么是标准谱线？

标准谱线是指波长已知且精度很高的特征谱线（如低压汞灯、钠灯的特征谱线）。

(3) 光谱仪使用前为什么要进行标定？

光谱仪使用前标定的核心目的是确保波长测量的准确性，具体原因如下：

- 色散的非线性：光栅或棱镜的色散率（波长随衍射角 / 偏向角的变化率）不是严格常数，不同波长的谱线在光谱仪中的“位置 - 波长”关系是非线性的。只有通过标准谱线标定，才能建立准确的“位置 - 波长”校准曲线。
- 机械与光学误差：光谱仪的狭缝宽度、反射镜角度、光栅安装精度等存在微小误差，会导致谱线的实际位置与理论位置偏离。标定可修正这些系统误差。
- 光电元件的响应差异：光电倍增管、CCD 等检测元件对不同波长的光响应效率不同，标定过程中也可辅助修正光强测量的系统误差（若涉及光强定量分析）。

参考文献

[1] 沈韩. 大学物理实验[M]. 北京: 科学出版社, 2024.

附录: 源代码

Listing 1: MATLAB Code

```
% 第一组数据
I1 = [0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32,
    34, 36, 38, 40];
counts1 = [0, 2745, 5032, 7501, 9768, 12248, 14584, 16814, 18564,
    21514, 22814, 25224, 27024, 28484, 29364, 29664, 30854, 31624,
    36824, 38484, 40624];

% 线性拟合
p1 = polyfit(I1, counts1, 1);
slope1 = p1(1);
intercept1 = p1(2);

% 计算 R²
fitted_values1 = polyval(p1, I1);
ss_res1 = sum((counts1 - fitted_values1).^2);
ss_tot1 = sum((counts1 - mean(counts1)).^2);
r_squared1 = 1 - (ss_res1 / ss_tot1);

% 绘图
figure;
plot(I1, counts1, 'bo-', 'LineWidth', 2, 'MarkerSize', 8,
    'MarkerFaceColor', 'blue');
hold on;

% 图形设置
grid on;
xlabel('电流 I (mA)');
ylabel('光强 (counts)');
title('第一组数据: 电流与光强关系');

legend('测量数据', '线性拟合', 'Location', 'northwest');

% 输出结果到命令窗口
fprintf('第一组数据线性方程: y = %.2fx + %.2f\n', slope1,
    intercept1);
fprintf('R² = %.6f\n\n', r_squared1);

%% 绘制第二张图

% 第二组数据
I2 = [0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32,
    34, 36, 38, 40];
counts2 = [0, 1792, 2406, 3118, 3626, 4108, 4351, 5071, 5298, 5840,
```

```
    6261, 6222, 6407, 6688, 6944, 7058, 7120, 7208, 7281, 7305,
    7341];

% 线性拟合
p2 = polyfit(I2, counts2, 1);
slope2 = p2(1);
intercept2 = p2(2);

% 计算 R²
fitted_values2 = polyval(p2, I2);
ss_res2 = sum((counts2 - fitted_values2).^2);
ss_tot2 = sum((counts2 - mean(counts2)).^2);
r_squared2 = 1 - (ss_res2 / ss_tot2);

% 绘图
figure;
plot(I2, counts2, 'bo-', 'LineWidth', 2, 'MarkerSize', 8,
    'MarkerFaceColor', 'blue');
hold on;

% 图形设置
grid on;
xlabel('电流 I (mA)');
ylabel('光强 (counts)');
title('第二组数据: 电流与光强关系');


% 输出结果到命令窗口
fprintf('第二组数据线性方程: y = %.2fx + %.2f\n', slope2,
    intercept2);
fprintf('R² = %.6f\n', r_squared2);
```

附录: 原始数据

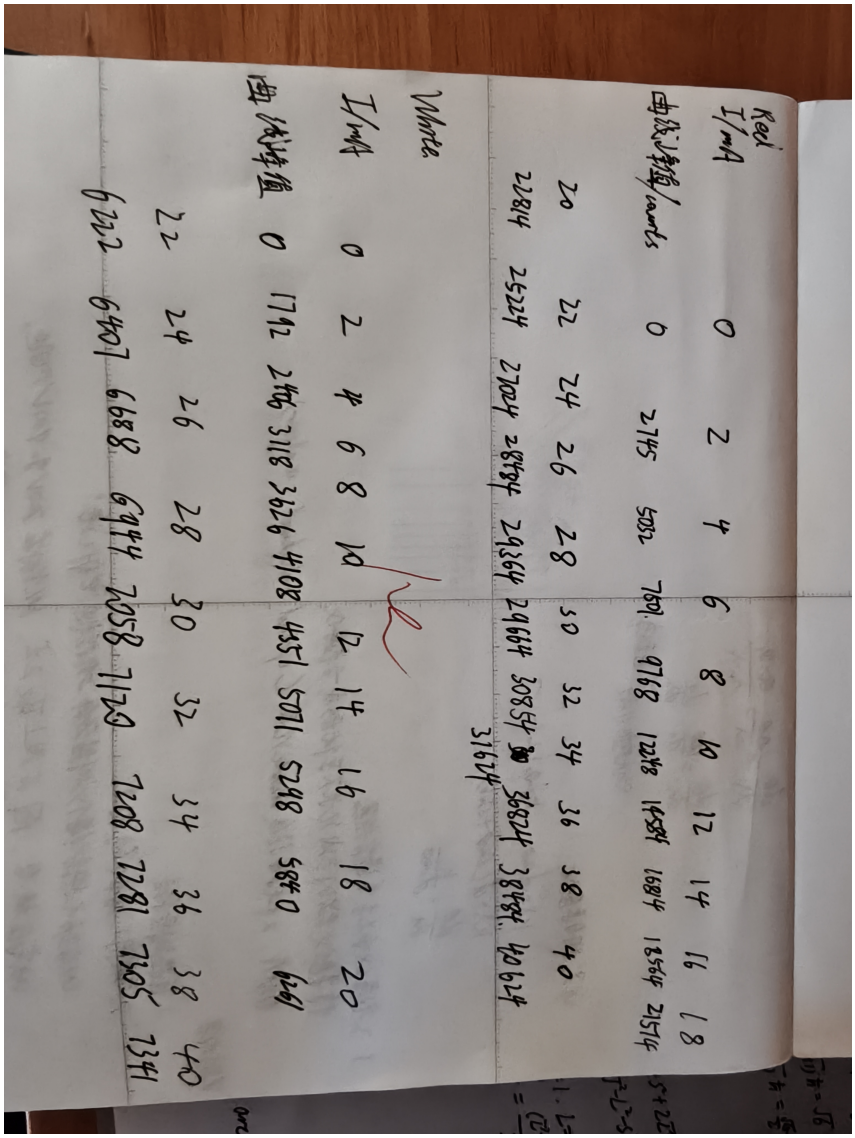


图 23: data

Listing 2: 汞灯

```
暗光谱： 否
参考光谱： 否
光谱数量： 1
光谱仪： USB2+H14105
积分时间（毫秒）： 1 (USB2+H14105)
平均次数： 1 (USB2+H14105)
平滑度： 3 (USB2+H14105)
去除暗噪声： 否 (USB2+H14105)
339.35  762.15
339.73  762.15
340.11  762.15
340.49  745.85
340.87  731.29
```

```
14  341.25  731.63
15  341.63  724.01
16  342.01  736.14
17  342.39  733.37
18  342.77  732.33
19  343.15  738.92
20  343.53  762.84
21  343.91  764.23
22  344.29  786.42
23  344.66  802.72
24  345.04  832.88
25  345.42  862.70
26  345.80  876.23
27  346.18  885.94
28  346.56  911.25
29  346.94  921.65
30  347.32  919.57
31  347.70  917.14
32  348.08  922.34
33  348.45  937.25
34  348.83  963.26
35  349.21  974.70
36  349.59  1000.02
37  349.97  1025.67
38  350.35  1036.08
39  350.73  1055.84
40  351.10  1071.10
41  351.48  1072.14
42  351.86  1087.40
43  352.24  1091.56
44  352.62  1095.72
45  353.00  1118.26
46  353.37  1127.62
47  353.75  1128.31
48  354.13  1138.02
49  354.51  1140.10
50  354.89  1144.61
51  355.27  1140.45
52  355.64  1140.10
53  356.02  1140.45
54  356.40  1147.38
55  356.78  1151.20
56  357.16  1158.48
57  357.53  1143.92
58  357.91  1165.41
59  358.29  1177.55
60  358.67  1189.69
```

```
 61  359.04  1206.33
 62  359.42  1220.20
 63  359.80  1226.79
 64  360.18  1254.18
 65  360.55  1268.40
 66  360.93  1295.10
 67  361.31  1335.32
 68  361.69  1417.84
 69  362.06  1548.91
 70  362.44  1712.23
 71  362.82  1929.29
 72  363.20  2156.07
 73  363.57  2368.62
 74  363.95  2499.00
 75  364.33  2552.40
 76  364.71  2520.15
 77  365.08  2425.84
 78  365.46  2246.22
 79  365.84  2033.32
 80  366.21  1812.79
 81  366.59  1640.46
 82  366.97  1507.65
 83  367.34  1391.15
 84  367.72  1306.54
 85  368.10  1261.46
 86  368.47  1220.20
 87  368.85  1190.38
 88  369.23  1178.94
 89  369.60  1144.96
 90  369.98  1136.98
 91  370.36  1142.18
 92  370.73  1131.09
 93  371.11  1128.66
 94  371.49  1117.22
 95  371.86  1115.14
 96  372.24  1125.54
 97  372.62  1131.43
 98  372.99  1120.68
 99  373.37  1124.15
100  373.74  1120.34
101  374.12  1114.44
102  374.50  1107.16
103  374.87  1101.27
104  375.25  1100.23
105  375.62  1103.35
106  376.00  1094.68
107  376.38  1096.06
```

```
108  376.75  1109.59
109  377.13  1115.83
110  377.50  1112.71
111  377.88  1094.33
112  378.26  1102.65
113  378.63  1103.69
114  379.01  1100.92
115  379.38  1086.36
116  379.76  1078.03
117  380.13  1093.64
118  380.51  1108.89
119  380.88  1098.49
120  381.26  1103.35
121  381.64  1110.28
122  382.01  1123.80
123  382.39  1129.35
124  382.76  1120.68
125  383.14  1114.09
126  383.51  1112.01
127  383.89  1103.69
128  384.26  1102.65
129  384.64  1104.39
130  385.01  1104.39
131  385.39  1105.77
132  385.76  1109.24
133  386.14  1108.20
134  386.51  1113.75
135  386.89  1111.67
136  387.26  1110.28
137  387.64  1109.59
138  388.01  1110.63
139  388.39  1120.34
140  388.76  1128.31
141  389.13  1135.94
142  389.51  1144.61
143  389.88  1144.26
144  390.26  1147.04
145  390.63  1149.12
146  391.01  1138.71
147  391.38  1143.92
148  391.76  1134.90
149  392.13  1132.82
150  392.50  1143.22
151  392.88  1143.22
152  393.25  1144.61
153  393.63  1157.78
154  394.00  1150.50
```

```
394.37  1164.37
394.75  1163.33
395.12  1160.91
395.50  1170.61
395.87  1169.57
396.24  1159.87
396.62  1166.80
396.99  1166.80
397.37  1169.57
397.74  1179.28
398.11  1184.83
398.49  1201.82
398.86  1212.92
399.23  1218.12
399.61  1219.16
399.98  1240.31
400.35  1280.19
400.73  1481.30
401.10  1908.84
401.47  2694.22
401.85  4005.96
402.22  5770.55
402.59  7693.95
402.97  9535.17
403.34  10773.05
403.71  11363.21
404.09  11229.37
404.46  10256.05
404.83  8673.51
405.20  6937.00
405.58  5274.35
405.95  4047.22
406.32  3217.11
406.70  2703.58
407.07  2441.09
407.44  2303.43
407.81  2108.91
408.19  1875.55
408.56  1659.18
408.93  1453.56
409.30  1313.13
409.68  1231.30
410.05  1184.83
410.42  1168.88
410.79  1165.41
411.17  1164.37
411.54  1167.15
```

```
202  411.91  1167.15
203  412.28  1162.99
204  412.65  1151.20
205  413.03  1148.42
206  413.40  1149.81
207  413.77  1141.83
208  414.14  1141.14
209  414.51  1135.25
210  414.89  1134.55
211  415.26  1140.10
212  415.63  1138.71
213  416.00  1141.83
214  416.37  1135.94
215  416.74  1131.78
216  417.12  1139.06
217  417.49  1146.00
218  417.86  1146.00
219  418.23  1142.18
220  418.60  1140.79
221  418.97  1149.81
222  419.34  1151.89
223  419.72  1155.01
224  420.09  1137.67
225  420.46  1148.42
226  420.83  1153.62
227  421.20  1170.27
228  421.57  1170.96
229  421.94  1183.79
230  422.31  1173.39
231  422.69  1190.38
232  423.06  1180.67
233  423.43  1185.87
234  423.80  1175.47
235  424.17  1178.94
236  424.54  1173.39
237  424.91  1184.48
238  425.28  1181.02
239  425.65  1187.61
240  426.02  1202.52
241  426.39  1214.30
242  426.76  1239.96
243  427.13  1253.14
244  427.51  1270.13
245  427.88  1295.79
246  428.25  1312.43
247  428.62  1312.09
248  428.99  1314.17
```

```
249  429.36  1314.17
250  429.73  1320.41
251  430.10  1331.85
252  430.47  1344.33
253  430.84  1369.99
254  431.21  1423.05
255  431.58  1609.25
256  431.95  2164.04
257  432.32  3427.24
258  432.69  5702.24
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260  433.43  15064.03
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1558  877.46  1112.36
1559  877.77  1119.64
1560  878.08  1115.48
1561  878.39  1123.80
1562  878.71  1121.72
1563  879.02  1114.79
1564  879.33  1108.55
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880.27  1096.41
880.58  1092.25
880.89  1095.72
881.20  1094.33
881.52  1106.81
881.83  1104.04
882.14  1106.81
882.45  1107.85
882.76  1100.57
883.07  1103.69
883.39  1100.57
883.70  1096.76
884.01  1110.97
884.32  1114.10
884.63  1118.26
884.94  1124.15
885.25  1116.87
885.57  1119.99
885.88  1122.07
886.19  1115.14
886.50  1123.46
886.81  1129.70
887.12  1132.13
887.43  1124.15
887.74  1133.51
888.05  1119.30
888.37  1129.01
888.68  1123.11
888.99  1117.56
889.30  1122.42
889.61  1130.05
889.92  1127.96
890.23  1134.21
890.54  1123.11
890.85  1118.95
891.16  1125.19
891.47  1123.11
891.78  1131.78
892.09  1124.84
892.40  1116.87
892.71  1123.11
893.02  1118.60
893.33  1112.71
893.64  1107.16
893.95  1097.10
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1614	894.88	1097.80
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1616	895.50	1097.10
1617	895.81	1097.45
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1620	896.74	1114.09
1621	897.05	1108.55
1622	897.36	1112.36
1623	897.67	1110.28
1624	897.98	1112.71
1625	898.29	1108.89
1626	898.60	1126.23
1627	898.91	1119.64
1628	899.22	1124.50
1629	899.52	1129.01
1630	899.83	1126.23
1631	900.14	1115.83
1632	900.45	1104.04
1633	900.76	1084.62
1634	901.07	1085.66
1635	901.38	1087.05
1636	901.69	1081.50
1637	902.00	1088.44
1638	902.30	1093.98
1639	902.61	1103.69
1640	902.92	1107.51
1641	903.23	1101.96
1642	903.54	1103.35
1643	903.85	1112.01
1644	904.16	1109.93
1645	904.46	1106.12
1646	904.77	1109.24
1647	905.08	1112.36
1648	905.39	1112.01
1649	905.70	1101.61
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1651	906.31	1092.25
1652	906.62	1092.60
1653	906.93	1084.97
1654	907.24	1091.56
1655	907.55	1094.68
1656	907.85	1097.45
1657	908.16	1094.33
1658	908.47	1098.49

1659	908.78	1101.61
1660	909.08	1113.40
1661	909.39	1117.22
1662	909.70	1121.03
1663	910.01	1130.74
1664	910.31	1133.86
1665	910.62	1124.50
1666	910.93	1122.07
1667	911.24	1120.34
1668	911.54	1123.46
1669	911.85	1117.56
1670	912.16	1113.05
1671	912.46	1118.26
1672	912.77	1127.27
1673	913.08	1132.13
1674	913.39	1123.80
1675	913.69	1115.14
1676	914.00	1126.23
1677	914.31	1133.17
1678	914.61	1124.50
1679	914.92	1127.96
1680	915.23	1132.82
1681	915.53	1138.37
1682	915.84	1138.02
1683	916.15	1139.41
1684	916.45	1129.70
1685	916.76	1132.13
1686	917.06	1126.58
1687	917.37	1127.62
1688	917.68	1125.54
1689	917.98	1120.68
1690	918.29	1114.44
1691	918.60	1113.75
1692	918.90	1129.70
1693	919.21	1137.33
1694	919.51	1127.27
1695	919.82	1123.80
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1698	920.74	1141.49
1699	921.04	1124.84
1700	921.35	1117.91
1701	921.65	1128.31
1702	921.96	1132.47
1703	922.26	1122.76
1704	922.57	1111.32
1705	922.88	1113.05

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1713  925.32  1116.87
1714  925.62  1121.38
1715  925.93  1127.96
1716  926.23  1116.52
1717  926.54  1121.38
1718  926.84  1129.70
1719  927.15  1122.76
1720  927.45  1122.42
1721  927.76  1128.31
1722  928.06  1132.82
1723  928.36  1138.02
1724  928.67  1132.13
1725  928.97  1121.03
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1727  929.58  1132.13
1728  929.89  1130.74
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1730  930.50  1115.83
1731  930.80  1121.03
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1733  931.41  1113.05
1734  931.71  1108.55
1735  932.02  1115.48
1736  932.32  1121.03
1737  932.62  1117.56
1738  932.93  1108.20
1739  933.23  1116.18
1740  933.53  1120.34
1741  933.84  1117.56
1742  934.14  1109.24
1743  934.44  1115.14
1744  934.75  1108.20
1745  935.05  1114.79
1746  935.36  1108.89
1747  935.66  1096.41
1748  935.96  1106.47
1749  936.27  1097.45
1750  936.57  1087.05
1751  936.87  1090.52
1752  937.17  1084.97
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1755	938.08	1090.86
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1757	938.69	1114.79
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1760	939.60	1124.50
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1762	940.20	1122.42
1763	940.51	1112.36
1764	940.81	1113.75
1765	941.11	1106.12
1766	941.41	1106.12
1767	941.71	1105.08
1768	942.02	1093.29
1769	942.32	1096.41
1770	942.62	1096.06
1771	942.92	1090.86
1772	943.23	1091.56
1773	943.53	1092.60
1774	943.83	1093.29
1775	944.13	1091.90
1776	944.43	1094.33
1777	944.74	1095.02
1778	945.04	1104.04
1779	945.34	1104.73
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1781	945.94	1113.05
1782	946.24	1117.22
1783	946.55	1117.56
1784	946.85	1116.18
1785	947.15	1099.18
1786	947.45	1101.27
1787	947.75	1097.45
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1789	948.35	1104.04
1790	948.66	1109.93
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1798	951.06	1122.42
1799	951.36	1116.52

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1808  954.07  1126.58
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1813  955.57  1108.89
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1815  956.17  1109.93
1816  956.47  1119.64
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1828  960.06  1087.74
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1844  964.85  1083.58
1845  965.14  1083.23
1846  965.44  1084.97
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1856	968.42	1114.10
1857	968.72	1114.10
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1861	969.91	1127.62
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1871	972.89	1135.59
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1873	973.48	1136.98
1874	973.78	1138.02
1875	974.08	1133.86
1876	974.37	1130.39
1877	974.67	1124.84
1878	974.97	1126.23
1879	975.26	1125.54
1880	975.56	1121.03
1881	975.86	1124.15
1882	976.15	1136.63
1883	976.45	1138.71
1884	976.75	1133.17
1885	977.04	1121.38
1886	977.34	1114.10
1887	977.63	1116.87
1888	977.93	1105.08
1889	978.23	1105.77
1890	978.52	1106.47
1891	978.82	1103.69
1892	979.12	1123.80
1893	979.41	1135.59

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1898  980.89  1119.99
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1901  981.78  1121.38
1902  982.07  1118.95
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1904  982.67  1104.73
1905  982.96  1125.19
1906  983.26  1132.13
1907  983.55  1117.22
1908  983.85  1119.64
1909  984.14  1122.07
1910  984.44  1121.03
1911  984.73  1129.01
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1914  985.62  1089.82
1915  985.91  1083.93
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1918  986.80  1098.14
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1921  987.68  1127.27
1922  987.98  1132.82
1923  988.27  1126.92
1924  988.56  1126.23
1925  988.86  1130.05
1926  989.15  1118.60
1927  989.45  1108.20
1928  989.74  1106.81
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1930  990.33  1103.35
1931  990.62  1101.27
1932  990.92  1102.31
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1935  991.80  1107.16
1936  992.09  1106.81
1937  992.39  1103.35
1938  992.68  1104.73
1939  992.98  1110.28
1940  993.27  1108.89
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1943  994.15  1133.17
1944  994.44  1140.45
1945  994.74  1149.81
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1947  995.32  1139.41
1948  995.62  1138.37
1949  995.91  1124.84
1950  996.20  1104.73
1951  996.50  1093.98
1952  996.79  1084.97
1953  997.08  1086.01
1954  997.38  1085.32
1955  997.67  1087.74
1956  997.96  1095.37
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1961  999.42  1090.17
1962  999.72  1088.09
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1964  1000.30 1089.82
1965  1000.59 1085.66
1966  1000.89 1100.57
1967  1001.18 1102.31
1968  1001.47 1110.28
1969  1001.76 1107.85
1970  1002.06 1103.00
1971  1002.35 1108.55
1972  1002.64 1110.28
1973  1002.93 1108.20
1974  1003.22 1114.79
1975  1003.52 1101.61
1976  1003.81 1100.57
1977  1004.10 1110.97
1978  1004.39 1099.18
1979  1004.68 1096.76
1980  1004.97 1094.68
1981  1005.27 1094.68
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1983  1005.85 1109.24
1984  1006.14 1115.48
1985  1006.43 1125.88
1986  1006.72 1121.38
1987  1007.01 1116.52
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1990  1007.89 1118.60
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1993  1008.76 1109.93
1994  1009.05 1115.14
1995  1009.34 1123.11
1996  1009.63 1117.91
1997  1009.93 1116.52
1998  1010.22 1124.15
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2001  1011.09 1140.79
2002  1011.38 1132.47
2003  1011.67 1130.39
2004  1011.96 1126.92
2005  1012.25 1115.83
2006  1012.54 1103.35
2007  1012.83 1106.81
2008  1013.12 1101.27
2009  1013.41 1104.04
2010  1013.70 1122.07
2011  1013.99 1129.70
2012  1014.28 1141.49
2013  1014.57 1149.81
2014  1014.86 1161.60
2015  1015.15 1182.06
2016  1015.44 1197.66
2017  1015.73 1200.78
2018  1016.02 1210.84
2019  1016.31 1203.21
2020  1016.60 1205.98
2021  1016.89 1201.13
2022  1017.18 1194.19
2023  1017.47 1182.40
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2025  1018.05 1162.29
2026  1018.34 1162.29
2027  1018.62 1157.09
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2029  1019.20 1147.73
2030  1019.49 1143.92
2031  1019.78 1132.13
2032  1020.07 1135.59
2033  1020.36 1126.92
2034  1020.65 1122.07
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1023.25 1116.87
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1024.40 1141.14
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1024.97 1140.45
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1026.13 1107.51
1026.41 1075.26
1026.70 1075.26
1026.99 1075.26
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Listing 3: 钠灯

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暗光谱: 否
参考光谱: 否
光谱数量: 1
光谱仪: USB2+H14105
积分时间（毫秒）: 1 (USB2+H14105)
平均次数: 1 (USB2+H14105)
平滑度: 3 (USB2+H14105)
去除暗噪声: 否 (USB2+H14105)


339.35  774.28
339.73  774.28
340.11  774.28
340.49  754.52
340.87  737.18
341.25  745.50
341.63  741.00
342.01  735.80
342.39  749.32
342.77  768.04
343.15  781.91
343.53  804.80
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25  344.66  848.14
26  345.04  860.62
27  345.42  866.17
28  345.80  884.90
29  346.18  908.82
30  346.56  933.09
31  346.94  955.98
32  347.32  962.91
33  347.70  979.56
34  348.08  998.63
35  348.45  1017.70
36  348.83  1034.69
37  349.21  1055.15
38  349.59  1058.62
39  349.97  1077.69
40  350.35  1086.36
41  350.73  1110.97
42  351.10  1108.55
43  351.48  1113.40
44  351.86  1112.36
45  352.24  1122.42
46  352.62  1119.99
47  353.00  1136.63
48  353.37  1125.54
49  353.75  1144.96
50  354.13  1140.79
51  354.51  1148.77
52  354.89  1152.24
53  355.27  1155.36
54  355.64  1143.92
55  356.02  1140.79
56  356.40  1131.09
57  356.78  1125.88
58  357.16  1122.07
59  357.53  1123.46
60  357.91  1125.19
61  358.29  1132.47
62  358.67  1135.59
63  359.04  1133.17
64  359.42  1142.53
65  359.80  1131.78
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67  360.55  1124.84
68  360.93  1115.48
69  361.31  1113.75
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 72  362.44  1115.83
 73  362.82  1118.95
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 76  363.95  1110.97
 77  364.33  1107.16
 78  364.71  1110.28
 79  365.08  1106.12
 80  365.46  1100.23
 81  365.84  1101.27
 82  366.21  1090.17
 83  366.59  1090.52
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 85  367.34  1090.17
 86  367.72  1091.21
 87  368.10  1093.29
 88  368.47  1083.58
 89  368.85  1087.05
 90  369.23  1083.23
 91  369.60  1089.82
 92  369.98  1080.11
 93  370.36  1074.91
 94  370.73  1076.99
 95  371.11  1088.78
 96  371.49  1082.89
 97  371.86  1088.78
 98  372.24  1086.70
 99  372.62  1090.86
100  372.99  1092.60
101  373.37  1086.70
102  373.74  1089.13
103  374.12  1100.57
104  374.50  1102.65
105  374.87  1100.57
106  375.25  1107.16
107  375.62  1118.95
108  376.00  1119.64
109  376.38  1109.59
110  376.75  1103.35
111  377.13  1105.77
112  377.50  1103.35
113  377.88  1101.96
114  378.26  1101.96
115  378.63  1106.47
116  379.01  1108.89
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118  379.76  1122.42
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123  381.64  1112.71
124  382.01  1093.64
125  382.39  1092.25
126  382.76  1082.89
127  383.14  1083.93
128  383.51  1097.10
129  383.89  1087.74
130  384.26  1099.18
131  384.64  1108.20
132  385.01  1102.65
133  385.39  1100.23
134  385.76  1117.22
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136  386.51  1106.81
137  386.89  1115.14
138  387.26  1116.87
139  387.64  1120.68
140  388.01  1133.86
141  388.39  1116.52
142  388.76  1119.30
143  389.13  1127.96
144  389.51  1121.38
145  389.88  1127.62
146  390.26  1129.35
147  390.63  1122.76
148  391.01  1129.35
149  391.38  1120.68
150  391.76  1123.80
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867.12  1180.67
867.43  1175.82
867.74  1172.35
868.06  1168.88
868.37  1168.53
868.69  1153.28
869.00  1147.38
869.31  1130.74
869.63  1138.37
869.94  1143.22
870.25  1138.02
870.57  1135.59
870.88  1147.73
871.20  1146.00
871.51  1156.74
871.82  1147.04
872.14  1134.21
872.45  1131.78
872.76  1128.66
873.08  1120.34
873.39  1131.09
873.70  1132.82
874.02  1142.53
874.33  1146.00
874.64  1139.75
874.95  1140.45
875.27  1145.30
875.58  1131.78
875.89  1134.90
876.21  1122.42
876.52  1123.46
876.83  1135.94
877.14  1141.83
877.46  1141.83
877.77  1144.61
878.08  1145.30
878.39  1146.00
878.71  1148.08
879.02  1149.81
879.33  1142.18
879.64  1139.06
879.95  1145.65
880.27  1147.04
880.58  1142.18
880.89  1141.14
881.20  1135.94
881.52  1142.87
```

1574	881.83	1135.94
1575	882.14	1131.78
1576	882.45	1128.66
1577	882.76	1138.02
1578	883.07	1140.10
1579	883.39	1140.79
1580	883.70	1149.12
1581	884.01	1153.28
1582	884.32	1146.69
1583	884.63	1139.06
1584	884.94	1135.59
1585	885.25	1130.05
1586	885.57	1119.64
1587	885.88	1105.43
1588	886.19	1106.12
1589	886.50	1115.14
1590	886.81	1118.60
1591	887.12	1120.34
1592	887.43	1113.05
1593	887.74	1119.99
1594	888.05	1115.83
1595	888.37	1115.14
1596	888.68	1097.80
1597	888.99	1100.92
1598	889.30	1096.76
1599	889.61	1110.97
1600	889.92	1114.09
1601	890.23	1116.18
1602	890.54	1118.60
1603	890.85	1121.72
1604	891.16	1115.48
1605	891.47	1114.10
1606	891.78	1107.16
1607	892.09	1109.59
1608	892.40	1108.89
1609	892.71	1113.05
1610	893.02	1125.88
1611	893.33	1118.95
1612	893.64	1132.13
1613	893.95	1133.17
1614	894.26	1131.09
1615	894.57	1141.14
1616	894.88	1138.71
1617	895.19	1144.26
1618	895.50	1154.32
1619	895.81	1141.14
1620	896.12	1141.49

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1621  896.43  1145.65
1622  896.74  1142.53
1623  897.05  1139.41
1624  897.36  1124.15
1625  897.67  1126.23
1626  897.98  1123.80
1627  898.29  1119.99
1628  898.60  1113.75
1629  898.91  1117.56
1630  899.22  1123.80
1631  899.52  1134.55
1632  899.83  1130.39
1633  900.14  1142.87
1634  900.45  1150.85
1635  900.76  1148.08
1636  901.07  1149.46
1637  901.38  1142.53
1638  901.69  1137.67
1639  902.00  1141.83
1640  902.30  1136.29
1641  902.61  1132.13
1642  902.92  1138.37
1643  903.23  1132.82
1644  903.54  1128.66
1645  903.85  1123.11
1646  904.16  1121.72
1647  904.46  1123.80
1648  904.77  1130.74
1649  905.08  1134.55
1650  905.39  1144.96
1651  905.70  1157.78
1652  906.01  1166.45
1653  906.31  1169.92
1654  906.62  1172.35
1655  906.93  1162.29
1656  907.24  1150.50
1657  907.55  1133.51
1658  907.85  1134.21
1659  908.16  1130.39
1660  908.47  1124.84
1661  908.78  1123.11
1662  909.08  1119.30
1663  909.39  1121.38
1664  909.70  1135.94
1665  910.01  1128.66
1666  910.31  1132.13
1667  910.62  1151.20
```

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1669	911.24	1206.68
1670	911.54	1252.45
1671	911.85	1271.86
1672	912.16	1293.36
1673	912.46	1295.79
1674	912.77	1285.73
1675	913.08	1258.34
1676	913.39	1238.58
1677	913.69	1200.43
1678	914.00	1171.31
1679	914.31	1146.69
1680	914.61	1142.18
1681	914.92	1139.75
1682	915.23	1140.79
1683	915.53	1138.37
1684	915.84	1141.14
1685	916.15	1144.26
1686	916.45	1149.12
1687	916.76	1155.36
1688	917.06	1149.81
1689	917.37	1153.62
1690	917.68	1148.77
1691	917.98	1141.83
1692	918.29	1140.79
1693	918.60	1145.65
1694	918.90	1137.67
1695	919.21	1143.92
1696	919.51	1134.21
1697	919.82	1136.63
1698	920.13	1139.06
1699	920.43	1141.83
1700	920.74	1137.67
1701	921.04	1136.98
1702	921.35	1147.04
1703	921.65	1165.41
1704	921.96	1167.84
1705	922.26	1171.31
1706	922.57	1176.86
1707	922.88	1168.88
1708	923.18	1174.78
1709	923.49	1159.52
1710	923.79	1138.02
1711	924.10	1134.55
1712	924.40	1127.96
1713	924.71	1119.99
1714	925.01	1121.03

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1715  925.32  1113.05
1716  925.62  1113.75
1717  925.93  1126.92
1718  926.23  1126.92
1719  926.54  1125.19
1720  926.84  1126.92
1721  927.15  1134.90
1722  927.45  1134.55
1723  927.76  1130.05
1724  928.06  1125.54
1725  928.36  1136.63
1726  928.67  1135.94
1727  928.97  1131.43
1728  929.28  1125.88
1729  929.58  1121.38
1730  929.89  1132.13
1731  930.19  1129.70
1732  930.50  1119.64
1733  930.80  1115.48
1734  931.10  1115.83
1735  931.41  1121.38
1736  931.71  1125.19
1737  932.02  1119.99
1738  932.32  1119.30
1739  932.62  1108.55
1740  932.93  1111.67
1741  933.23  1111.32
1742  933.53  1110.97
1743  933.84  1108.55
1744  934.14  1107.85
1745  934.44  1110.97
1746  934.75  1129.35
1747  935.05  1144.96
1748  935.36  1146.00
1749  935.66  1141.83
1750  935.96  1134.55
1751  936.27  1130.05
1752  936.57  1121.38
1753  936.87  1117.91
1754  937.17  1119.30
1755  937.48  1120.34
1756  937.78  1123.46
1757  938.08  1140.45
1758  938.39  1144.26
1759  938.69  1153.62
1760  938.99  1143.22
1761  939.29  1143.22
```

939.60 1148.77
939.90 1144.96
940.20 1146.34
940.51 1149.46
940.81 1150.85
941.11 1161.60
941.41 1147.04
941.71 1141.49
942.02 1144.61
942.32 1129.01
942.62 1133.17
942.92 1123.80
943.23 1125.19
943.53 1131.78
943.83 1131.09
944.13 1133.86
944.43 1150.16
944.74 1143.57
945.04 1151.54
945.34 1141.49
945.64 1133.17
945.94 1130.74
946.24 1126.23
946.55 1116.52
946.85 1106.81
947.15 1107.51
947.45 1116.52
947.75 1119.30
948.05 1112.71
948.35 1115.14
948.66 1115.14
948.96 1122.42
949.26 1116.87
949.56 1116.18
949.86 1116.87
950.16 1132.82
950.46 1131.43
950.76 1135.59
951.06 1138.71
951.36 1136.98
951.66 1129.70
951.97 1128.31
952.27 1120.68
952.57 1111.67
952.87 1113.05
953.17 1115.48
953.47 1117.56

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1811  954.37  1120.34
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1813  954.97  1130.05
1814  955.27  1122.07
1815  955.57  1128.66
1816  955.87  1120.68
1817  956.17  1132.82
1818  956.47  1130.39
1819  956.77  1133.51
1820  957.07  1125.19
1821  957.37  1143.57
1822  957.67  1143.92
1823  957.97  1162.64
1824  958.27  1157.09
1825  958.57  1149.81
1826  958.87  1142.87
1827  959.17  1160.91
1828  959.47  1141.14
1829  959.76  1141.14
1830  960.06  1131.09
1831  960.36  1138.37
1832  960.66  1138.02
1833  960.96  1137.33
1834  961.26  1126.58
1835  961.56  1127.96
1836  961.86  1123.80
1837  962.16  1119.64
1838  962.46  1116.87
1839  962.76  1114.10
1840  963.05  1117.22
1841  963.35  1116.52
1842  963.65  1120.34
1843  963.95  1122.07
1844  964.25  1135.94
1845  964.55  1143.22
1846  964.85  1156.05
1847  965.14  1162.64
1848  965.44  1166.80
1849  965.74  1168.19
1850  966.04  1164.37
1851  966.34  1156.74
1852  966.64  1150.50
1853  966.93  1143.57
1854  967.23  1139.06
1855  967.53  1134.55
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1857	968.13	1138.71
1858	968.42	1137.67
1859	968.72	1135.94
1860	969.02	1141.49
1861	969.32	1140.45
1862	969.62	1144.96
1863	969.91	1136.29
1864	970.21	1149.81
1865	970.51	1156.74
1866	970.81	1145.30
1867	971.10	1144.61
1868	971.40	1143.22
1869	971.70	1134.21
1870	972.00	1138.02
1871	972.29	1126.92
1872	972.59	1119.64
1873	972.89	1123.11
1874	973.18	1121.72
1875	973.48	1119.99
1876	973.78	1123.80
1877	974.08	1113.05
1878	974.37	1107.51
1879	974.67	1111.67
1880	974.97	1110.63
1881	975.26	1110.63
1882	975.56	1121.72
1883	975.86	1122.07
1884	976.15	1132.47
1885	976.45	1139.06
1886	976.75	1133.51
1887	977.04	1134.55
1888	977.34	1135.59
1889	977.63	1125.88
1890	977.93	1127.96
1891	978.23	1125.19
1892	978.52	1123.80
1893	978.82	1120.34
1894	979.12	1123.80
1895	979.41	1127.96
1896	979.71	1121.72
1897	980.00	1109.93
1898	980.30	1121.38
1899	980.60	1131.43
1900	980.89	1130.74
1901	981.19	1126.58
1902	981.48	1119.99

1903	981.78	1125.88
1904	982.07	1135.94
1905	982.37	1119.99
1906	982.67	1119.30
1907	982.96	1123.46
1908	983.26	1120.68
1909	983.55	1120.68
1910	983.85	1117.56
1911	984.14	1107.85
1912	984.44	1110.28
1913	984.73	1108.20
1914	985.03	1115.48
1915	985.32	1125.88
1916	985.62	1129.35
1917	985.91	1144.61
1918	986.21	1155.01
1919	986.50	1163.33
1920	986.80	1159.52
1921	987.09	1145.30
1922	987.39	1138.37
1923	987.68	1131.43
1924	987.98	1128.66
1925	988.27	1133.86
1926	988.56	1123.80
1927	988.86	1124.15
1928	989.15	1134.21
1929	989.45	1141.49
1930	989.74	1150.85
1931	990.04	1146.00
1932	990.33	1140.10
1933	990.62	1140.45
1934	990.92	1142.53
1935	991.21	1140.79
1936	991.51	1140.10
1937	991.80	1141.49
1938	992.09	1146.00
1939	992.39	1135.59
1940	992.68	1126.92
1941	992.98	1123.80
1942	993.27	1125.54
1943	993.56	1119.30
1944	993.86	1115.48
1945	994.15	1105.77
1946	994.44	1115.83
1947	994.74	1120.68
1948	995.03	1126.23
1949	995.32	1127.27

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995.62  1130.05
995.91  1131.43
996.20  1128.31
996.50  1118.26
996.79  1127.96
997.08  1126.23
997.38  1122.42
997.67  1129.01
997.96  1124.15
998.25  1133.51
998.55  1141.14
998.84  1146.34
999.13  1147.73
999.42  1148.08
999.72  1143.92
1000.01 1138.02
1000.30 1133.17
1000.59 1131.43
1000.89 1118.95
1001.18 1111.67
1001.47 1117.22
1001.76 1109.24
1002.06 1117.91
1002.35 1113.75
1002.64 1115.83
1002.93 1124.84
1003.22 1129.01
1003.52 1125.88
1003.81 1136.98
1004.10 1137.33
1004.39 1140.79
1004.68 1140.10
1004.97 1135.59
1005.27 1139.06
1005.56 1136.29
1005.85 1121.72
1006.14 1118.26
1006.43 1123.80
1006.72 1131.09
1007.01 1139.06
1007.31 1127.62
1007.60 1132.47
1007.89 1144.96
1008.18 1149.12
1008.47 1151.89
1008.76 1144.26
1009.05 1132.13
```

1997 1009.34 1149.46
1998 1009.63 1141.49
1999 1009.93 1140.79
2000 1010.22 1132.47
2001 1010.51 1127.27
2002 1010.80 1129.35
2003 1011.09 1132.47
2004 1011.38 1129.70
2005 1011.67 1144.61
2006 1011.96 1145.65
2007 1012.25 1141.83
2008 1012.54 1141.83
2009 1012.83 1134.21
2010 1013.12 1134.21
2011 1013.41 1130.74
2012 1013.70 1121.38
2013 1013.99 1117.22
2014 1014.28 1125.54
2015 1014.57 1131.09
2016 1014.86 1150.16
2017 1015.15 1147.04
2018 1015.44 1150.85
2019 1015.73 1155.70
2020 1016.02 1163.33
2021 1016.31 1167.15
2022 1016.60 1159.87
2023 1016.89 1144.96
2024 1017.18 1146.34
2025 1017.47 1140.10
2026 1017.76 1142.18
2027 1018.05 1139.06
2028 1018.34 1136.29
2029 1018.62 1136.63
2030 1018.91 1135.94
2031 1019.20 1143.57
2032 1019.49 1136.98
2033 1019.78 1132.47
2034 1020.07 1126.92
2035 1020.36 1139.06
2036 1020.65 1140.79
2037 1020.94 1138.71
2038 1021.23 1133.86
2039 1021.51 1141.83
2040 1021.80 1129.35
2041 1022.09 1134.90
2042 1022.38 1122.76
2043 1022.67 1116.87

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1022.96 1122.07
1023.25 1125.88
1023.53 1115.83
1023.82 1119.99
1024.11 1116.87
1024.40 1119.30
1024.69 1117.22
1024.97 1125.19
1025.26 1108.89
1025.55 1123.46
1025.84 1132.82
1026.13 1140.45
1026.41 1179.63
1026.70 1179.63
1026.99 1179.63
```

Listing 4: 氢氘灯

```
暗光谱: 否
参考光谱: 否
光谱数量: 1
光谱仪: USB2+H14105
积分时间（毫秒）: 23 (USB2+H14105)
平均次数: 1 (USB2+H14105)
平滑度: 3 (USB2+H14105)
去除暗噪声: 否 (USB2+H14105)
339.35  796.13
339.73  796.13
340.11  796.13
340.49  781.91
340.87  769.43
341.25  769.78
341.63  767.70
342.01  768.39
342.39  770.12
342.77  771.51
343.15  775.67
343.53  798.90
343.91  804.45
344.29  819.36
344.66  840.86
345.04  851.26
345.42  865.82
345.80  889.75
346.18  904.31
346.56  918.53
346.94  932.40
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30  347.32  952.86
31  347.70  983.03
32  348.08  1016.66
33  348.45  1033.65
34  348.83  1056.19
35  349.21  1084.97
36  349.59  1096.06
37  349.97  1112.71
38  350.35  1121.38
39  350.73  1126.58
40  351.10  1133.51
41  351.48  1147.04
42  351.86  1159.17
43  352.24  1178.24
44  352.62  1181.71
45  353.00  1187.95
46  353.37  1191.42
47  353.75  1205.64
48  354.13  1205.29
49  354.51  1207.02
50  354.89  1210.84
51  355.27  1216.73
52  355.64  1214.65
53  356.02  1215.34
54  356.40  1202.86
55  356.78  1197.31
56  357.16  1195.23
57  357.53  1190.03
58  357.91  1187.95
59  358.29  1184.14
60  358.67  1174.08
61  359.04  1180.32
62  359.42  1172.00
63  359.80  1167.15
64  360.18  1163.33
65  360.55  1170.96
66  360.93  1176.16
67  361.31  1190.73
68  361.69  1176.51
69  362.06  1193.50
70  362.44  1191.07
71  362.82  1203.56
72  363.20  1189.69
73  363.57  1179.63
74  363.95  1180.67
75  364.33  1194.19
76  364.71  1186.56
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 77  365.08  1194.19
 78  365.46  1196.62
 79  365.84  1203.21
 80  366.21  1219.51
 81  366.59  1213.26
 82  366.97  1218.47
 83  367.34  1229.91
 84  367.72  1230.95
 85  368.10  1224.36
 86  368.47  1227.83
 87  368.85  1224.01
 88  369.23  1218.81
 89  369.60  1224.71
 90  369.98  1211.18
 91  370.36  1208.06
 92  370.73  1204.60
 93  371.11  1204.60
 94  371.49  1198.01
 95  371.86  1203.21
 96  372.24  1203.90
 97  372.62  1214.65
 98  372.99  1212.92
 99  373.37  1218.81
100  373.74  1223.67
101  374.12  1225.75
102  374.50  1230.25
103  374.87  1227.83
104  375.25  1219.51
105  375.62  1223.32
106  376.00  1221.24
107  376.38  1219.85
108  376.75  1220.89
109  377.13  1219.51
110  377.50  1216.04
111  377.88  1214.30
112  378.26  1217.08
113  378.63  1221.93
114  379.01  1219.85
115  379.38  1230.95
116  379.76  1234.76
117  380.13  1238.23
118  380.51  1237.88
119  380.88  1228.87
120  381.26  1226.09
121  381.64  1231.64
122  382.01  1227.13
123  382.39  1228.17
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125  383.14  1242.39
126  383.51  1257.30
127  383.89  1258.69
128  384.26  1257.30
129  384.64  1248.63
130  385.01  1252.79
131  385.39  1265.28
132  385.76  1256.26
133  386.14  1258.34
134  386.51  1259.03
135  386.89  1254.18
136  387.26  1257.99
137  387.64  1258.34
138  388.01  1254.87
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1498  858.62  1167.84
1499  858.93  1164.72
1500  859.25  1168.53
1501  859.56  1170.27
1502  859.88  1167.15
1503  860.19  1156.05
1504  860.51  1145.30
1505  860.82  1148.08
1506  861.14  1148.08
1507  861.45  1144.96
1508  861.77  1144.96
1509  862.08  1143.92
1510  862.40  1149.81
1511  862.71  1150.85
1512  863.03  1150.50
1513  863.34  1158.13
1514  863.66  1157.44
1515  863.97  1158.13
1516  864.29  1162.64
1517  864.60  1152.93
1518  864.92  1147.38
1519  865.23  1145.65
1520  865.54  1136.63
1521  865.86  1143.57
1522  866.17  1145.65
1523  866.49  1150.85
1524  866.80  1159.87
1525  867.12  1163.68
1526  867.43  1167.15
1527  867.74  1179.63
1528  868.06  1174.08
1529  868.37  1176.16
1530  868.69  1165.76
1531  869.00  1173.04
1532  869.31  1170.96
1533  869.63  1165.41
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870.57  1162.64
870.88  1163.33
871.20  1155.01
871.51  1150.16
871.82  1158.48
872.14  1144.61
872.45  1141.14
872.76  1141.14
873.08  1144.61
873.39  1144.26
873.70  1141.83
874.02  1144.96
874.33  1142.18
874.64  1145.30
874.95  1141.83
875.27  1139.06
875.58  1136.98
875.89  1141.49
876.21  1131.43
876.52  1125.19
876.83  1122.07
877.14  1114.79
877.46  1119.30
877.77  1121.38
878.08  1123.80
878.39  1131.43
878.71  1140.10
879.02  1137.33
879.33  1152.58
879.64  1154.32
879.95  1146.00
880.27  1148.08
880.58  1143.57
880.89  1147.73
881.20  1147.38
881.52  1135.25
881.83  1133.17
882.14  1144.61
882.45  1142.53
882.76  1138.71
883.07  1142.53
883.39  1158.13
883.70  1164.72
884.01  1161.25
884.32  1153.28
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1582  884.94  1166.11
1583  885.25  1167.84
1584  885.57  1154.32
1585  885.88  1147.73
1586  886.19  1154.32
1587  886.50  1159.52
1588  886.81  1164.37
1589  887.12  1161.60
1590  887.43  1159.87
1591  887.74  1167.15
1592  888.05  1173.04
1593  888.37  1168.88
1594  888.68  1171.31
1595  888.99  1171.65
1596  889.30  1182.06
1597  889.61  1174.43
1598  889.92  1161.25
1599  890.23  1168.19
1600  890.54  1171.31
1601  890.85  1176.51
1602  891.16  1174.78
1603  891.47  1171.31
1604  891.78  1171.31
1605  892.09  1173.74
1606  892.40  1156.05
1607  892.71  1153.62
1608  893.02  1140.79
1609  893.33  1145.30
1610  893.64  1140.10
1611  893.95  1127.96
1612  894.26  1129.70
1613  894.57  1138.71
1614  894.88  1144.61
1615  895.19  1145.65
1616  895.50  1142.18
1617  895.81  1137.67
1618  896.12  1141.49
1619  896.43  1148.42
1620  896.74  1143.92
1621  897.05  1136.63
1622  897.36  1133.51
1623  897.67  1131.43
1624  897.98  1117.22
1625  898.29  1124.50
1626  898.60  1128.66
1627  898.91  1131.09
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1629	899.52	1147.73
1630	899.83	1141.83
1631	900.14	1162.29
1632	900.45	1165.41
1633	900.76	1164.37
1634	901.07	1168.53
1635	901.38	1166.11
1636	901.69	1157.44
1637	902.00	1166.80
1638	902.30	1148.08
1639	902.61	1148.77
1640	902.92	1142.18
1641	903.23	1146.00
1642	903.54	1155.01
1643	903.85	1153.62
1644	904.16	1145.30
1645	904.46	1152.93
1646	904.77	1148.77
1647	905.08	1144.96
1648	905.39	1148.42
1649	905.70	1135.94
1650	906.01	1136.29
1651	906.31	1135.94
1652	906.62	1134.90
1653	906.93	1130.05
1654	907.24	1139.41
1655	907.55	1126.58
1656	907.85	1139.41
1657	908.16	1138.02
1658	908.47	1140.10
1659	908.78	1150.50
1660	909.08	1157.78
1661	909.39	1148.42
1662	909.70	1159.87
1663	910.01	1150.85
1664	910.31	1158.48
1665	910.62	1158.13
1666	910.93	1153.28
1667	911.24	1159.52
1668	911.54	1162.64
1669	911.85	1146.69
1670	912.16	1147.73
1671	912.46	1147.38
1672	912.77	1153.97
1673	913.08	1152.58
1674	913.39	1142.53

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1677  914.31  1162.29
1678  914.61  1156.40
1679  914.92  1150.16
1680  915.23  1145.65
1681  915.53  1148.08
1682  915.84  1144.61
1683  916.15  1142.18
1684  916.45  1143.57
1685  916.76  1151.89
1686  917.06  1146.00
1687  917.37  1145.65
1688  917.68  1146.00
1689  917.98  1145.30
1690  918.29  1145.30
1691  918.60  1144.96
1692  918.90  1142.87
1693  919.21  1158.48
1694  919.51  1162.64
1695  919.82  1166.45
1696  920.13  1167.49
1697  920.43  1178.24
1698  920.74  1173.04
1699  921.04  1169.57
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1702  921.96  1166.45
1703  922.26  1170.61
1704  922.57  1163.68
1705  922.88  1163.33
1706  923.18  1162.99
1707  923.49  1157.09
1708  923.79  1155.01
1709  924.10  1157.78
1710  924.40  1145.65
1711  924.71  1146.34
1712  925.01  1143.92
1713  925.32  1133.51
1714  925.62  1144.61
1715  925.93  1139.06
1716  926.23  1132.82
1717  926.54  1138.37
1718  926.84  1146.00
1719  927.15  1142.53
1720  927.45  1143.57
1721  927.76  1131.78
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1723	928.36	1135.94
1724	928.67	1131.43
1725	928.97	1119.30
1726	929.28	1117.56
1727	929.58	1117.56
1728	929.89	1127.27
1729	930.19	1111.32
1730	930.50	1111.32
1731	930.80	1117.22
1732	931.10	1124.50
1733	931.41	1137.33
1734	931.71	1144.96
1735	932.02	1145.30
1736	932.32	1156.40
1737	932.62	1161.25
1738	932.93	1165.07
1739	933.23	1156.05
1740	933.53	1154.66
1741	933.84	1158.13
1742	934.14	1147.38
1743	934.44	1146.34
1744	934.75	1138.02
1745	935.05	1138.71
1746	935.36	1144.96
1747	935.66	1142.87
1748	935.96	1140.45
1749	936.27	1140.45
1750	936.57	1135.59
1751	936.87	1136.29
1752	937.17	1131.78
1753	937.48	1126.58
1754	937.78	1118.60
1755	938.08	1113.40
1756	938.39	1115.14
1757	938.69	1123.46
1758	938.99	1127.62
1759	939.29	1127.27
1760	939.60	1134.55
1761	939.90	1151.89
1762	940.20	1150.50
1763	940.51	1159.17
1764	940.81	1154.66
1765	941.11	1152.58
1766	941.41	1148.77
1767	941.71	1149.81
1768	942.02	1140.79

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1769  942.32  1149.81
1770  942.62  1143.92
1771  942.92  1158.13
1772  943.23  1161.60
1773  943.53  1166.11
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1775  944.13  1165.76
1776  944.43  1160.91
1777  944.74  1157.78
1778  945.04  1135.59
1779  945.34  1123.46
1780  945.64  1133.51
1781  945.94  1129.01
1782  946.24  1122.76
1783  946.55  1123.11
1784  946.85  1130.39
1785  947.15  1140.79
1786  947.45  1154.66
1787  947.75  1135.25
1788  948.05  1141.14
1789  948.35  1144.61
1790  948.66  1139.41
1791  948.96  1126.92
1792  949.26  1134.90
1793  949.56  1123.80
1794  949.86  1128.31
1795  950.16  1127.96
1796  950.46  1130.74
1797  950.76  1135.94
1798  951.06  1148.08
1799  951.36  1149.81
1800  951.66  1158.13
1801  951.97  1153.97
1802  952.27  1148.42
1803  952.57  1133.86
1804  952.87  1138.71
1805  953.17  1149.46
1806  953.47  1133.17
1807  953.77  1124.15
1808  954.07  1130.74
1809  954.37  1134.55
1810  954.67  1148.77
1811  954.97  1134.55
1812  955.27  1127.62
1813  955.57  1141.14
1814  955.87  1151.54
1815  956.17  1153.97
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1817  956.77  1143.57
1818  957.07  1150.85
1819  957.37  1144.26
1820  957.67  1133.17
1821  957.97  1141.83
1822  958.27  1135.59
1823  958.57  1143.92
1824  958.87  1141.83
1825  959.17  1141.14
1826  959.47  1139.41
1827  959.76  1150.50
1828  960.06  1140.79
1829  960.36  1143.57
1830  960.66  1129.01
1831  960.96  1134.55
1832  961.26  1137.67
1833  961.56  1143.22
1834  961.86  1127.62
1835  962.16  1128.31
1836  962.46  1129.70
1837  962.76  1146.34
1838  963.05  1143.57
1839  963.35  1148.77
1840  963.65  1141.14
1841  963.95  1152.24
1842  964.25  1149.12
1843  964.55  1164.03
1844  964.85  1148.77
1845  965.14  1151.89
1846  965.44  1145.65
1847  965.74  1152.58
1848  966.04  1136.98
1849  966.34  1136.63
1850  966.64  1131.09
1851  966.93  1133.51
1852  967.23  1131.09
1853  967.53  1132.82
1854  967.83  1133.51
1855  968.13  1151.20
1856  968.42  1154.66
1857  968.72  1141.14
1858  969.02  1149.81
1859  969.32  1148.42
1860  969.62  1156.40
1861  969.91  1152.93
1862  970.21  1155.01
```

970.51 1149.12
970.81 1157.44
971.10 1159.17
971.40 1162.29
971.70 1148.08
972.00 1146.34
972.29 1142.87
972.59 1142.87
972.89 1141.14
973.18 1138.02
973.48 1142.18
973.78 1145.65
974.08 1146.00
974.37 1142.53
974.67 1134.55
974.97 1138.37
975.26 1124.50
975.56 1117.22
975.86 1125.19
976.15 1122.76
976.45 1129.01
976.75 1142.53
977.04 1129.01
977.34 1143.57
977.63 1150.50
977.93 1140.10
978.23 1141.49
978.52 1146.34
978.82 1138.71
979.12 1140.79
979.41 1135.59
979.71 1132.13
980.00 1145.65
980.30 1143.57
980.60 1136.63
980.89 1132.82
981.19 1139.06
981.48 1140.79
981.78 1140.10
982.07 1126.92
982.37 1134.55
982.67 1132.82
982.96 1134.90
983.26 1134.21
983.55 1135.94
983.85 1137.67
984.14 1143.57

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1910  984.44  1133.86
1911  984.73  1129.70
1912  985.03  1146.69
1913  985.32  1149.46
1914  985.62  1153.28
1915  985.91  1151.89
1916  986.21  1149.46
1917  986.50  1154.66
1918  986.80  1154.66
1919  987.09  1143.57
1920  987.39  1140.45
1921  987.68  1124.50
1922  987.98  1131.09
1923  988.27  1130.05
1924  988.56  1132.47
1925  988.86  1128.66
1926  989.15  1135.59
1927  989.45  1134.90
1928  989.74  1132.13
1929  990.04  1121.38
1930  990.33  1122.07
1931  990.62  1115.48
1932  990.92  1126.92
1933  991.21  1124.50
1934  991.51  1126.23
1935  991.80  1141.83
1936  992.09  1142.18
1937  992.39  1141.14
1938  992.68  1145.65
1939  992.98  1145.65
1940  993.27  1149.46
1941  993.56  1155.70
1942  993.86  1145.30
1943  994.15  1151.54
1944  994.44  1147.73
1945  994.74  1138.71
1946  995.03  1138.37
1947  995.32  1133.51
1948  995.62  1121.72
1949  995.91  1119.64
1950  996.20  1117.56
1951  996.50  1127.27
1952  996.79  1133.86
1953  997.08  1128.31
1954  997.38  1126.58
1955  997.67  1133.86
1956  997.96  1137.67
```

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998.25  1127.62
998.55  1121.03
998.84  1121.03
999.13  1120.68
999.42  1119.64
999.72  1117.56
1000.01 1119.30
1000.30 1125.88
1000.59 1125.54
1000.89 1126.58
1001.18 1131.09
1001.47 1122.76
1001.76 1118.60
1002.06 1118.95
1002.35 1108.55
1002.64 1113.75
1002.93 1109.59
1003.22 1097.10
1003.52 1108.55
1003.81 1117.22
1004.10 1115.14
1004.39 1132.13
1004.68 1118.26
1004.97 1118.95
1005.27 1127.62
1005.56 1126.58
1005.85 1109.24
1006.14 1115.83
1006.43 1114.10
1006.72 1122.07
1007.01 1126.92
1007.31 1133.17
1007.60 1136.29
1007.89 1143.22
1008.18 1148.42
1008.47 1151.54
1008.76 1149.12
1009.05 1154.32
1009.34 1144.26
1009.63 1132.82
1009.93 1139.06
1010.22 1135.94
1010.51 1128.66
1010.80 1137.33
1011.09 1123.80
1011.38 1120.68
1011.67 1123.46
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1011.96 1127.62
1012.25 1120.34
1012.54 1122.76

1012.83 1121.38
1013.12 1131.43
1013.41 1141.14
1013.70 1149.81
1013.99 1133.17
1014.28 1141.83
1014.57 1138.02
1014.86 1139.75
1015.15 1151.54
1015.44 1140.10
1015.73 1135.25
1016.02 1144.96
1016.31 1124.84
1016.60 1131.78
1016.89 1120.34
1017.18 1108.20
1017.47 1118.26
1017.76 1116.18
1018.05 1113.40
1018.34 1127.27
1018.62 1123.46
1018.91 1138.02
1019.20 1135.25
1019.49 1129.01
1019.78 1129.35
1020.07 1130.74
1020.36 1137.67
1020.65 1136.29
1020.94 1130.74
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1021.51 1133.17
1021.80 1125.88
1022.09 1127.27
1022.38 1122.42
1022.67 1126.58
1022.96 1122.76
1023.25 1120.34
1023.53 1130.05
1023.82 1141.49
1024.11 1144.61
1024.40 1143.57
1024.69 1147.73
1024.97 1145.65
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2051  1025.26 1150.85
2052  1025.55 1137.33
2053  1025.84 1125.19
2054  1026.13 1115.83
2055  1026.41 1075.26
2056  1026.70 1075.26
2057  1026.99 1075.26
```

Listing 5: 溴钨灯

```
 1  暗光谱: 否
 2  参考光谱: 否
 3  光谱数量: 1
 4  光谱仪: USB2+H14105
 5  积分时间（毫秒）: 2 (USB2+H14105)
 6  平均次数: 1 (USB2+H14105)
 7  平滑度: 10 (USB2+H14105)
 8  去除暗噪声: 否 (USB2+H14105)
 9  339.35  839.82
10  339.73  839.82
11  340.11  839.82
12  340.49  742.73
13  340.87  745.16
14  341.25  703.89
15  341.63  808.26
16  342.01  701.47
17  342.39  779.14
18  342.77  800.98
19  343.15  813.00
20  343.53  818.09
21  343.91  827.45
22  344.29  839.13
23  344.66  859.47
24  345.04  880.16
25  345.42  899.81
26  345.80  921.77
27  346.18  945.35
28  346.56  967.07
29  346.94  991.69
30  347.32  1016.08
31  347.70  1036.66
32  348.08  1057.46
33  348.45  1083.93
34  348.83  1106.81
35  349.21  1129.24
36  349.59  1154.20
37  349.97  1176.05
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38  350.35  1192.92
39  350.73  1215.34
40  351.10  1237.31
41  351.48  1253.60
42  351.86  1272.90
43  352.24  1285.85
44  352.62  1299.26
45  353.00  1308.74
46  353.37  1323.53
47  353.75  1329.66
48  354.13  1338.09
49  354.51  1343.18
50  354.89  1346.07
51  355.27  1350.69
52  355.64  1356.93
53  356.02  1360.75
54  356.40  1366.64
55  356.78  1370.80
56  357.16  1374.96
57  357.53  1371.50
58  357.91  1376.35
59  358.29  1381.44
60  358.67  1382.36
61  359.04  1385.25
62  359.42  1386.52
63  359.80  1385.83
64  360.18  1388.26
65  360.55  1383.86
66  360.93  1388.26
67  361.31  1387.91
68  361.69  1387.91
69  362.06  1392.07
70  362.44  1399.12
71  362.82  1407.67
72  363.20  1413.57
73  363.57  1421.89
74  363.95  1430.33
75  364.33  1436.92
76  364.71  1444.31
77  365.08  1451.48
78  365.46  1459.34
79  365.84  1461.65
80  366.21  1467.78
81  366.59  1471.13
82  366.97  1473.67
83  367.34  1485.00
84  367.72  1490.55
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 86  368.47  1508.35
 87  368.85  1514.36
 88  369.23  1523.95
 89  369.60  1534.93
 90  369.98  1542.21
 91  370.36  1550.42
 92  370.73  1553.42
 93  371.11  1560.36
 94  371.49  1564.40
 95  371.86  1569.95
 96  372.24  1572.38
 97  372.62  1578.16
 98  372.99  1583.36
 99  373.37  1593.99
100  373.74  1601.39
101  374.12  1610.52
102  374.50  1623.58
103  374.87  1634.91
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1431	837.38	17976.93
1432	837.69	17852.10
1433	838.01	17787.03
1434	838.33	17744.96
1435	838.65	17662.78
1436	838.97	17550.43
1437	839.29	17439.24
1438	839.60	17353.71
1439	839.92	17235.70
1440	840.24	17163.58
1441	840.56	17120.35
1442	840.88	17074.12
1443	841.20	17024.42
1444	841.51	16997.95
1445	841.83	16985.01
1446	842.15	16917.51
1447	842.47	16834.17

1448	842.79	16778.23
1449	843.10	16710.15
1450	843.42	16606.59
1451	843.74	16509.62
1452	844.06	16458.65
1453	844.37	16383.98
1454	844.69	16260.77
1455	845.01	16200.21
1456	845.33	16180.09
1457	845.64	16143.92
1458	845.96	16105.31
1459	846.28	16045.67
1460	846.60	15980.83
1461	846.91	15941.65
1462	847.23	15921.08
1463	847.55	15893.80
1464	847.86	15867.33
1465	848.18	15814.39
1466	848.50	15750.01
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1468	849.13	15673.61
1469	849.45	15627.73
1470	849.77	15622.87
1471	850.08	15671.65
1472	850.40	15686.79
1473	850.72	15662.98
1474	851.03	15653.85
1475	851.35	15691.07
1476	851.67	15696.50
1477	851.98	15676.97
1478	852.30	15608.89
1479	852.61	15521.16
1480	852.93	15467.76
1481	853.25	15476.43
1482	853.56	15478.40
1483	853.88	15431.24
1484	854.20	15346.86
1485	854.51	15270.46
1486	854.83	15223.65
1487	855.14	15208.74
1488	855.46	15192.22
1489	855.78	15174.65
1490	856.09	15130.84
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1492	856.72	14992.72
1493	857.04	14909.15
1494	857.35	14880.95

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1512  863.03  14250.45
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1515  863.97  14164.81
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1517  864.60  14038.94
1518  864.92  13967.85
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1526  867.43  13500.67
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1530  868.69  13256.56
1531  869.00  13183.52
1532  869.31  13144.33
1533  869.63  13099.60
1534  869.94  13055.33
1535  870.25  12985.99
1536  870.57  12925.54
1537  870.88  12906.35
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1540  871.82  12811.57
1541  872.14  12764.41
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1544	873.08	12548.62
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1549	874.64	12345.78
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1552	875.58	12280.36
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1554	876.21	12232.16
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1556	876.83	12180.26
1557	877.14	12147.55
1558	877.46	12114.50
1559	877.77	12079.48
1560	878.08	12069.07
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1562	878.71	11988.63
1563	879.02	11955.11
1564	879.33	11987.59
1565	879.64	12006.20
1566	879.95	11998.57
1567	880.27	11970.94
1568	880.58	11969.90
1569	880.89	12001.80
1570	881.20	12015.67
1571	881.52	12029.54
1572	881.83	12018.68
1573	882.14	11975.45
1574	882.45	11935.46
1575	882.76	11885.53
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1577	883.39	11954.76
1578	883.70	11963.78
1579	884.01	11916.85
1580	884.32	11875.13
1581	884.63	11840.91
1582	884.94	11803.93
1583	885.25	11744.17
1584	885.57	11732.27
1585	885.88	11720.71
1586	886.19	11700.02
1587	886.50	11706.96
1588	886.81	11699.33

1589	887.12	11675.98
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1592	888.05	11519.25
1593	888.37	11468.16
1594	888.68	11413.15
1595	888.99	11344.61
1596	889.30	11299.76
1597	889.61	11222.55
1598	889.92	11170.54
1599	890.23	11140.95
1600	890.54	11145.46
1601	890.85	11137.48
1602	891.16	11129.39
1603	891.47	11130.20
1604	891.78	11133.90
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1606	892.40	11024.67
1607	892.71	10974.28
1608	893.02	10913.83
1609	893.33	10853.04
1610	893.64	10769.93
1611	893.95	10734.91
1612	894.26	10706.25
1613	894.57	10662.09
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1616	895.50	10637.94
1617	895.81	10628.92
1618	896.12	10577.26
1619	896.43	10525.59
1620	896.74	10489.53
1621	897.05	10438.56
1622	897.36	10397.87
1623	897.67	10333.84
1624	897.98	10278.48
1625	898.29	10256.05
1626	898.60	10226.81
1627	898.91	10187.05
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1629	899.52	10098.98
1630	899.83	10076.09
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1635	901.38	9930.58

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1689	917.98	7649.33
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1691	918.60	7529.13
1692	918.90	7510.17
1693	919.21	7484.98
1694	919.51	7413.55
1695	919.82	7318.42
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1697	920.43	7166.20
1698	920.74	7112.34
1699	921.04	7060.44
1700	921.35	7006.35
1701	921.65	6949.72
1702	921.96	6897.01
1703	922.26	6854.94
1704	922.57	6800.15
1705	922.88	6752.30
1706	923.18	6720.98
1707	923.49	6704.22
1708	923.79	6682.95
1709	924.10	6649.20
1710	924.40	6615.34
1711	924.71	6584.71
1712	925.01	6543.10
1713	925.32	6483.23
1714	925.62	6390.41
1715	925.93	6344.87
1716	926.23	6337.94
1717	926.54	6317.94
1718	926.84	6282.81
1719	927.15	6245.94
1720	927.45	6207.10
1721	927.76	6161.33
1722	928.06	6115.79
1723	928.36	6071.18
1724	928.67	5994.20
1725	928.97	5933.63
1726	929.28	5881.97
1727	929.58	5835.85
1728	929.89	5769.97
1729	930.19	5708.13

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935.96  4537.98
936.27  4454.76
936.57  4379.52
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937.17  4256.89
937.48  4213.66
937.78  4153.67
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938.39  4017.17
938.69  3961.92
938.99  3908.06
939.29  3858.94
939.60  3816.06
939.90  3761.27
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940.51  3663.37
940.81  3602.23
941.11  3554.26
941.41  3500.63
941.71  3446.66
942.02  3416.14
942.32  3390.02
942.62  3368.87
942.92  3336.39
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943.53  3285.07
943.83  3259.18
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944.43  3238.95
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1784  946.85  3124.41
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1788  948.05  3095.40
1789  948.35  3082.69
1790  948.66  3065.93
1791  948.96  3056.80
1792  949.26  3050.44
1793  949.56  3037.96
1794  949.86  3036.80
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1796  950.46  3026.05
1797  950.76  3011.84
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1802  952.27  2969.19
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1809  954.37  2926.88
1810  954.67  2922.61
1811  954.97  2926.31
1812  955.27  2929.08
1813  955.57  2930.24
1814  955.87  2936.59
1815  956.17  2926.19
1816  956.47  2912.78
1817  956.77  2901.80
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1819  957.37  2894.52
1820  957.67  2894.40
1821  957.97  2888.51
1822  958.27  2885.04
1823  958.57  2867.59
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1830  960.66  2791.77
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1833  961.56  2753.63
1834  961.86  2733.28
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1837  962.76  2680.58
1838  963.05  2666.94
1839  963.35  2655.73
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1843  964.55  2606.84
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1847  965.74  2577.36
1848  966.04  2570.66
1849  966.34  2563.26
1850  966.64  2552.51
1851  966.93  2546.62
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1857  968.72  2483.28
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1860  969.62  2468.48
1861  969.91  2457.16
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1863  970.51  2434.62
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1875  974.08  2290.72
1876  974.37  2279.74
1877  974.67  2273.84
1878  974.97  2262.86
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1880  975.56  2231.54
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1884  976.75  2170.63
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1888  977.93  2105.33
1889  978.23  2097.81
1890  978.52  2087.64
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1893  979.41  2048.69
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1898  980.89  1976.57
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1901  981.78  1936.23
1902  982.07  1921.32
1903  982.37  1902.60
1904  982.67  1888.26
1905  982.96  1874.62
1906  983.26  1863.99
1907  983.55  1853.13
1908  983.85  1837.18
1909  984.14  1824.00
1910  984.44  1810.25
1911  984.73  1796.95
1912  985.03  1786.32
1913  985.32  1774.88
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1915  985.91  1751.30
1916  986.21  1742.98
1917  986.50  1731.88
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1926  989.15  1672.93
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1928  989.74  1655.48
1929  990.04  1655.02
1930  990.33  1648.43
1931  990.62  1643.81
1932  990.92  1640.69
1933  991.21  1635.60
1934  991.51  1628.67
1935  991.80  1627.86
1936  992.09  1622.54
1937  992.39  1611.44
1938  992.68  1602.20
1939  992.98  1599.31
1940  993.27  1593.41
1941  993.56  1583.47
1942  993.86  1574.34
1943  994.15  1567.64
1944  994.44  1560.59
1945  994.74  1554.00
1946  995.03  1546.37
1947  995.32  1540.48
1948  995.62  1535.39
1949  995.91  1532.50
1950  996.20  1525.80
1951  996.50  1519.90
1952  996.79  1514.47
1953  997.08  1506.50
1954  997.38  1498.98
1955  997.67  1498.98
1956  997.96  1491.47
1957  998.25  1486.96
1958  998.55  1488.70
1959  998.84  1488.12
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1962  999.72  1477.25
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1964  1000.30 1472.86
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1002.64 1440.27
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1013.41 1314.75
1013.70 1310.01
1013.99 1304.92
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1026.13 1235.46
1026.41 1201.48
1026.70 1201.48
1026.99 1201.48
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Listing 6: 红灯

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暗光谱： 否
参考光谱： 否
光谱数量： 1
光谱仪： USB2+H14105
积分时间（毫秒）： 1 (USB2+H14105)
平均次数： 1 (USB2+H14105)
平滑度： 20 (USB2+H14105)
去除暗噪声： 否 (USB2+H14105)
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339.73  762.15
340.11  762.15
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340.87  750.01
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341.63  771.86
342.01  779.14
342.39  701.47
342.77  691.76
343.15  791.27
343.53  757.29
343.91  808.26
344.29  844.67
344.66  827.68
345.04  956.33
345.42  837.39
345.80  854.38
346.18  883.51
346.56  951.47
346.94  935.61
347.32  945.02
347.70  953.01
348.08  963.25
348.45  973.49
348.83  984.03
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Listing 7: 黄灯

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1  暗光谱: 否
2  参考光谱: 否
3  光谱数量: 1
4  光谱仪: USB2+H14105
5  积分时间（毫秒）: 1 (USB2+H14105)
6  平均次数: 1 (USB2+H14105)
7  平滑度: 20 (USB2+H14105)
```

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 8  去除暗噪声: 否 (USB2+H14105)
 9  339.35  813.12
10  339.73  813.12
11  340.11  813.12
12  340.49  767.00
13  340.87  759.72
14  341.25  720.88
15  341.63  740.30
16  342.01  796.13
17  342.39  725.74
18  342.77  764.58
19  343.15  771.86
20  343.53  767.00
21  343.91  735.45
22  344.29  771.86
23  344.66  883.51
24  345.04  808.26
25  345.42  859.24
26  345.80  878.65
27  346.18  859.24
28  346.56  997.59
29  346.94  936.49
30  347.32  946.08
31  347.70  953.54
32  348.08  962.72
33  348.45  970.30
34  348.83  978.47
35  349.21  989.71
36  349.59  999.19
37  349.97  1008.36
38  350.35  1018.84
39  350.73  1028.25
40  351.10  1037.25
41  351.48  1047.73
42  351.86  1057.91
43  352.24  1067.68
44  352.62  1075.08
45  353.00  1084.61
46  353.37  1090.65
47  353.75  1097.16
48  354.13  1104.09
49  354.51  1107.52
50  354.89  1113.80
51  355.27  1120.37
52  355.64  1122.56
53  356.02  1125.70
54  356.40  1130.55
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 55  356.78  1134.76
 56  357.16  1135.76
 57  357.53  1138.01
 58  357.91  1137.66
 59  358.29  1139.85
 60  358.67  1139.43
 61  359.04  1139.08
 62  359.42  1138.60
 63  359.80  1139.08
 64  360.18  1137.06
 65  360.55  1138.13
 66  360.93  1136.35
 67  361.31  1134.22
 68  361.69  1133.10
 69  362.06  1131.68
 70  362.44  1132.51
 71  362.82  1129.61
 72  363.20  1131.03
 73  363.57  1129.49
 74  363.95  1129.49
 75  364.33  1129.66
 76  364.71  1127.53
 77  365.08  1125.76
 78  365.46  1125.94
 79  365.84  1123.98
 80  366.21  1122.50
 81  366.59  1121.32
 82  366.97  1120.37
 83  367.34  1119.54
 84  367.72  1117.82
 85  368.10  1114.75
 86  368.47  1112.61
 87  368.85  1112.67
 88  369.23  1110.96
 89  369.60  1109.48
 90  369.98  1108.83
 91  370.36  1105.98
 92  370.73  1103.32
 93  371.11  1103.32
 94  371.49  1105.16
 95  371.86  1103.14
 96  372.24  1101.66
 97  372.62  1102.14
 98  372.99  1101.90
 99  373.37  1103.44
100  373.74  1103.32
101  374.12  1104.74
```

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102  374.50  1103.68
103  374.87  1103.91
104  375.25  1103.97
105  375.62  1107.46
106  376.00  1104.27
107  376.38  1103.97
108  376.75  1105.98
109  377.13  1108.71
110  377.50  1110.78
111  377.88  1107.52
112  378.26  1107.94
113  378.63  1106.04
114  379.01  1107.46
115  379.38  1108.83
116  379.76  1110.19
117  380.13  1111.31
118  380.51  1112.32
119  380.88  1108.83
120  381.26  1109.36
121  381.64  1109.06
122  382.01  1109.42
123  382.39  1109.36
124  382.76  1108.17
125  383.14  1107.82
126  383.51  1108.12
127  383.89  1108.35
128  384.26  1106.52
129  384.64  1107.05
130  385.01  1107.46
131  385.39  1108.77
132  385.76  1108.12
133  386.14  1109.71
134  386.51  1110.78
135  386.89  1108.65
136  387.26  1110.66
137  387.64  1112.14
138  388.01  1113.38
139  388.39  1114.27
140  388.76  1113.62
141  389.13  1114.45
142  389.51  1113.74
143  389.88  1114.75
144  390.26  1116.05
145  390.63  1115.69
146  391.01  1115.22
147  391.38  1116.34
148  391.76  1116.29
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149  392.13  1115.16
150  392.50  1112.67
151  392.88  1110.78
152  393.25  1114.69
153  393.63  1115.58
154  394.00  1114.33
155  394.37  1111.67
156  394.75  1111.19
157  395.12  1107.88
158  395.50  1106.34
159  395.87  1108.47
160  396.24  1111.43
161  396.62  1112.08
162  396.99  1111.49
163  397.37  1112.73
164  397.74  1111.67
165  398.11  1112.38
166  398.49  1112.26
167  398.86  1113.74
168  399.23  1112.20
169  399.61  1114.86
170  399.98  1114.98
171  400.35  1115.34
172  400.73  1113.44
173  401.10  1114.10
174  401.47  1114.45
175  401.85  1115.10
176  402.22  1115.16
177  402.59  1115.75
178  402.97  1113.62
179  403.34  1113.92
180  403.71  1113.56
181  404.09  1112.73
182  404.46  1114.15
183  404.83  1114.15
184  405.20  1116.46
185  405.58  1116.46
186  405.95  1116.46
187  406.32  1114.86
188  406.70  1115.63
189  407.07  1115.99
190  407.44  1117.11
191  407.81  1118.30
192  408.19  1119.42
193  408.56  1118.30
194  408.93  1119.25
195  409.30  1120.37
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196  409.68  1120.43
197  410.05  1120.49
198  410.42  1122.09
199  410.79  1122.98
200  411.17  1122.38
201  411.54  1120.31
202  411.91  1121.20
203  412.28  1122.68
204  412.65  1121.50
205  413.03  1121.26
206  413.40  1121.67
207  413.77  1122.21
208  414.14  1123.15
209  414.51  1125.11
210  414.89  1124.22
211  415.26  1122.44
212  415.63  1122.92
213  416.00  1123.03
214  416.37  1123.21
215  416.74  1123.86
216  417.12  1123.09
217  417.49  1125.34
218  417.86  1122.74
219  418.23  1123.27
220  418.60  1121.79
221  418.97  1121.44
222  419.34  1122.26
223  419.72  1120.02
224  420.09  1119.07
225  420.46  1117.94
226  420.83  1117.88
227  421.20  1118.83
228  421.57  1119.19
229  421.94  1118.71
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231  422.69  1120.61
232  423.06  1119.96
233  423.43  1119.48
234  423.80  1119.66
235  424.17  1116.88
236  424.54  1118.00
237  424.91  1118.77
238  425.28  1119.01
239  425.65  1120.37
240  426.02  1119.13
241  426.39  1117.11
242  426.76  1118.36
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244  427.51  1116.82
245  427.88  1117.71
246  428.25  1117.06
247  428.62  1116.82
248  428.99  1117.53
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250  429.73  1115.40
251  430.10  1115.40
252  430.47  1118.77
253  430.84  1118.59
254  431.21  1119.01
255  431.58  1120.02
256  431.95  1121.55
257  432.32  1122.03
258  432.69  1120.13
259  433.06  1121.38
260  433.43  1121.61
261  433.80  1122.09
262  434.17  1120.43
263  434.54  1119.54
264  434.91  1118.36
265  435.28  1119.72
266  435.65  1120.02
267  436.02  1119.96
268  436.39  1118.06
269  436.75  1115.69
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271  437.49  1116.64
272  437.86  1117.29
273  438.23  1117.17
274  438.60  1119.36
275  438.97  1120.43
276  439.34  1122.21
277  439.71  1120.78
278  440.08  1121.55
279  440.45  1122.38
280  440.82  1122.32
281  441.19  1122.62
282  441.55  1122.15
283  441.92  1122.15
284  442.29  1123.98
285  442.66  1124.69
286  443.03  1123.33
287  443.40  1125.34
288  443.77  1125.28
289  444.14  1126.23
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291  444.87  1125.88
292  445.24  1126.17
293  445.61  1126.05
294  445.98  1125.46
295  446.35  1127.18
296  446.72  1125.52
297  447.08  1123.09
298  447.45  1122.86
299  447.82  1122.44
300  448.19  1122.62
301  448.56  1122.92
302  448.93  1123.86
303  449.29  1126.29
304  449.66  1127.83
305  450.03  1129.43
306  450.40  1129.49
307  450.77  1129.55
308  451.13  1127.59
309  451.50  1129.55
310  451.87  1131.09
311  452.24  1131.03
312  452.61  1131.32
313  452.97  1129.55
314  453.34  1128.95
315  453.71  1127.30
316  454.08  1127.36
317  454.44  1126.94
318  454.81  1128.95
319  455.18  1127.71
320  455.55  1127.06
321  455.91  1126.94
322  456.28  1128.84
323  456.65  1131.09
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325  457.38  1129.84
326  457.75  1128.95
327  458.12  1129.72
328  458.48  1130.26
329  458.85  1130.08
330  459.22  1130.26
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332  459.95  1131.20
333  460.32  1130.61
334  460.69  1129.96
335  461.05  1131.80
336  461.42  1130.38
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342  463.62  1133.87
343  463.99  1132.21
344  464.35  1130.61
345  464.72  1130.08
346  465.09  1131.20
347  465.45  1131.20
348  465.82  1130.38
349  466.18  1131.80
350  466.55  1133.04
351  466.92  1133.87
352  467.28  1133.63
353  467.65  1133.16
354  468.02  1134.46
355  468.38  1135.05
356  468.75  1136.00
357  469.11  1135.64
358  469.48  1135.58
359  469.85  1134.16
360  470.21  1134.52
361  470.58  1135.94
362  470.94  1136.95
363  471.31  1136.53
364  471.67  1136.83
365  472.04  1136.71
366  472.41  1136.83
367  472.77  1138.19
368  473.14  1137.36
369  473.50  1136.12
370  473.87  1135.70
371  474.23  1134.22
372  474.60  1135.64
373  474.96  1135.76
374  475.33  1136.77
375  475.69  1138.07
376  476.06  1138.13
377  476.42  1139.43
378  476.79  1140.02
379  477.15  1139.20
380  477.52  1140.56
381  477.88  1141.45
382  478.25  1140.08
383  478.61  1138.84
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386  479.71  1137.95
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388  480.44  1136.41
389  480.80  1136.24
390  481.17  1136.41
391  481.53  1135.82
392  481.90  1134.52
393  482.26  1134.16
394  482.62  1133.63
395  482.99  1133.87
396  483.35  1134.64
397  483.72  1132.98
398  484.08  1132.74
399  484.45  1132.33
400  484.81  1133.34
401  485.17  1135.35
402  485.54  1134.52
403  485.90  1134.34
404  486.27  1134.82
405  486.63  1135.05
406  487.00  1136.30
407  487.36  1137.12
408  487.72  1135.64
409  488.09  1135.94
410  488.45  1135.47
411  488.81  1137.78
412  489.18  1137.89
413  489.54  1136.77
414  489.91  1137.42
415  490.27  1136.77
416  490.63  1137.01
417  491.00  1135.76
418  491.36  1135.47
419  491.72  1134.82
420  492.09  1136.47
421  492.45  1134.05
422  492.81  1134.93
423  493.18  1134.87
424  493.54  1136.35
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427  494.63  1142.10
428  494.99  1142.10
429  495.35  1142.45
430  495.72  1144.29
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432  496.44  1143.81
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435  497.53  1143.93
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437  498.26  1147.01
438  498.62  1148.14
439  498.98  1148.19
440  499.35  1148.55
441  499.71  1147.78
442  500.07  1147.66
443  500.43  1146.54
444  500.79  1144.64
445  501.16  1143.70
446  501.52  1144.88
447  501.88  1145.06
448  502.24  1144.88
449  502.61  1146.36
450  502.97  1146.71
451  503.33  1147.84
452  503.69  1147.48
453  504.05  1147.66
454  504.42  1147.78
455  504.78  1148.31
456  505.14  1150.92
457  505.50  1148.67
458  505.86  1149.14
459  506.23  1148.85
460  506.59  1149.02
461  506.95  1148.25
462  507.31  1147.31
463  507.67  1147.37
464  508.03  1147.96
465  508.40  1147.01
466  508.76  1146.83
467  509.12  1146.42
468  509.48  1146.12
469  509.84  1146.60
470  510.20  1147.13
471  510.56  1146.83
472  510.93  1147.13
473  511.29  1147.13
474  511.65  1148.31
475  512.01  1149.73
476  512.37  1150.21
477  512.73  1149.26
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479  513.45  1147.25
480  513.81  1146.12
481  514.17  1146.77
482  514.54  1147.07
483  514.90  1147.66
484  515.26  1149.50
485  515.62  1151.15
486  515.98  1150.38
487  516.34  1149.50
488  516.70  1150.03
489  517.06  1151.63
490  517.42  1151.92
491  517.78  1154.94
492  518.14  1155.12
493  518.50  1154.59
494  518.86  1155.71
495  519.22  1157.13
496  519.58  1156.13
497  519.94  1154.88
498  520.30  1156.19
499  520.66  1155.36
500  521.02  1155.95
501  521.38  1156.07
502  521.74  1155.12
503  522.10  1157.49
504  522.46  1157.43
505  522.82  1158.73
506  523.18  1159.56
507  523.54  1159.15
508  523.90  1159.98
509  524.26  1159.38
510  524.62  1160.15
511  524.98  1161.22
512  525.34  1160.39
513  525.70  1160.57
514  526.06  1161.99
515  526.42  1163.41
516  526.78  1164.00
517  527.14  1165.19
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521  528.58  1171.34
522  528.93  1172.53
523  529.29  1174.54
524  529.65  1174.36
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526  530.37  1178.33
527  530.73  1182.06
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529  531.45  1184.66
530  531.81  1184.66
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535  533.60  1192.48
536  533.96  1194.49
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538  534.68  1197.03
539  535.03  1201.06
540  535.39  1204.08
541  535.75  1206.98
542  536.11  1209.05
543  536.47  1213.37
544  536.83  1215.51
545  537.18  1218.41
546  537.54  1220.12
547  537.90  1223.79
548  538.26  1230.07
549  538.62  1234.33
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553  540.05  1254.22
554  540.41  1258.90
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557  541.48  1274.29
558  541.84  1279.38
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560  542.55  1293.65
561  542.91  1301.05
562  543.27  1306.97
563  543.62  1313.42
564  543.98  1320.29
565  544.34  1326.74
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568  545.41  1347.88
569  545.77  1356.05
570  546.12  1364.57
571  546.48  1373.33
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578  548.98  1439.99
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585  551.48  1534.42
586  551.83  1550.64
587  552.19  1568.28
588  552.55  1583.73
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591  553.62  1635.77
592  553.97  1653.47
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594  554.68  1690.59
595  555.04  1712.61
596  555.40  1735.05
597  555.75  1759.32
598  556.11  1782.59
599  556.46  1807.63
600  556.82  1832.73
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602  557.53  1883.82
603  557.89  1911.64
604  558.24  1941.36
605  558.60  1972.50
606  558.95  2003.58
607  559.31  2035.43
608  559.67  2069.18
609  560.02  2104.05
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611  560.73  2174.73
612  561.09  2214.22
613  561.44  2254.71
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615  562.15  2345.29
616  562.51  2392.77
617  562.86  2442.44
618  563.22  2491.51
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623  564.99  2760.17
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625  565.70  2886.09
626  566.06  2948.96
627  566.41  3015.91
628  566.77  3081.86
629  567.12  3154.80
630  567.48  3230.34
631  567.83  3307.65
632  568.19  3386.86
633  568.54  3468.32
634  568.89  3552.92
635  569.25  3638.29
636  569.60  3727.86
637  569.96  3818.02
638  570.31  3914.99
639  570.67  4010.48
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641  571.37  4217.51
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644  572.44  4569.81
645  572.79  4688.15
646  573.14  4808.86
647  573.50  4935.49
648  573.85  5070.05
649  574.21  5209.77
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653  575.62  5815.27
654  575.98  5974.28
655  576.33  6143.77
656  576.68  6311.84
657  577.04  6482.87
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659  577.74  6868.21
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661  578.45  7269.77
662  578.80  7479.34
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664  579.51  7910.91
665  579.86  8137.71
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2004 1011.96 1130.43
2005 1012.25 1132.33
2006 1012.54 1131.32
2007 1012.83 1129.61
2008 1013.12 1129.55
2009 1013.41 1130.97
2010 1013.70 1131.56
2011 1013.99 1130.73
2012 1014.28 1130.55
2013 1014.57 1131.03
2014 1014.86 1133.34
2015 1015.15 1135.05
2016 1015.44 1135.53
2017 1015.73 1136.89
2018 1016.02 1135.76
2019 1016.31 1133.93
2020 1016.60 1132.45
2021 1016.89 1131.91
2022 1017.18 1132.62
2023 1017.47 1132.98
2024 1017.76 1133.63
2025 1018.05 1131.91
2026 1018.34 1132.57
2027 1018.62 1131.56
2028 1018.91 1130.32

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2029  1019.20 1129.37
2030  1019.49 1131.14
2031  1019.78 1132.74
2032  1020.07 1133.63
2033  1020.36 1132.86
2034  1020.65 1132.57
2035  1020.94 1134.87
2036  1021.23 1133.93
2037  1021.51 1148.08
2038  1021.80 1104.39
2039  1022.09 1075.26
2040  1022.38 1104.39
2041  1022.67 1131.09
2042  1022.96 1157.78
2043  1023.25 1174.78
2044  1023.53 1121.38
2045  1023.82 1067.98
2046  1024.11 1118.95
2047  1024.40 1097.10
2048  1024.69 1128.66
2049  1024.97 1123.80
2050  1025.26 1167.49
2051  1025.55 1177.20
2052  1025.84 1121.38
2053  1026.13 1172.35
2054  1026.41 1150.50
2055  1026.70 1150.50
2056  1026.99 1150.50
```

Listing 8: 蓝灯

```
1
2  暗光谱: 否
3  参考光谱: 否
4  光谱数量: 1
5  光谱仪: USB2+H14105
6  积分时间（毫秒）: 74 (USB2+H14105)
7  平均次数: 1 (USB2+H14105)
8  平滑度: 20 (USB2+H14105)
9  去除暗噪声: 否 (USB2+H14105)
10 339.35  745.16
11 339.73  745.16
12 340.11  745.16
13 340.49  745.16
14 340.87  767.00
15 341.25  783.99
16 341.63  759.72
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17  342.01  703.89
18  342.39  733.02
19  342.77  759.72
20  343.15  747.58
21  343.53  793.70
22  343.91  813.12
23  344.29  820.40
24  344.66  917.49
25  345.04  900.50
26  345.42  844.67
27  345.80  883.51
28  346.18  929.63
29  346.56  934.48
30  346.94  942.12
31  347.32  951.35
32  347.70  960.88
33  348.08  970.18
34  348.45  979.59
35  348.83  987.05
36  349.21  995.40
37  349.59  1004.69
38  349.97  1015.70
39  350.35  1026.24
40  350.73  1034.71
41  351.10  1046.13
42  351.48  1054.72
43  351.86  1062.83
44  352.24  1070.29
45  352.62  1074.67
46  353.00  1080.11
47  353.37  1089.53
48  353.75  1096.28
49  354.13  1101.96
50  354.51  1107.29
51  354.89  1111.19
52  355.27  1116.34
53  355.64  1121.61
54  356.02  1123.63
55  356.40  1127.00
56  356.78  1130.79
57  357.16  1134.05
58  357.53  1137.42
59  357.91  1136.77
60  358.29  1137.18
61  358.67  1137.30
62  359.04  1138.78
63  359.42  1139.31
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 64  359.80  1140.02
 65  360.18  1138.13
 66  360.55  1137.24
 67  360.93  1137.54
 68  361.31  1137.83
 69  361.69  1138.43
 70  362.06  1138.49
 71  362.44  1134.99
 72  362.82  1136.35
 73  363.20  1136.30
 74  363.57  1137.06
 75  363.95  1138.72
 76  364.33  1140.44
 77  364.71  1140.08
 78  365.08  1140.74
 79  365.46  1138.43
 80  365.84  1137.24
 81  366.21  1138.01
 82  366.59  1137.78
 83  366.97  1136.41
 84  367.34  1136.53
 85  367.72  1135.82
 86  368.10  1135.23
 87  368.47  1134.70
 88  368.85  1132.03
 89  369.23  1133.10
 90  369.60  1132.57
 91  369.98  1132.98
 92  370.36  1134.34
 93  370.73  1135.53
 94  371.11  1134.70
 95  371.49  1135.41
 96  371.86  1134.76
 97  372.24  1133.22
 98  372.62  1131.26
 99  372.99  1130.79
100  373.37  1132.21
101  373.74  1131.91
102  374.12  1131.32
103  374.50  1132.57
104  374.87  1131.74
105  375.25  1132.68
106  375.62  1133.04
107  376.00  1133.87
108  376.38  1134.46
109  376.75  1134.10
110  377.13  1133.93
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112  377.88  1135.29
113  378.26  1133.51
114  378.63  1132.68
115  379.01  1133.99
116  379.38  1132.45
117  379.76  1131.38
118  380.13  1131.74
119  380.51  1131.62
120  380.88  1132.98
121  381.26  1134.93
122  381.64  1134.28
123  382.01  1134.40
124  382.39  1134.93
125  382.76  1132.27
126  383.14  1132.98
127  383.51  1134.87
128  383.89  1135.05
129  384.26  1136.95
130  384.64  1134.93
131  385.01  1134.93
132  385.39  1135.76
133  385.76  1135.35
134  386.14  1134.87
135  386.51  1134.76
136  386.89  1135.29
137  387.26  1136.77
138  387.64  1138.54
139  388.01  1138.96
140  388.39  1140.32
141  388.76  1141.50
142  389.13  1142.27
143  389.51  1143.99
144  389.88  1144.88
145  390.26  1147.19
146  390.63  1147.19
147  391.01  1149.38
148  391.38  1149.26
149  391.76  1149.79
150  392.13  1150.62
151  392.50  1150.86
152  392.88  1149.56
153  393.25  1151.27
154  393.63  1152.10
155  394.00  1153.88
156  394.37  1152.93
157  394.75  1153.76
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158  395.12  1153.52
159  395.50  1153.46
160  395.87  1153.05
161  396.24  1155.30
162  396.62  1154.41
163  396.99  1155.89
164  397.37  1157.73
165  397.74  1158.91
166  398.11  1162.82
167  398.49  1162.70
168  398.86  1164.36
169  399.23  1165.78
170  399.61  1164.83
171  399.98  1167.38
172  400.35  1169.21
173  400.73  1169.03
174  401.10  1170.39
175  401.47  1173.06
176  401.85  1174.89
177  402.22  1176.85
178  402.59  1178.03
179  402.97  1180.81
180  403.34  1183.95
181  403.71  1186.79
182  404.09  1186.97
183  404.46  1190.94
184  404.83  1192.77
185  405.20  1193.90
186  405.58  1198.63
187  405.95  1203.19
188  406.32  1206.15
189  406.70  1210.95
190  407.07  1215.15
191  407.44  1220.36
192  407.81  1224.86
193  408.19  1231.84
194  408.56  1236.52
195  408.93  1245.11
196  409.30  1250.79
197  409.68  1256.71
198  410.05  1266.18
199  410.42  1277.67
200  410.79  1288.50
201  411.17  1299.51
202  411.54  1308.57
203  411.91  1319.99
204  412.28  1331.78
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413.03  1354.09
413.40  1367.53
413.77  1383.52
414.14  1399.09
414.51  1416.37
414.89  1433.66
415.26  1452.49
415.63  1472.61
416.00  1494.46
416.37  1519.50
416.74  1544.36
417.12  1568.81
417.49  1595.04
417.86  1622.09
418.23  1649.39
418.60  1678.75
418.97  1708.76
419.34  1743.93
419.72  1780.34
420.09  1818.05
420.46  1856.11
420.83  1891.28
421.20  1931.77
421.57  1974.57
421.94  2019.69
422.31  2068.35
422.69  2115.77
423.06  2166.27
423.43  2218.84
423.80  2276.14
424.17  2335.34
424.54  2395.55
424.91  2462.33
425.28  2526.92
425.65  2593.87
426.02  2660.77
426.39  2732.82
426.76  2809.01
427.13  2883.72
427.51  2967.55
427.88  3047.23
428.25  3130.52
428.62  3218.38
428.99  3307.06
429.36  3399.47
429.73  3499.58
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253  430.47  3704.59
254  430.84  3807.54
255  431.21  3910.61
256  431.58  4019.66
257  431.95  4130.66
258  432.32  4246.04
259  432.69  4359.82
260  433.06  4486.63
261  433.43  4610.89
262  433.80  4739.24
263  434.17  4873.86
264  434.54  5007.95
265  434.91  5144.11
266  435.28  5283.06
267  435.65  5428.75
268  436.02  5569.17
269  436.39  5716.82
270  436.75  5864.70
271  437.12  6010.51
272  437.49  6163.72
273  437.86  6321.67
274  438.23  6482.46
275  438.60  6644.25
276  438.97  6807.77
277  439.34  6971.87
278  439.71  7139.35
279  440.08  7297.77
280  440.45  7461.81
281  440.82  7630.12
282  441.19  7805.12
283  441.55  7980.83
284  441.92  8153.16
285  442.29  8341.89
286  442.66  8518.84
287  443.03  8697.21
288  443.40  8885.65
289  443.77  9065.85
290  444.14  9250.50
291  444.51  9437.69
292  444.87  9617.31
293  445.24  9808.52
294  445.61  10006.55
295  445.98  10204.81
296  446.35  10404.38
297  446.72  10602.17
298  447.08  10793.44
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300  447.82  11179.73
301  448.19  11366.68
302  448.56  11548.37
303  448.93  11723.31
304  449.29  11902.39
305  449.66  12086.32
306  450.03  12266.59
307  450.40  12436.97
308  450.77  12602.43
309  451.13  12781.40
310  451.50  12939.76
311  451.87  13098.24
312  452.24  13257.19
313  452.61  13395.31
314  452.97  13536.20
315  453.34  13670.12
316  453.71  13797.75
317  454.08  13909.40
318  454.44  14016.08
319  454.81  14123.59
320  455.18  14221.15
321  455.55  14304.27
322  455.91  14383.54
323  456.28  14449.14
324  456.65  14510.59
325  457.02  14565.17
326  457.38  14604.95
327  457.75  14637.69
328  458.12  14668.77
329  458.48  14677.77
330  458.85  14680.14
331  459.22  14678.00
332  459.59  14661.55
333  459.95  14637.45
334  460.32  14603.18
335  460.69  14548.65
336  461.05  14482.52
337  461.42  14416.69
338  461.79  14334.70
339  462.15  14257.80
340  462.52  14171.37
341  462.89  14076.05
342  463.25  13962.57
343  463.62  13862.28
344  463.99  13755.31
345  464.35  13632.82
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347  465.09  13365.23
348  465.45  13225.40
349  465.82  13077.28
350  466.18  12919.87
351  466.55  12771.92
352  466.92  12614.75
353  467.28  12451.29
354  467.65  12294.47
355  468.02  12126.40
356  468.38  11964.78
357  468.75  11792.51
358  469.11  11637.29
359  469.48  11477.03
360  469.85  11302.92
361  470.21  11140.89
362  470.58  10980.99
363  470.94  10816.41
364  471.31  10653.32
365  471.67  10485.84
366  472.04  10319.60
367  472.41  10145.37
368  472.77  9982.28
369  473.14  9824.45
370  473.50  9667.45
371  473.87  9516.07
372  474.23  9360.26
373  474.60  9207.76
374  474.96  9057.68
375  475.33  8900.09
376  475.69  8750.37
377  476.06  8609.06
378  476.42  8464.02
379  476.79  8321.17
380  477.15  8174.65
381  477.52  8032.80
382  477.88  7885.22
383  478.25  7754.86
384  478.61  7610.94
385  478.98  7477.98
386  479.34  7345.01
387  479.71  7210.74
388  480.07  7078.79
389  480.44  6948.90
390  480.80  6829.43
391  481.17  6701.97
392  481.53  6574.58
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394 482.26 6332.80
395 482.62 6215.05
396 482.99 6099.31
397 483.35 5974.10
398 483.72 5867.07
399 484.08 5749.68
400 484.45 5631.51
401 484.81 5523.82
402 485.17 5413.83
403 485.54 5307.21
404 485.90 5201.77
405 486.27 5098.94
406 486.63 4997.24
407 487.00 4901.63
408 487.36 4809.81
409 487.72 4715.62
410 488.09 4616.87
411 488.45 4522.92
412 488.81 4430.98
413 489.18 4342.48
414 489.54 4253.20
415 489.91 4166.06
416 490.27 4082.05
417 490.63 3997.40
418 491.00 3916.53
419 491.36 3833.65
420 491.72 3757.28
421 492.09 3683.87
422 492.45 3609.10
423 492.81 3542.74
424 493.18 3472.76
425 493.54 3406.40
426 493.90 3338.44
427 494.27 3270.83
428 494.63 3202.99
429 494.99 3142.01
430 495.35 3084.29
431 495.72 3023.73
432 496.08 2971.39
433 496.44 2918.65
434 496.81 2865.54
435 497.17 2814.16
436 497.53 2769.76
437 497.89 2720.62
438 498.26 2676.75
439 498.62 2625.43

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441  499.35  2537.34
442  499.71  2492.70
443  500.07  2451.91
444  500.43  2413.19
445  500.79  2377.32
446  501.16  2341.50
447  501.52  2304.97
448  501.88  2265.01
449  502.24  2228.31
450  502.61  2192.85
451  502.97  2160.94
452  503.33  2130.27
453  503.69  2100.91
454  504.05  2071.60
455  504.42  2045.38
456  504.78  2019.92
457  505.14  1996.36
458  505.50  1973.04
459  505.86  1948.88
460  506.23  1927.69
461  506.59  1903.95
462  506.95  1879.03
463  507.31  1856.94
464  507.67  1837.58
465  508.03  1818.70
466  508.40  1800.53
467  508.76  1781.11
468  509.12  1765.95
469  509.48  1749.79
470  509.84  1731.68
471  510.20  1717.59
472  510.56  1699.71
473  510.93  1682.42
474  511.29  1664.36
475  511.65  1650.63
476  512.01  1636.42
477  512.37  1616.41
478  512.73  1600.61
479  513.09  1586.75
480  513.45  1574.85
481  513.81  1560.76
482  514.17  1546.55
483  514.54  1535.96
484  514.90  1523.70
485  515.26  1511.75
486  515.62  1498.66
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489  516.70  1469.77
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491  517.42  1452.31
492  517.78  1441.06
493  518.14  1433.13
494  518.50  1423.71
495  518.86  1414.60
496  519.22  1404.65
497  519.58  1396.54
498  519.94  1386.24
499  520.30  1380.44
500  520.66  1372.86
501  521.02  1365.82
502  521.38  1358.65
503  521.74  1353.09
504  522.10  1348.17
505  522.46  1341.66
506  522.82  1332.49
507  523.18  1327.81
508  523.54  1322.42
509  523.90  1315.61
510  524.26  1309.34
511  524.62  1304.90
512  524.98  1300.46
513  525.34  1298.45
514  525.70  1295.19
515  526.06  1292.82
516  526.42  1287.97
517  526.78  1284.00
518  527.14  1278.14
519  527.50  1276.36
520  527.86  1272.69
521  528.22  1268.08
522  528.58  1267.37
523  528.93  1262.57
524  529.29  1257.60
525  529.65  1255.41
526  530.01  1252.98
527  530.37  1250.02
528  530.73  1247.36
529  531.09  1244.99
530  531.45  1241.08
531  531.81  1239.66
532  532.16  1238.06
533  532.52  1237.82
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535  533.24  1231.19
536  533.60  1228.53
537  533.96  1225.87
538  534.32  1225.33
539  534.68  1226.58
540  535.03  1224.03
541  535.39  1223.73
542  535.75  1222.37
543  536.11  1222.37
544  536.47  1221.13
545  536.83  1221.19
546  537.18  1220.89
547  537.54  1221.54
548  537.90  1219.29
549  538.26  1217.70
550  538.62  1216.10
551  538.97  1216.45
552  539.33  1215.51
553  539.69  1212.13
554  540.05  1208.88
555  540.41  1206.80
556  540.76  1205.09
557  541.12  1203.25
558  541.48  1200.47
559  541.84  1200.35
560  542.19  1200.35
561  542.55  1198.75
562  542.91  1199.28
563  543.27  1198.28
564  543.62  1198.40
565  543.98  1199.52
566  544.34  1198.99
567  544.70  1198.28
568  545.05  1196.27
569  545.41  1196.38
570  545.77  1194.79
571  546.12  1193.84
572  546.48  1192.12
573  546.84  1190.76
574  547.20  1188.57
575  547.55  1188.63
576  547.91  1188.63
577  548.27  1188.27
578  548.62  1189.34
579  548.98  1188.27
580  549.34  1185.61
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582  550.05  1182.65
583  550.41  1181.88
584  550.76  1181.17
585  551.12  1179.45
586  551.48  1179.22
587  551.83  1178.68
588  552.19  1177.56
589  552.55  1177.50
590  552.90  1174.72
591  553.26  1173.00
592  553.62  1173.35
593  553.97  1172.59
594  554.33  1174.12
595  554.68  1172.23
596  555.04  1171.34
597  555.40  1171.34
598  555.75  1171.34
599  556.11  1171.40
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602  557.18  1170.81
603  557.53  1169.51
604  557.89  1169.63
605  558.24  1168.97
606  558.60  1168.74
607  558.95  1168.20
608  559.31  1165.84
609  559.67  1166.61
610  560.02  1166.19
611  560.38  1166.13
612  560.73  1166.37
613  561.09  1165.07
614  561.44  1165.24
615  561.80  1166.07
616  562.15  1165.72
617  562.51  1167.14
618  562.86  1167.67
619  563.22  1168.38
620  563.57  1167.73
621  563.93  1169.63
622  564.28  1168.74
623  564.64  1170.99
624  564.99  1169.39
625  565.35  1169.98
626  565.70  1170.28
627  566.06  1167.32
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629  566.77  1164.95
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631  567.48  1165.24
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1933  990.92  1158.79
1934  991.21  1156.60
1935  991.51  1157.49
1936  991.80  1159.74
1937  992.09  1158.44
1938  992.39  1160.80
1939  992.68  1161.28
1940  992.98  1160.51
1941  993.27  1159.92
1942  993.56  1158.67
1943  993.86  1158.85
```

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994.15  1158.73
994.44  1160.98
994.74  1159.32
995.03  1163.53
995.32  1165.42
995.62  1168.38
995.91  1169.63
996.20  1169.15
996.50  1168.56
996.79  1169.27
997.08  1168.50
997.38  1165.78
997.67  1166.01
997.96  1166.78
998.25  1168.74
998.55  1171.22
998.84  1170.99
999.13  1170.57
999.42  1170.81
999.72  1169.21
1000.01 1170.57
1000.30 1172.17
1000.59 1172.59
1000.89 1168.86
1001.18 1167.14
1001.47 1167.97
1001.76 1166.49
1002.06 1167.55
1002.35 1167.49
1002.64 1166.19
1002.93 1165.84
1003.22 1165.19
1003.52 1162.46
1003.81 1160.15
1004.10 1162.46
1004.39 1161.99
1004.68 1161.81
1004.97 1160.27
1005.27 1159.98
1005.56 1159.86
1005.85 1159.44
1006.14 1157.19
1006.43 1158.08
1006.72 1159.03
1007.01 1156.01
1007.31 1155.42
1007.60 1153.05
```

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1991  1007.89 1154.77
1992  1008.18 1155.30
1993  1008.47 1155.42
1994  1008.76 1154.53
1995  1009.05 1156.42
1996  1009.34 1158.32
1997  1009.63 1157.02
1998  1009.93 1156.36
1999  1010.22 1155.42
2000  1010.51 1152.93
2001  1010.80 1155.24
2002  1011.09 1153.23
2003  1011.38 1152.87
2004  1011.67 1153.88
2005  1011.96 1152.99
2006  1012.25 1151.81
2007  1012.54 1148.49
2008  1012.83 1149.44
2009  1013.12 1148.25
2010  1013.41 1146.42
2011  1013.70 1146.71
2012  1013.99 1144.94
2013  1014.28 1145.00
2014  1014.57 1146.66
2015  1014.86 1146.60
2016  1015.15 1148.55
2017  1015.44 1148.61
2018  1015.73 1150.03
2019  1016.02 1149.44
2020  1016.31 1149.62
2021  1016.60 1149.50
2022  1016.89 1151.27
2023  1017.18 1149.38
2024  1017.47 1150.50
2025  1017.76 1152.22
2026  1018.05 1153.70
2027  1018.34 1150.56
2028  1018.62 1150.74
2029  1018.91 1153.40
2030  1019.20 1151.63
2031  1019.49 1150.74
2032  1019.78 1149.02
2033  1020.07 1148.14
2034  1020.36 1147.54
2035  1020.65 1147.31
2036  1020.94 1145.65
2037  1021.23 1145.23
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2038  1021.51 1211.18
2039  1021.80 1179.63
2040  1022.09 1157.78
2041  1022.38 1148.08
2042  1022.67 1157.78
2043  1022.96 1082.54
2044  1023.25 1169.92
2045  1023.53 1169.92
2046  1023.82 1177.20
2047  1024.11 1063.12
2048  1024.40 1143.22
2049  1024.69 1225.75
2050  1024.97 1133.51
2051  1025.26 1099.53
2052  1025.55 1169.92
2053  1025.84 1169.92
2054  1026.13 1138.37
2055  1026.41 1123.80
2056  1026.70 1123.80
2057  1026.99 1123.80
```

Listing 9: 绿灯

```
1  暗光谱: 否
2  参考光谱: 否
3  光谱数量: 1
4  光谱仪: USB2+H14105
5  积分时间（毫秒）: 1 (USB2+H14105)
6  平均次数: 1 (USB2+H14105)
7  平滑度: 20 (USB2+H14105)
8  去除暗噪声: 否 (USB2+H14105)
9  339.35  820.40
10 339.73  820.40
11 340.11  820.40
12 340.49  750.01
13 340.87  771.86
14 341.25  762.15
15 341.63  713.60
16 342.01  759.72
17 342.39  725.74
18 342.77  786.42
19 343.15  742.73
20 343.53  759.72
21 343.91  830.11
22 344.29  839.82
23 344.66  805.84
24 345.04  827.68
```

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25  345.42  864.09
26  345.80  873.80
27  346.18  888.36
28  346.56  932.05
29  346.94  954.67
30  347.32  962.25
31  347.70  971.13
32  348.08  979.65
33  348.45  990.01
34  348.83  1000.90
35  349.21  1010.08
36  349.59  1022.27
37  349.97  1031.16
38  350.35  1041.52
39  350.73  1051.16
40  351.10  1060.70
41  351.48  1071.41
42  351.86  1080.41
43  352.24  1086.69
44  352.62  1094.32
45  353.00  1101.90
46  353.37  1109.00
47  353.75  1115.52
48  354.13  1120.73
49  354.51  1125.58
50  354.89  1131.09
51  355.27  1136.65
52  355.64  1140.85
53  356.02  1142.87
54  356.40  1145.77
55  356.78  1146.54
56  357.16  1148.96
57  357.53  1147.31
58  357.91  1149.50
59  358.29  1150.56
60  358.67  1151.10
61  359.04  1151.21
62  359.42  1151.15
63  359.80  1150.98
64  360.18  1150.74
65  360.55  1151.27
66  360.93  1150.86
67  361.31  1148.14
68  361.69  1147.78
69  362.06  1146.00
70  362.44  1145.59
71  362.82  1146.60
```

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 72  363.20  1145.59
 73  363.57  1144.76
 74  363.95  1143.46
 75  364.33  1141.15
 76  364.71  1139.55
 77  365.08  1136.65
 78  365.46  1137.24
 79  365.84  1136.89
 80  366.21  1134.05
 81  366.59  1134.93
 82  366.97  1134.52
 83  367.34  1132.80
 84  367.72  1133.87
 85  368.10  1133.22
 86  368.47  1134.52
 87  368.85  1132.27
 88  369.23  1133.16
 89  369.60  1133.34
 90  369.98  1133.39
 91  370.36  1132.62
 92  370.73  1131.26
 93  371.11  1130.32
 94  371.49  1131.62
 95  371.86  1131.38
 96  372.24  1132.68
 97  372.62  1133.28
 98  372.99  1135.94
 99  373.37  1137.42
100  373.74  1136.47
101  374.12  1136.59
102  374.50  1137.60
103  374.87  1136.71
104  375.25  1137.60
105  375.62  1137.60
106  376.00  1138.49
107  376.38  1138.49
108  376.75  1140.20
109  377.13  1140.32
110  377.50  1141.33
111  377.88  1141.27
112  378.26  1139.37
113  378.63  1137.89
114  379.01  1139.08
115  379.38  1138.96
116  379.76  1139.43
117  380.13  1141.45
118  380.51  1142.10
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119  380.88  1142.16
120  381.26  1139.43
121  381.64  1140.91
122  382.01  1138.90
123  382.39  1137.54
124  382.76  1138.66
125  383.14  1138.13
126  383.51  1139.08
127  383.89  1137.72
128  384.26  1139.02
129  384.64  1138.13
130  385.01  1138.49
131  385.39  1139.26
132  385.76  1139.67
133  386.14  1139.02
134  386.51  1138.96
135  386.89  1137.95
136  387.26  1136.59
137  387.64  1135.47
138  388.01  1135.76
139  388.39  1135.23
140  388.76  1135.41
141  389.13  1136.06
142  389.51  1137.42
143  389.88  1137.18
144  390.26  1137.18
145  390.63  1136.77
146  391.01  1137.95
147  391.38  1137.42
148  391.76  1137.89
149  392.13  1137.72
150  392.50  1136.89
151  392.88  1136.77
152  393.25  1139.31
153  393.63  1140.50
154  394.00  1143.70
155  394.37  1143.81
156  394.75  1145.06
157  395.12  1144.58
158  395.50  1145.35
159  395.87  1146.77
160  396.24  1146.89
161  396.62  1149.02
162  396.99  1148.37
163  397.37  1150.98
164  397.74  1150.44
165  398.11  1149.67
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166  398.49  1151.15
167  398.86  1151.57
168  399.23  1152.40
169  399.61  1153.94
170  399.98  1155.54
171  400.35  1156.42
172  400.73  1157.02
173  401.10  1159.27
174  401.47  1161.57
175  401.85  1161.57
176  402.22  1161.57
177  402.59  1164.06
178  402.97  1164.77
179  403.34  1166.13
180  403.71  1167.20
181  404.09  1167.20
182  404.46  1168.03
183  404.83  1168.86
184  405.20  1167.85
185  405.58  1168.20
186  405.95  1168.32
187  406.32  1167.97
188  406.70  1167.97
189  407.07  1166.43
190  407.44  1169.21
191  407.81  1170.87
192  408.19  1170.51
193  408.56  1170.75
194  408.93  1172.64
195  409.30  1171.93
196  409.68  1170.51
197  410.05  1170.99
198  410.42  1172.53
199  410.79  1173.00
200  411.17  1172.94
201  411.54  1174.36
202  411.91  1177.68
203  412.28  1180.04
204  412.65  1179.33
205  413.03  1180.81
206  413.40  1182.89
207  413.77  1181.47
208  414.14  1183.00
209  414.51  1184.01
210  414.89  1185.79
211  415.26  1187.74
212  415.63  1189.34
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213  416.00  1191.11
214  416.37  1191.29
215  416.74  1191.06
216  417.12  1194.43
217  417.49  1194.13
218  417.86  1194.07
219  418.23  1197.39
220  418.60  1196.92
221  418.97  1196.92
222  419.34  1194.55
223  419.72  1195.79
224  420.09  1194.13
225  420.46  1195.79
226  420.83  1195.73
227  421.20  1196.92
228  421.57  1198.99
229  421.94  1200.65
230  422.31  1203.49
231  422.69  1201.30
232  423.06  1202.30
233  423.43  1204.97
234  423.80  1204.73
235  424.17  1205.26
236  424.54  1205.86
237  424.91  1208.76
238  425.28  1211.36
239  425.65  1212.07
240  426.02  1211.72
241  426.39  1213.08
242  426.76  1213.61
243  427.13  1213.20
244  427.51  1213.55
245  427.88  1215.21
246  428.25  1215.33
247  428.62  1214.20
248  428.99  1216.28
249  429.36  1215.92
250  429.73  1217.40
251  430.10  1216.39
252  430.47  1215.86
253  430.84  1216.75
254  431.21  1216.81
255  431.58  1217.76
256  431.95  1220.66
257  432.32  1220.72
258  432.69  1226.10
259  433.06  1226.52
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260  433.43  1226.99
261  433.80  1229.89
262  434.17  1232.67
263  434.54  1237.05
264  434.91  1238.53
265  435.28  1241.67
266  435.65  1243.80
267  436.02  1246.53
268  436.39  1247.95
269  436.75  1247.71
270  437.12  1250.08
271  437.49  1251.97
272  437.86  1255.64
273  438.23  1258.07
274  438.60  1259.85
275  438.97  1263.40
276  439.34  1265.83
277  439.71  1270.68
278  440.08  1273.05
279  440.45  1274.88
280  440.82  1279.50
281  441.19  1283.47
282  441.55  1286.49
283  441.92  1288.56
284  442.29  1290.93
285  442.66  1296.73
286  443.03  1301.29
287  443.40  1307.44
288  443.77  1314.07
289  444.14  1321.30
290  444.51  1326.45
291  444.87  1331.30
292  445.24  1338.70
293  445.61  1345.15
294  445.98  1351.61
295  446.35  1357.35
296  446.72  1362.80
297  447.08  1370.08
298  447.45  1377.36
299  447.82  1385.17
300  448.19  1395.30
301  448.56  1403.35
302  448.93  1411.46
303  449.29  1420.04
304  449.66  1427.80
305  450.03  1438.16
306  450.40  1448.52
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307  450.77  1459.00
308  451.13  1471.49
309  451.50  1483.80
310  451.87  1500.14
311  452.24  1514.59
312  452.61  1529.62
313  452.97  1545.02
314  453.34  1557.63
315  453.71  1573.20
316  454.08  1588.17
317  454.44  1605.10
318  454.81  1623.87
319  455.18  1644.89
320  455.55  1665.61
321  455.91  1684.97
322  456.28  1705.57
323  456.65  1727.71
324  457.02  1753.11
325  457.38  1779.27
326  457.75  1804.08
327  458.12  1830.90
328  458.48  1859.90
329  458.85  1888.62
330  459.22  1918.45
331  459.59  1950.89
332  459.95  1986.12
333  460.32  2023.65
334  460.69  2058.40
335  461.05  2094.69
336  461.42  2134.95
337  461.79  2177.28
338  462.15  2219.07
339  462.52  2260.75
340  462.89  2302.78
341  463.25  2351.92
342  463.62  2400.64
343  463.99  2454.04
344  464.35  2506.37
345  464.72  2566.58
346  465.09  2628.56
347  465.45  2691.26
348  465.82  2756.26
349  466.18  2822.98
350  466.55  2893.49
351  466.92  2967.25
352  467.28  3042.91
353  467.65  3122.65
```

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468.02  3208.73
468.38  3298.65
468.75  3391.13
469.11  3489.28
469.48  3584.30
469.85  3684.70
470.21  3790.73
470.58  3903.45
470.94  4019.01
471.31  4139.78
471.67  4263.80
472.04  4389.01
472.41  4520.55
472.77  4655.29
473.14  4800.45
473.50  4947.33
473.87  5105.16
474.23  5259.32
474.60  5425.61
474.96  5596.70
475.33  5770.99
475.69  5959.24
476.06  6156.32
476.42  6354.70
476.79  6562.85
477.15  6779.23
477.52  7004.43
477.88  7230.28
478.25  7462.82
478.61  7696.84
478.98  7941.22
479.34  8202.12
479.71  8455.14
480.07  8723.20
480.44  9002.45
480.80  9295.61
481.17  9594.69
481.53  9906.86
481.90  10208.90
482.26  10523.49
482.62  10861.76
482.99  11182.51
483.35  11517.52
483.72  11850.11
484.08  12184.54
484.45  12549.09
484.81  12917.62
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401  485.17  13293.24
402  485.54  13686.75
403  485.90  14078.42
404  486.27  14492.71
405  486.63  14923.45
406  487.00  15354.79
407  487.36  15787.07
408  487.72  16220.83
409  488.09  16684.25
410  488.45  17171.35
411  488.81  17640.70
412  489.18  18123.59
413  489.54  18616.56
414  489.91  19111.77
415  490.27  19627.17
416  490.63  20144.64
417  491.00  20704.44
418  491.36  21265.84
419  491.72  21822.98
420  492.09  22355.78
421  492.45  22944.41
422  492.81  23537.19
423  493.18  24121.20
424  493.54  24722.38
425  493.90  25326.41
426  494.27  25910.54
427  494.63  26508.64
428  494.99  27119.65
429  495.35  27725.21
430  495.72  28367.89
431  496.08  29017.15
432  496.44  29614.72
433  496.81  30264.92
434  497.17  30896.59
435  497.53  31562.65
436  497.89  32213.21
437  498.26  32864.29
438  498.62  33501.71
439  498.98  34159.96
440  499.35  34787.13
441  499.71  35426.79
442  500.07  36064.02
443  500.43  36672.01
444  500.79  37316.53
445  501.16  37947.84
446  501.52  38591.47
447  501.88  39231.07
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448  502.24  39840.48
449  502.61  40461.20
450  502.97  41081.56
451  503.33  41708.20
452  503.69  42315.36
453  504.05  42887.06
454  504.42  43498.55
455  504.78  44112.40
456  505.14  44708.31
457  505.50  45302.21
458  505.86  45865.09
459  506.23  46427.85
460  506.59  46984.57
461  506.95  47560.65
462  507.31  48120.33
463  507.67  48642.07
464  508.03  49158.53
465  508.40  49657.12
466  508.76  50104.91
467  509.12  50581.89
468  509.48  51068.70
469  509.84  51512.82
470  510.20  51920.83
471  510.56  52296.28
472  510.93  52655.33
473  511.29  53044.93
474  511.65  53378.05
475  512.01  53702.35
476  512.37  53995.28
477  512.73  54316.85
478  513.09  54601.73
479  513.45  54871.38
480  513.81  55142.70
481  514.17  55419.82
482  514.54  55643.77
483  514.90  55829.78
484  515.26  56019.52
485  515.62  56184.45
486  515.98  56304.69
487  516.34  56410.66
488  516.70  56483.53
489  517.06  56597.38
490  517.42  56682.86
491  517.78  56727.74
492  518.14  56742.71
493  518.50  56748.46
494  518.86  56772.49
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519.22  56731.05
519.58  56652.85
519.94  56549.25
520.30  56425.46
520.66  56246.85
521.02  56058.53
521.38  55861.45
521.74  55660.76
522.10  55385.01
522.46  55110.85
522.82  54845.57
523.18  54541.22
523.54  54224.44
523.90  53900.61
524.26  53550.56
524.62  53218.45
524.98  52858.68
525.34  52498.45
525.70  52131.94
526.06  51727.72
526.42  51274.83
526.78  50830.77
527.14  50346.80
527.50  49871.25
527.86  49390.36
528.22  48909.47
528.58  48373.47
528.93  47830.31
529.29  47314.38
529.65  46794.89
530.01  46269.13
530.37  45728.99
530.73  45175.87
531.09  44618.92
531.45  44065.63
531.81  43490.02
532.16  42886.71
532.52  42289.14
532.88  41673.81
533.24  41066.53
533.60  40458.24
533.96  39850.37
534.32  39249.72
534.68  38645.82
535.03  38052.69
535.39  37477.50
535.75  36895.02
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542  536.11  36302.01
543  536.47  35692.72
544  536.83  35102.55
545  537.18  34522.74
546  537.54  33928.19
547  537.90  33342.46
548  538.26  32800.30
549  538.62  32230.73
550  538.97  31641.56
551  539.33  31056.72
552  539.69  30527.41
553  540.05  29966.54
554  540.41  29404.79
555  540.76  28857.66
556  541.12  28362.33
557  541.48  27862.02
558  541.84  27351.66
559  542.19  26821.22
560  542.55  26325.00
561  542.91  25838.08
562  543.27  25363.17
563  543.62  24878.14
564  543.98  24385.47
565  544.34  23918.44
566  544.70  23454.72
567  545.05  22992.19
568  545.41  22557.95
569  545.77  22100.15
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1864  970.81  1149.67
1865  971.10  1152.46
1866  971.40  1151.51
1867  971.70  1151.98
1868  972.00  1150.86
1869  972.29  1147.19
1870  972.59  1147.37
1871  972.89  1148.96
1872  973.18  1150.33
1873  973.48  1153.17
1874  973.78  1154.41
1875  974.08  1154.53
1876  974.37  1156.54
1877  974.67  1157.43
1878  974.97  1155.00
1879  975.26  1156.36
1880  975.56  1160.75
1881  975.86  1161.40
1882  976.15  1160.51
1883  976.45  1161.99
1884  976.75  1161.10
1885  977.04  1161.40
1886  977.34  1161.46
1887  977.63  1161.16
1888  977.93  1160.98
1889  978.23  1160.98
1890  978.52  1160.45
1891  978.82  1160.98
1892  979.12  1161.87
1893  979.41  1160.39
1894  979.71  1158.91
1895  980.00  1158.32
1896  980.30  1157.78
1897  980.60  1157.49
1898  980.89  1157.31
1899  981.19  1160.33
1900  981.48  1161.99
1901  981.78  1161.75
1902  982.07  1161.16
1903  982.37  1163.29
1904  982.67  1162.88
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1905  982.96  1163.29
1906  983.26  1161.93
1907  983.55  1162.23
1908  983.85  1161.40
1909  984.14  1163.17
1910  984.44  1163.71
1911  984.73  1162.64
1912  985.03  1163.17
1913  985.32  1163.17
1914  985.62  1160.75
1915  985.91  1161.28
1916  986.21  1161.87
1917  986.50  1160.92
1918  986.80  1161.04
1919  987.09  1162.11
1920  987.39  1159.44
1921  987.68  1156.54
1922  987.98  1155.48
1923  988.27  1155.36
1924  988.56  1155.06
1925  988.86  1155.89
1926  989.15  1154.59
1927  989.45  1152.52
1928  989.74  1154.41
1929  990.04  1153.52
1930  990.33  1154.59
1931  990.62  1152.52
1932  990.92  1153.76
1933  991.21  1153.40
1934  991.51  1154.88
1935  991.80  1154.77
1936  992.09  1157.13
1937  992.39  1158.08
1938  992.68  1157.02
1939  992.98  1157.07
1940  993.27  1154.71
1941  993.56  1154.71
1942  993.86  1155.71
1943  994.15  1156.01
1944  994.44  1152.58
1945  994.74  1152.87
1946  995.03  1151.86
1947  995.32  1153.34
1948  995.62  1152.58
1949  995.91  1151.10
1950  996.20  1149.26
1951  996.50  1149.32
```

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996.79  1149.79
997.08  1149.50
997.38  1148.49
997.67  1148.73
997.96  1146.89
998.25  1146.42
998.55  1145.77
998.84  1145.65
999.13  1146.54
999.42  1149.38
999.72  1149.91
1000.01 1152.75
1000.30 1154.17
1000.59 1153.34
1000.89 1151.92
1001.18 1151.15
1001.47 1151.57
1001.76 1150.38
1002.06 1150.74
1002.35 1150.98
1002.64 1151.51
1002.93 1151.15
1003.22 1152.52
1003.52 1153.88
1003.81 1155.89
1004.10 1154.47
1004.39 1153.23
1004.68 1152.63
1004.97 1151.69
1005.27 1149.56
1005.56 1149.20
1005.85 1148.79
1006.14 1149.08
1006.43 1149.73
1006.72 1151.39
1007.01 1152.16
1007.31 1151.33
1007.60 1151.63
1007.89 1152.63
1008.18 1153.17
1008.47 1154.23
1008.76 1154.71
1009.05 1154.71
1009.34 1155.42
1009.63 1155.30
1009.93 1155.06
1010.22 1155.89
```

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1999  1010.51 1156.30
2000  1010.80 1157.43
2001  1011.09 1158.02
2002  1011.38 1156.60
2003  1011.67 1155.89
2004  1011.96 1153.82
2005  1012.25 1154.00
2006  1012.54 1154.77
2007  1012.83 1156.25
2008  1013.12 1158.44
2009  1013.41 1159.44
2010  1013.70 1158.44
2011  1013.99 1158.55
2012  1014.28 1158.44
2013  1014.57 1158.73
2014  1014.86 1159.44
2015  1015.15 1157.67
2016  1015.44 1155.00
2017  1015.73 1153.94
2018  1016.02 1153.94
2019  1016.31 1153.76
2020  1016.60 1155.65
2021  1016.89 1155.59
2022  1017.18 1155.89
2023  1017.47 1154.59
2024  1017.76 1153.94
2025  1018.05 1152.16
2026  1018.34 1152.81
2027  1018.62 1152.28
2028  1018.91 1152.58
2029  1019.20 1152.34
2030  1019.49 1151.98
2031  1019.78 1152.04
2032  1020.07 1153.46
2033  1020.36 1152.52
2034  1020.65 1152.81
2035  1020.94 1153.23
2036  1021.23 1153.46
2037  1021.51 1162.64
2038  1021.80 1152.93
2039  1022.09 1111.67
2040  1022.38 1191.77
2041  1022.67 1143.22
2042  1022.96 1106.81
2043  1023.25 1128.66
2044  1023.53 1126.23
2045  1023.82 1092.25
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2046  1024.11 1172.35
2047  1024.40 1150.50
2048  1024.69 1150.50
2049  1024.97 1143.22
2050  1025.26 1131.09
2051  1025.55 1148.08
2052  1025.84 1206.33
2053  1026.13 1138.37
2054  1026.41 1172.35
2055  1026.70 1172.35
2056  1026.99 1172.35
```

Listing 10: 白灯

```
1  暗光谱: 否
2  参考光谱: 否
3  光谱数量: 1
4  光谱仪: USB2+H14105
5  积分时间（毫秒）: 50 (USB2+H14105)
6  平均次数: 1 (USB2+H14105)
7  平滑度: 20 (USB2+H14105)
8  去除暗噪声: 否 (USB2+H14105)
9
10 339.35  783.99
11 339.73  783.99
12 340.11  783.99
13 340.49  757.29
14 340.87  757.29
15 341.25  825.26
16 341.63  713.60
17 342.01  691.76
18 342.39  827.68
19 342.77  820.40
20 343.15  783.99
21 343.53  750.01
22 343.91  783.99
23 344.29  822.83
24 344.66  827.68
25 345.04  837.39
26 345.42  871.37
27 345.80  842.25
28 346.18  912.64
29 346.56  975.74
30 346.94  952.30
31 347.32  962.19
32 347.70  971.60
33 348.08  981.66
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34  348.45  991.19
35  348.83  1000.02
36  349.21  1007.47
37  349.59  1019.73
38  349.97  1030.44
39  350.35  1039.62
40  350.73  1048.15
41  351.10  1056.55
42  351.48  1066.38
43  351.86  1075.91
44  352.24  1082.25
45  352.62  1090.00
46  353.00  1098.64
47  353.37  1105.27
48  353.75  1112.85
49  354.13  1118.54
50  354.51  1121.50
51  354.89  1125.58
52  355.27  1130.38
53  355.64  1134.40
54  356.02  1137.18
55  356.40  1138.54
56  356.78  1141.56
57  357.16  1144.46
58  357.53  1145.35
59  357.91  1147.42
60  358.29  1148.55
61  358.67  1149.56
62  359.04  1150.09
63  359.42  1150.33
64  359.80  1151.51
65  360.18  1151.33
66  360.55  1148.73
67  360.93  1150.38
68  361.31  1149.20
69  361.69  1149.62
70  362.06  1148.02
71  362.44  1147.96
72  362.82  1145.94
73  363.20  1143.04
74  363.57  1142.27
75  363.95  1142.57
76  364.33  1144.29
77  364.71  1143.28
78  365.08  1140.08
79  365.46  1140.32
80  365.84  1136.83
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 81  366.21  1135.76
 82  366.59  1134.40
 83  366.97  1133.51
 84  367.34  1133.22
 85  367.72  1136.41
 86  368.10  1137.78
 87  368.47  1136.77
 88  368.85  1138.37
 89  369.23  1138.66
 90  369.60  1139.73
 91  369.98  1141.15
 92  370.36  1142.16
 93  370.73  1141.68
 94  371.11  1141.62
 95  371.49  1141.56
 96  371.86  1141.56
 97  372.24  1140.32
 98  372.62  1140.62
 99  372.99  1138.72
100  373.37  1139.31
101  373.74  1139.02
102  374.12  1139.97
103  374.50  1139.20
104  374.87  1140.02
105  375.25  1139.91
106  375.62  1142.10
107  376.00  1141.86
108  376.38  1141.62
109  376.75  1141.62
110  377.13  1140.74
111  377.50  1141.21
112  377.88  1140.50
113  378.26  1141.74
114  378.63  1143.28
115  379.01  1142.87
116  379.38  1143.99
117  379.76  1142.10
118  380.13  1142.93
119  380.51  1145.47
120  380.88  1147.54
121  381.26  1150.74
122  381.64  1152.10
123  382.01  1154.29
124  382.39  1156.07
125  382.76  1154.65
126  383.14  1151.92
127  383.51  1150.21
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128  383.89  1148.96
129  384.26  1147.42
130  384.64  1146.42
131  385.01  1147.01
132  385.39  1147.01
133  385.76  1147.31
134  386.14  1147.66
135  386.51  1147.60
136  386.89  1148.19
137  387.26  1149.14
138  387.64  1149.97
139  388.01  1149.50
140  388.39  1152.58
141  388.76  1153.46
142  389.13  1153.46
143  389.51  1152.46
144  389.88  1153.82
145  390.26  1155.95
146  390.63  1154.94
147  391.01  1155.42
148  391.38  1157.43
149  391.76  1158.14
150  392.13  1158.67
151  392.50  1161.46
152  392.88  1162.23
153  393.25  1164.18
154  393.63  1164.00
155  394.00  1165.01
156  394.37  1166.78
157  394.75  1168.38
158  395.12  1170.93
159  395.50  1173.47
160  395.87  1175.78
161  396.24  1178.33
162  396.62  1179.16
163  396.99  1182.00
164  397.37  1182.47
165  397.74  1184.25
166  398.11  1188.57
167  398.49  1194.73
168  398.86  1197.92
169  399.23  1200.88
170  399.61  1206.21
171  399.98  1211.72
172  400.35  1214.97
173  400.73  1218.41
174  401.10  1225.63
```

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401.47  1231.73
401.85  1239.66
402.22  1247.83
402.59  1256.35
402.97  1265.53
403.34  1274.35
403.71  1283.23
404.09  1292.82
404.46  1305.02
404.83  1317.86
405.20  1330.59
405.58  1343.02
405.95  1358.59
406.32  1374.75
406.70  1391.09
407.07  1409.51
407.44  1428.57
407.81  1447.51
408.19  1469.00
408.56  1491.56
408.93  1515.47
409.30  1542.29
409.68  1566.45
410.05  1592.44
410.42  1622.04
410.79  1654.00
411.17  1683.07
411.54  1714.45
411.91  1751.74
412.28  1789.04
412.65  1832.32
413.03  1876.18
413.40  1921.89
413.77  1966.29
414.14  2017.44
414.51  2070.95
414.89  2123.70
415.26  2183.14
415.63  2244.00
416.00  2310.18
416.37  2378.74
416.74  2451.32
417.12  2522.42
417.49  2602.46
417.86  2691.91
418.23  2778.28
418.60  2870.40
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222  418.97  2967.84
223  419.34  3067.24
224  419.72  3175.16
225  420.09  3287.35
226  420.46  3403.20
227  420.83  3520.60
228  421.20  3642.85
229  421.57  3779.84
230  421.94  3915.46
231  422.31  4058.14
232  422.69  4212.71
233  423.06  4360.59
234  423.43  4513.33
235  423.80  4676.84
236  424.17  4861.67
237  424.54  5042.70
238  424.91  5238.89
239  425.28  5433.43
240  425.65  5634.06
241  426.02  5837.29
242  426.39  6048.76
243  426.76  6275.91
244  427.13  6510.99
245  427.51  6764.08
246  427.88  7013.01
247  428.25  7284.86
248  428.62  7560.44
249  428.99  7836.43
250  429.36  8124.27
251  429.73  8423.65
252  430.10  8720.89
253  430.47  9042.94
254  430.84  9371.09
255  431.21  9696.99
256  431.58  10049.35
257  431.95  10416.99
258  432.32  10803.45
259  432.69  11170.67
260  433.06  11540.20
261  433.43  11930.86
262  433.80  12323.36
263  434.17  12696.92
264  434.54  13114.64
265  434.91  13532.77
266  435.28  13935.39
267  435.65  14371.11
268  436.02  14811.03
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269  436.39  15238.40
270  436.75  15657.54
271  437.12  16082.54
272  437.49  16544.48
273  437.86  16976.88
274  438.23  17418.52
275  438.60  17849.61
276  438.97  18276.39
277  439.34  18704.71
278  439.71  19150.84
279  440.08  19580.58
280  440.45  20004.46
281  440.82  20457.99
282  441.19  20914.43
283  441.55  21379.27
284  441.92  21824.75
285  442.29  22231.40
286  442.66  22621.59
287  443.03  23002.61
288  443.40  23374.45
289  443.77  23699.16
290  444.14  24023.82
291  444.51  24339.77
292  444.87  24638.02
293  445.24  24946.99
294  445.61  25201.73
295  445.98  25454.87
296  446.35  25694.57
297  446.72  25890.41
298  447.08  26040.54
299  447.45  26133.61
300  447.82  26232.23
301  448.19  26314.11
302  448.56  26341.22
303  448.93  26359.34
304  449.29  26401.78
305  449.66  26379.35
306  450.03  26329.62
307  450.40  26284.69
308  450.77  26201.39
309  451.13  26109.87
310  451.50  25989.99
311  451.87  25846.01
312  452.24  25688.95
313  452.61  25493.94
314  452.97  25316.16
315  453.34  25122.16
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316  453.71  24907.56
317  454.08  24683.55
318  454.44  24421.94
319  454.81  24153.76
320  455.18  23871.08
321  455.55  23572.95
322  455.91  23240.24
323  456.28  22889.36
324  456.65  22523.62
325  457.02  22157.76
326  457.38  21814.93
327  457.75  21443.74
328  458.12  21081.55
329  458.48  20690.12
330  458.85  20337.46
331  459.22  19978.70
332  459.59  19605.27
333  459.95  19232.42
334  460.32  18856.32
335  460.69  18484.36
336  461.05  18101.87
337  461.42  17735.71
338  461.79  17381.81
339  462.15  17040.82
340  462.52  16720.66
341  462.89  16404.53
342  463.25  16095.03
343  463.62  15818.56
344  463.99  15550.44
345  464.35  15263.91
346  464.72  14985.20
347  465.09  14721.04
348  465.45  14461.09
349  465.82  14200.55
350  466.18  13932.67
351  466.55  13697.23
352  466.92  13470.49
353  467.28  13254.17
354  467.65  13032.17
355  468.02  12809.28
356  468.38  12595.80
357  468.75  12407.78
358  469.11  12220.00
359  469.48  12044.05
360  469.85  11854.49
361  470.21  11678.14
362  470.58  11518.35
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363  470.94  11350.46
364  471.31  11190.62
365  471.67  11034.63
366  472.04  10876.38
367  472.41  10725.07
368  472.77  10582.16
369  473.14  10440.31
370  473.50  10314.16
371  473.87  10195.28
372  474.23  10083.21
373  474.60  9976.77
374  474.96  9868.26
375  475.33  9755.48
376  475.69  9666.56
377  476.06  9579.54
378  476.42  9487.30
379  476.79  9397.67
380  477.15  9318.40
381  477.52  9255.00
382  477.88  9183.90
383  478.25  9118.13
384  478.61  9054.43
385  478.98  8980.90
386  479.34  8921.05
387  479.71  8875.88
388  480.07  8835.15
389  480.44  8792.88
390  480.80  8752.56
391  481.17  8739.24
392  481.53  8726.63
393  481.90  8713.61
394  482.26  8695.61
395  482.62  8671.99
396  482.99  8657.72
397  483.35  8650.74
398  483.72  8643.52
399  484.08  8634.64
400  484.45  8627.35
401  484.81  8639.19
402  485.17  8646.42
403  485.54  8666.01
404  485.90  8689.63
405  486.27  8710.47
406  486.63  8739.30
407  487.00  8774.05
408  487.36  8798.86
409  487.72  8835.56
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411  488.45  8948.10
412  488.81  8997.42
413  489.18  9055.20
414  489.54  9102.79
415  489.91  9168.15
416  490.27  9229.90
417  490.63  9292.83
418  491.00  9360.14
419  491.36  9421.35
420  491.72  9486.35
421  492.09  9568.88
422  492.45  9656.73
423  492.81  9742.04
424  493.18  9811.90
425  493.54  9888.74
426  493.90  9985.24
427  494.27  10083.15
428  494.63  10176.45
429  494.99  10269.93
430  495.35  10352.81
431  495.72  10443.51
432  496.08  10522.07
433  496.44  10613.41
434  496.81  10714.77
435  497.17  10817.12
436  497.53  10949.08
437  497.89  11069.97
438  498.26  11180.67
439  498.62  11305.94
440  498.98  11414.99
441  499.35  11531.50
442  499.71  11628.11
443  500.07  11734.20
444  500.43  11845.14
445  500.79  11974.14
446  501.16  12098.76
447  501.52  12209.76
448  501.88  12322.24
449  502.24  12438.21
450  502.61  12571.35
451  502.97  12685.85
452  503.33  12809.64
453  503.69  12941.06
454  504.05  13054.84
455  504.42  13187.16
456  504.78  13317.52
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505.14  13445.45
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505.86  13687.52
506.23  13824.04
506.59  13961.92
506.95  14071.85
507.31  14175.16
507.67  14296.16
508.03  14444.99
508.40  14592.93
508.76  14718.50
509.12  14823.52
509.48  14938.01
509.84  15045.88
510.20  15168.19
510.56  15276.88
510.93  15399.54
511.29  15504.80
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512.01  15723.96
512.37  15804.41
512.73  15883.86
513.09  15977.81
513.45  16064.36
513.81  16179.03
514.17  16287.96
514.54  16407.08
514.90  16530.98
515.26  16635.89
515.62  16718.77
515.98  16811.71
516.34  16893.53
516.70  16997.19
517.06  17111.80
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1845  964.85  1154.94
1846  965.14  1154.65
1847  965.44  1153.88
1848  965.74  1153.82
1849  966.04  1155.48
1850  966.34  1154.06
1851  966.64  1155.42
1852  966.93  1152.81
1853  967.23  1153.52
1854  967.53  1155.06
1855  967.83  1155.42
1856  968.13  1155.30
1857  968.42  1152.93
1858  968.72  1153.17
1859  969.02  1151.27
1860  969.32  1152.46
1861  969.62  1154.06
1862  969.91  1156.36
1863  970.21  1157.07
1864  970.51  1154.82
1865  970.81  1155.54
1866  971.10  1153.11
```

971.40 1153.70
971.70 1152.52
972.00 1152.40
972.29 1151.86
972.59 1152.04
972.89 1154.06
973.18 1153.58
973.48 1153.11
973.78 1155.30
974.08 1155.89
974.37 1155.59
974.67 1154.29
974.97 1153.70
975.26 1154.41
975.56 1156.48
975.86 1156.36
976.15 1157.13
976.45 1158.08
976.75 1158.26
977.04 1158.73
977.34 1159.80
977.63 1160.98
977.93 1161.87
978.23 1159.98
978.52 1160.63
978.82 1160.03
979.12 1161.93
979.41 1161.22
979.71 1160.45
980.00 1161.63
980.30 1160.33
980.60 1161.69
980.89 1162.46
981.19 1164.42
981.48 1162.40
981.78 1160.92
982.07 1160.63
982.37 1160.09
982.67 1159.62
982.96 1161.46
983.26 1161.40
983.55 1162.40
983.85 1161.81
984.14 1161.16
984.44 1161.63
984.73 1163.11
985.03 1161.99

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1914  985.32  1162.05
1915  985.62  1163.29
1916  985.91  1160.09
1917  986.21  1160.21
1918  986.50  1159.62
1919  986.80  1160.69
1920  987.09  1161.51
1921  987.39  1162.17
1922  987.68  1161.51
1923  987.98  1161.57
1924  988.27  1161.22
1925  988.56  1162.76
1926  988.86  1161.16
1927  989.15  1160.86
1928  989.45  1161.63
1929  989.74  1160.92
1930  990.04  1160.09
1931  990.33  1161.40
1932  990.62  1161.69
1933  990.92  1161.69
1934  991.21  1162.11
1935  991.51  1161.81
1936  991.80  1160.98
1937  992.09  1160.15
1938  992.39  1162.34
1939  992.68  1161.51
1940  992.98  1161.22
1941  993.27  1159.32
1942  993.56  1159.68
1943  993.86  1157.96
1944  994.15  1157.37
1945  994.44  1159.86
1946  994.74  1161.57
1947  995.03  1159.21
1948  995.32  1159.68
1949  995.62  1158.79
1950  995.91  1160.27
1951  996.20  1161.04
1952  996.50  1160.51
1953  996.79  1158.38
1954  997.08  1158.50
1955  997.38  1158.73
1956  997.67  1158.44
1957  997.96  1161.75
1958  998.25  1161.87
1959  998.55  1160.98
1960  998.84  1161.10
```

```
1961  999.13  1160.27
1962  999.42  1158.97
1963  999.72  1158.44
1964  1000.01 1157.43
1965  1000.30 1158.91
1966  1000.59 1157.37
1967  1000.89 1158.97
1968  1001.18 1158.50
1969  1001.47 1156.60
1970  1001.76 1156.30
1971  1002.06 1155.30
1972  1002.35 1155.48
1973  1002.64 1156.96
1974  1002.93 1157.37
1975  1003.22 1156.96
1976  1003.52 1156.54
1977  1003.81 1157.43
1978  1004.10 1157.25
1979  1004.39 1156.25
1980  1004.68 1156.54
1981  1004.97 1157.02
1982  1005.27 1158.50
1983  1005.56 1157.73
1984  1005.85 1159.44
1985  1006.14 1160.98
1986  1006.43 1159.50
1987  1006.72 1160.45
1988  1007.01 1162.17
1989  1007.31 1164.47
1990  1007.60 1164.77
1991  1007.89 1165.13
1992  1008.18 1165.36
1993  1008.47 1166.55
1994  1008.76 1167.14
1995  1009.05 1167.67
1996  1009.34 1169.51
1997  1009.63 1168.68
1998  1009.93 1167.20
1999  1010.22 1167.79
2000  1010.51 1170.22
2001  1010.80 1171.52
2002  1011.09 1172.17
2003  1011.38 1170.34
2004  1011.67 1170.39
2005  1011.96 1170.51
2006  1012.25 1168.74
2007  1012.54 1167.32
```

```
1012.83 1165.78
1013.12 1165.13
1013.41 1165.42
1013.70 1166.61
1013.99 1168.68
1014.28 1167.43
1014.57 1166.55
1014.86 1166.37
1015.15 1166.49
1015.44 1167.26
1015.73 1167.08
1016.02 1165.54
1016.31 1164.53
1016.60 1163.05
1016.89 1162.40
1017.18 1160.63
1017.47 1163.41
1017.76 1164.42
1018.05 1162.52
1018.34 1162.17
1018.62 1161.63
1018.91 1160.86
1019.20 1159.56
1019.49 1158.79
1019.78 1157.49
1020.07 1158.26
1020.36 1157.02
1020.65 1156.36
1020.94 1155.48
1021.23 1152.99
1021.51 1172.35
1021.80 1092.25
1022.09 1097.10
1022.38 1070.40
1022.67 1169.92
1022.96 1109.24
1023.25 1220.89
1023.53 1194.19
1023.82 1157.78
1024.11 1155.36
1024.40 1152.93
1024.69 1143.22
1024.97 1157.78
1025.26 1145.65
1025.55 1162.64
1025.84 1201.48
1026.13 1116.52
```

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2055  1026.41 1131.09
2056  1026.70 1131.09
2057  1026.99 1131.09
```

Listing 11: 汞灯时序

```
 1  Trend type: Single 波长 at 339.35
 2  积分时间（毫秒）: 10 (USB2+H14105)
 3  平均次数: 15 (USB2+H14105)
 4  平滑度: 0 (USB2+H14105)
 5  去除暗噪声: 否 (USB2+H14105)
 6  10:41:14.680    801.31
 7  10:41:14.830    811.99
 8  10:41:14.980    802.60
 9  10:41:15.130    824.45
10  10:41:15.280    827.84
11  10:41:15.430    822.18
12  10:41:15.580    820.08
13  10:41:15.730    823.80
14  10:41:15.880    817.33
15  10:41:16.030    806.32
16  10:41:16.180    808.26
17  10:41:16.329    805.51
18  10:41:16.479    819.43
19  10:41:16.629    815.87
20  10:41:16.779    817.65
21  10:41:16.929    829.79
22  10:41:17.079    826.23
23  10:41:17.229    821.05
24  10:41:17.379    802.60
25  10:41:17.529    824.77
26  10:41:17.679    810.37
27  10:41:17.829    828.33
28  10:41:17.979    813.77
29  10:41:18.129    802.44
30  10:41:18.279    828.33
31  10:41:18.429    816.84
32  10:41:18.579    831.57
33  10:41:18.729    819.27
34  10:41:18.879    809.40
35  10:41:19.029    825.26
36  10:41:19.179    806.00
37  10:41:19.329    809.07
38  10:41:19.479    806.16
39  10:41:19.629    817.97
40  10:41:19.778    818.94
41  10:41:19.928    811.34
```

```
42  10:41:20.078    809.72
43  10:41:20.228    817.33
44  10:41:20.378    799.69
45  10:41:20.528    825.42
46  10:41:20.678    795.81
47  10:41:20.828    822.67
48  10:41:20.978    802.76
49  10:41:21.128    804.71
50  10:41:21.278    812.63
51  10:41:21.428    827.52
52  10:41:21.577    815.38
53  10:41:21.727    812.96
54  10:41:21.877    838.69
55  10:41:22.027    832.21
56  10:41:22.177    806.49
57  10:41:22.327    808.26
58  10:41:22.477    826.06
59  10:41:22.627    825.74
60  10:41:22.777    826.87
61  10:41:22.927    813.60
62  10:41:23.077    825.26
63  10:41:23.227    815.38
64  10:41:23.377    823.48
65  10:41:23.527    826.23
66  10:41:23.677    822.34
67  10:41:23.827    829.79
68  10:41:23.977    815.38
69  10:41:24.127    816.03
70  10:41:24.276    816.68
71  10:41:24.436    817.81
72  10:41:24.576    825.42
73  10:41:24.726    828.98
74  10:41:24.886    836.10
75  10:41:25.036    827.20
76  10:41:25.186    833.02
77  10:41:25.336    828.49
78  10:41:25.486    812.96
79  10:41:25.636    817.81
80  10:41:25.786    823.48
81  10:41:25.936    837.23
82  10:41:26.086    828.49
83  10:41:26.235    833.99
84  10:41:26.385    832.05
85  10:41:26.535    817.33
86  10:41:26.685    818.62
87  10:41:26.835    828.98
88  10:41:26.985    840.79
```

```
89  10:41:27.135    847.42
90  10:41:27.285    831.57
91  10:41:27.435    829.30
92  10:41:27.585    838.04
93  10:41:27.735    815.71
94  10:41:27.885    813.93
95  10:41:28.035    824.93
96  10:41:28.185    823.15
97  10:41:28.335    826.23
98  10:41:28.485    838.52
99  10:41:28.635    828.01
100 10:41:28.784    828.49
101 10:41:28.934    822.50
102 10:41:29.084    820.24
103 10:41:29.234    829.30
104 10:41:29.384    829.30
105 10:41:29.534    831.40
106 10:41:29.684    813.77
107 10:41:29.834    854.87
108 10:41:29.984    842.89
109 10:41:30.134    840.30
110 10:41:30.284    832.54
111 10:41:30.434    838.04
112 10:41:30.584    829.30
113 10:41:30.734    846.78
114 10:41:30.883    831.40
115 10:41:31.033    834.80
116 10:41:31.183    832.21
117 10:41:31.333    830.27
118 10:41:31.484    837.88
119 10:41:31.634    832.05
120 10:41:31.784    843.06
121 10:41:31.933    827.52
122 10:41:32.083    832.05
123 10:41:32.233    844.03
124 10:41:32.383    850.66
125 10:41:32.533    846.45
126 10:41:32.683    824.77
127 10:41:32.834    818.30
128 10:41:32.983    832.86
129 10:41:33.133    822.99
130 10:41:33.283    829.95
131 10:41:33.433    839.01
132 10:41:33.583    814.41
133 10:41:33.733    839.66
134 10:41:33.883    829.30
135 10:41:34.033    815.55
```

```
136  10:41:34.183    830.11
137  10:41:34.333    840.30
138  10:41:34.483    833.99
139  10:41:34.633    840.14
140  10:41:34.782    832.54
141  10:41:34.932    833.35
142  10:41:35.082    817.49
143  10:41:35.232    820.56
144  10:41:35.382    841.28
145  10:41:35.532    836.26
146  10:41:35.682    838.20
147  10:41:35.832    827.52
148  10:41:35.982    810.85
149  10:41:36.132    841.44
150  10:41:36.282    836.58
151  10:41:36.432    813.12
152  10:41:36.582    820.24
153  10:41:36.732    828.65
154  10:41:36.882    826.06
155  10:41:37.032    823.80
156  10:41:37.182    823.31
157  10:41:37.332    823.80
158  10:41:37.482    817.65
159  10:41:37.632    823.31
160  10:41:37.782    822.02
161  10:41:37.932    811.82
162  10:41:38.084    820.89
163  10:41:38.232    813.12
164  10:41:38.382    835.29
165  10:41:38.532    814.09
166  10:41:38.682    825.09
167  10:41:38.832    830.11
168  10:41:38.980    836.74
169  10:41:39.130    835.29
170  10:41:39.280    840.47
171  10:41:39.430    825.74
172  10:41:39.580    828.98
173  10:41:39.730    834.48
174  10:41:39.880    818.94
175  10:41:40.030    824.12
176  10:41:40.180    817.49
177  10:41:40.330    814.25
178  10:41:40.480    815.06
179  10:41:40.630    830.27
180  10:41:40.779    821.05
181  10:41:40.929    828.98
182  10:41:41.079    808.75
```

183	10:41:41.229	823.48
184	10:41:41.379	825.74
185	10:41:41.529	821.21
186	10:41:41.679	827.52
187	10:41:41.829	821.86
188	10:41:41.979	824.77
189	10:41:42.129	821.86
190	10:41:42.279	825.90
191	10:41:42.429	833.99
192	10:41:42.578	830.92
193	10:41:42.728	806.32
194	10:41:42.879	837.39
195	10:41:43.029	830.76
196	10:41:43.179	825.09
197	10:41:43.328	829.79
198	10:41:43.478	828.17
199	10:41:43.628	817.97
200	10:41:43.778	829.14
201	10:41:43.928	811.02
202	10:41:44.078	824.77
203	10:41:44.228	819.75
204	10:41:44.378	828.33
205	10:41:44.528	828.49
206	10:41:44.678	841.44
207	10:41:44.828	830.92
208	10:41:44.978	829.62
209	10:41:45.128	830.92
210	10:41:45.277	820.89
211	10:41:45.427	829.79
212	10:41:45.577	835.13
213	10:41:45.727	838.04
214	10:41:45.877	830.11
215	10:41:46.027	835.29
216	10:41:46.177	830.60
217	10:41:46.327	822.83
218	10:41:46.477	837.07
219	10:41:46.627	859.07
220	10:41:46.777	860.21
221	10:41:46.927	844.67
222	10:41:47.076	869.92
223	10:41:47.227	862.15
224	10:41:47.377	855.68
225	10:41:47.527	839.98
226	10:41:47.677	858.91
227	10:41:47.828	856.81
228	10:41:47.978	871.21
229	10:41:48.128	875.42

230	10:41:48.277	874.12
231	10:41:48.427	885.61
232	10:41:48.577	887.23
233	10:41:48.727	891.28
234	10:41:48.877	885.61
235	10:41:49.027	900.18
236	10:41:49.177	886.10
237	10:41:49.327	882.21
238	10:41:49.477	903.57
239	10:41:49.627	877.52
240	10:41:49.777	881.08
241	10:41:49.927	889.98
242	10:41:50.077	905.35
243	10:41:50.227	874.61
244	10:41:50.376	890.47
245	10:41:50.526	881.73
246	10:41:50.676	867.49
247	10:41:50.826	881.08
248	10:41:50.976	866.19
249	10:41:51.126	891.92
250	10:41:51.277	880.27
251	10:41:51.427	862.80
252	10:41:51.576	892.09
253	10:41:51.726	894.03
254	10:41:51.876	873.80
255	10:41:52.026	854.06
256	10:41:52.176	879.46
257	10:41:52.326	864.58
258	10:41:52.476	868.62
259	10:41:52.626	864.41
260	10:41:52.776	877.85
261	10:41:52.926	849.53
262	10:41:53.076	872.02
263	10:41:53.226	859.56
264	10:41:53.376	860.05
265	10:41:53.526	853.09
266	10:41:53.676	848.40
267	10:41:53.825	845.00
268	10:41:53.975	848.56
269	10:41:54.125	834.80
270	10:41:54.275	829.62
271	10:41:54.425	837.55
272	10:41:54.576	839.98
273	10:41:54.725	815.87
274	10:41:54.875	833.51
275	10:41:55.025	831.57
276	10:41:55.175	825.74

277	10:41:55.325	832.70
278	10:41:55.475	823.80
279	10:41:55.625	834.64
280	10:41:55.775	828.98
281	10:41:55.925	837.88
282	10:41:56.075	852.93
283	10:41:56.225	842.41
284	10:41:56.375	835.29
285	10:41:56.524	827.84
286	10:41:56.674	825.42
287	10:41:56.824	832.05
288	10:41:56.974	816.52
289	10:41:57.124	834.16
290	10:41:57.274	835.29
291	10:41:57.424	845.81
292	10:41:57.574	831.24
293	10:41:57.724	837.88
294	10:41:57.874	839.98
295	10:41:58.024	832.86
296	10:41:58.174	836.26
297	10:41:58.324	844.03
298	10:41:58.474	838.85
299	10:41:58.624	850.34
300	10:41:58.774	838.04
301	10:41:58.924	844.84
302	10:41:59.074	846.45
303	10:41:59.224	853.09
304	10:41:59.384	857.78
305	10:41:59.524	855.68
306	10:41:59.673	854.87
307	10:41:59.823	868.14
308	10:41:59.974	876.71
309	10:42:00.123	864.74
310	10:42:00.273	867.65
311	10:42:00.433	878.98
312	10:42:00.583	892.09
313	10:42:00.733	901.79
314	10:42:00.883	895.48
315	10:42:01.033	912.80
316	10:42:01.183	897.91
317	10:42:01.333	905.52
318	10:42:01.483	902.76
319	10:42:01.633	939.01
320	10:42:01.783	917.49
321	10:42:01.933	918.78
322	10:42:02.083	898.40
323	10:42:02.232	917.49

```
10:42:02.382    906.65
10:42:02.532    925.26
10:42:02.682    902.28
10:42:02.832    912.96
10:42:02.982    879.95
10:42:03.132    920.24
10:42:03.283    889.98
10:42:03.433    878.33
10:42:03.583    895.00
10:42:03.733    912.80
10:42:03.883    880.27
10:42:04.033    880.60
10:42:04.183    880.92
10:42:04.333    898.23
10:42:04.482    888.36
10:42:04.630    877.68
10:42:04.780    889.33
10:42:04.930    879.79
10:42:05.080    876.39
10:42:05.230    886.42
10:42:05.379    884.80
10:42:05.529    858.27
10:42:05.679    856.97
10:42:05.829    865.71
10:42:05.979    862.80
10:42:06.129    878.33
10:42:06.279    856.32
10:42:06.429    863.12
10:42:06.579    854.06
10:42:06.729    844.84
10:42:06.879    848.88
10:42:07.029    853.90
10:42:07.179    853.09
10:42:07.328    834.96
10:42:07.478    845.32
10:42:07.628    821.37
10:42:07.778    811.82
10:42:07.928    830.76
10:42:08.073    821.37
10:42:08.223    835.29
10:42:08.373    828.49
10:42:08.523    838.52
10:42:08.673    839.66
10:42:08.823    837.88
10:42:08.983    833.67
10:42:09.132    811.82
10:42:09.282    836.26
```

```
371  10:42:09.432    819.11
372  10:42:09.582    830.43
373  10:42:09.732    828.65
374  10:42:09.882    840.79
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384  10:42:11.381    864.41
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386  10:42:11.681    846.29
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511	10:42:30.436	837.39

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558  10:42:37.483    958.91
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564  10:42:38.383    937.56
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566  10:42:38.683    921.70
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617  10:42:46.339    900.98
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620  10:42:46.789    924.93
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623  10:42:47.239    950.18
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628  10:42:47.989    937.23
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631  10:42:48.438    955.52
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705	10:42:59.533	847.91
706	10:42:59.683	856.16
707	10:42:59.833	863.61
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711	10:43:00.433	857.94
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713	10:43:00.733	851.15
714	10:43:00.882	862.63
715	10:43:01.032	852.28
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757	10:43:07.333	855.19
758	10:43:07.483	832.86
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765	10:43:08.532	848.72
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10:43:29.235    834.16
10:43:29.385    828.33
10:43:29.535    825.58
10:43:29.685    828.65
10:43:29.835    817.00
10:43:29.985    834.48
10:43:30.135    838.85
10:43:30.285    817.16
10:43:30.435    826.55
10:43:30.585    833.67
10:43:30.735    839.66
10:43:30.884    817.81
10:43:31.034    830.27
10:43:31.184    836.91
10:43:31.335    823.31
10:43:31.485    833.51
10:43:31.635    835.61
10:43:31.785    834.16
10:43:31.935    827.04
10:43:32.085    834.64
10:43:32.235    839.17
10:43:32.385    823.15
10:43:32.535    838.85
10:43:32.684    823.48
10:43:32.834    844.19
10:43:32.984    840.30
10:43:33.133    841.60
10:43:33.283    847.91
10:43:33.433    817.65
10:43:33.583    836.58
10:43:33.734    832.70
10:43:33.884    840.47
```

935	10:43:34.034	831.89
936	10:43:34.184	830.27
937	10:43:34.334	834.32
938	10:43:34.484	838.85
939	10:43:34.634	851.79
940	10:43:34.784	841.76
941	10:43:34.934	831.40
942	10:43:35.084	834.48
943	10:43:35.234	831.08
944	10:43:35.384	842.25
945	10:43:35.533	834.32
946	10:43:35.683	835.29
947	10:43:35.833	852.44
948	10:43:35.983	836.10
949	10:43:36.133	844.35
950	10:43:36.283	866.36
951	10:43:36.433	840.95
952	10:43:36.583	849.37
953	10:43:36.733	849.85
954	10:43:36.883	856.65
955	10:43:37.033	850.50
956	10:43:37.183	868.30
957	10:43:37.333	857.62
958	10:43:37.482	845.64
959	10:43:37.632	863.44
960	10:43:37.782	862.96
961	10:43:37.932	861.34
962	10:43:38.082	868.78
963	10:43:38.232	874.29
964	10:43:38.382	872.51
965	10:43:38.532	881.73
966	10:43:38.682	895.16
967	10:43:38.832	873.15
968	10:43:38.982	886.58
969	10:43:39.132	885.94
970	10:43:39.282	904.38
971	10:43:39.432	900.50
972	10:43:39.582	902.76
973	10:43:39.732	889.17
974	10:43:39.882	925.58
975	10:43:40.032	895.16
976	10:43:40.181	918.30
977	10:43:40.331	908.27
978	10:43:40.481	927.20
979	10:43:40.631	917.17
980	10:43:40.781	925.42
981	10:43:40.931	926.88

982	10:43:41.081	932.86
983	10:43:41.231	939.33
984	10:43:41.381	956.49
985	10:43:41.531	932.54
986	10:43:41.681	949.21
987	10:43:41.831	948.72
988	10:43:41.981	973.32
989	10:43:42.130	923.96
990	10:43:42.280	947.59
991	10:43:42.430	940.95
992	10:43:42.580	972.99
993	10:43:42.730	956.65
994	10:43:42.880	972.51
995	10:43:43.032	947.43
996	10:43:43.182	982.70
997	10:43:43.332	968.62
998	10:43:43.482	980.60
999	10:43:43.632	954.38
1000	10:43:43.782	986.42
1001	10:43:43.932	955.84
1002	10:43:44.082	979.14
1003	10:43:44.232	962.80
1004	10:43:44.382	970.89
1005	10:43:44.532	952.44
1006	10:43:44.682	992.57
1007	10:43:44.832	947.59
1008	10:43:44.982	981.25
1009	10:43:45.132	945.65
1010	10:43:45.282	969.92
1011	10:43:45.432	967.17
1012	10:43:45.581	992.73
1013	10:43:45.731	967.01
1014	10:43:45.881	996.94
1015	10:43:46.031	964.58
1016	10:43:46.181	998.24
1017	10:43:46.332	960.21
1018	10:43:46.481	998.40
1019	10:43:46.631	980.44
1020	10:43:46.781	989.17
1021	10:43:46.931	952.77
1022	10:43:47.081	989.82
1023	10:43:47.231	974.61
1024	10:43:47.381	959.56
1025	10:43:47.531	971.21
1026	10:43:47.681	976.55
1027	10:43:47.831	937.23
1028	10:43:47.981	974.45

1029	10:43:48.131	956.97
1030	10:43:48.281	955.03
1031	10:43:48.431	950.18
1032	10:43:48.581	963.12
1033	10:43:48.731	958.43
1034	10:43:48.881	942.09
1035	10:43:49.031	939.01
1036	10:43:49.181	960.69
1037	10:43:49.331	905.68
1038	10:43:49.481	938.85
1039	10:43:49.631	915.39
1040	10:43:49.781	914.90
1041	10:43:49.931	891.60
1042	10:43:50.080	903.09
1043	10:43:50.230	893.22
1044	10:43:50.380	914.09
1045	10:43:50.530	908.27
1046	10:43:50.680	908.43
1047	10:43:50.830	867.65
1048	10:43:50.980	883.83
1049	10:43:51.130	868.46
1050	10:43:51.280	865.87
1051	10:43:51.430	869.27
1052	10:43:51.580	861.66
1053	10:43:51.730	850.50
1054	10:43:51.880	845.16
1055	10:43:52.030	827.84
1056	10:43:52.180	820.89
1057	10:43:52.330	847.26
1058	10:43:52.480	850.18
1059	10:43:52.630	832.70
1060	10:43:52.780	833.83
1061	10:43:52.930	837.39
1062	10:43:53.074	845.32
1063	10:43:53.224	834.32
1064	10:43:53.384	840.47
1065	10:43:53.534	835.13
1066	10:43:53.675	820.56
1067	10:43:53.825	832.05
1068	10:43:53.974	828.49
1069	10:43:54.134	829.62
1070	10:43:54.274	835.94
1071	10:43:54.424	843.06
1072	10:43:54.584	824.12
1073	10:43:54.734	827.68
1074	10:43:54.874	835.13
1075	10:43:55.034	852.60

1076	10:43:55.184	830.76
1077	10:43:55.334	829.14
1078	10:43:55.484	822.02
1079	10:43:55.634	849.69
1080	10:43:55.784	827.36
1081	10:43:55.933	847.91
1082	10:43:56.083	822.34
1083	10:43:56.233	817.00
1084	10:43:56.383	841.60
1085	10:43:56.533	840.30
1086	10:43:56.683	827.52
1087	10:43:56.833	846.45
1088	10:43:56.983	818.78
1089	10:43:57.133	844.84
1090	10:43:57.283	842.25
1091	10:43:57.433	845.16
1092	10:43:57.583	826.06
1093	10:43:57.733	846.13
1094	10:43:57.882	836.58
1095	10:43:58.032	816.68
1096	10:43:58.182	852.76
1097	10:43:58.332	852.44
1098	10:43:58.482	831.40
1099	10:43:58.632	843.06
1100	10:43:58.783	849.69
1101	10:43:58.933	858.10
1102	10:43:59.083	843.70
1103	10:43:59.232	847.91
1104	10:43:59.382	846.78
1105	10:43:59.532	823.64
1106	10:43:59.682	847.26
1107	10:43:59.832	834.16
1108	10:43:59.982	851.95
1109	10:44:00.132	837.07
1110	10:44:00.282	844.35
1111	10:44:00.432	852.12
1112	10:44:00.582	838.69
1113	10:44:00.732	864.74
1114	10:44:00.882	858.10
1115	10:44:01.031	837.07
1116	10:44:01.181	839.50
1117	10:44:01.331	857.62
1118	10:44:01.481	866.03
1119	10:44:01.631	854.54
1120	10:44:01.781	845.64
1121	10:44:01.931	844.67
1122	10:44:02.081	821.37

1123	10:44:02.231	861.50
1124	10:44:02.381	848.40
1125	10:44:02.531	853.41
1126	10:44:02.681	853.09
1127	10:44:02.831	861.34
1128	10:44:02.981	859.72
1129	10:44:03.130	874.29
1130	10:44:03.279	862.96
1131	10:44:03.429	846.78
1132	10:44:03.579	865.06
1133	10:44:03.729	879.30
1134	10:44:03.880	856.49
1135	10:44:04.030	866.36
1136	10:44:04.180	851.47
1137	10:44:04.330	878.01
1138	10:44:04.480	869.59
1139	10:44:04.629	877.20
1140	10:44:04.779	868.78
1141	10:44:04.929	870.56
1142	10:44:05.079	881.57
1143	10:44:05.229	874.12
1144	10:44:05.379	860.69
1145	10:44:05.529	867.65
1146	10:44:05.679	874.61
1147	10:44:05.829	863.28
1148	10:44:05.979	861.02
1149	10:44:06.129	877.20
1150	10:44:06.279	861.34
1151	10:44:06.428	862.96
1152	10:44:06.578	868.62
1153	10:44:06.728	894.51
1154	10:44:06.878	894.03
1155	10:44:07.028	893.87
1156	10:44:07.178	874.93
1157	10:44:07.328	881.41
1158	10:44:07.478	887.39
1159	10:44:07.628	906.32
1160	10:44:07.778	873.96
1161	10:44:07.928	894.84
1162	10:44:08.078	880.27
1163	10:44:08.228	892.89
1164	10:44:08.377	895.16
1165	10:44:08.527	897.42
1166	10:44:08.677	896.29
1167	10:44:08.828	896.62
1168	10:44:08.978	874.77
1169	10:44:09.128	901.31

1170	10:44:09.278	872.34
1171	10:44:09.427	907.46
1172	10:44:09.577	870.24
1173	10:44:09.727	885.94
1174	10:44:09.877	888.36
1175	10:44:10.027	904.54
1176	10:44:10.177	885.94
1177	10:44:10.327	904.06
1178	10:44:10.477	882.70
1179	10:44:10.627	899.53
1180	10:44:10.777	898.72
1181	10:44:10.927	895.64
1182	10:44:11.077	902.93
1183	10:44:11.226	895.32
1184	10:44:11.376	888.04
1185	10:44:11.526	900.34
1186	10:44:11.676	884.64
1187	10:44:11.826	908.91
1188	10:44:11.976	900.82
1189	10:44:12.126	904.38
1190	10:44:12.276	893.06
1191	10:44:12.426	880.11
1192	10:44:12.576	878.01
1193	10:44:12.726	906.65
1194	10:44:12.876	890.63
1195	10:44:13.025	905.35
1196	10:44:13.173	897.75
1197	10:44:13.323	895.48
1198	10:44:13.473	906.81
1199	10:44:13.632	909.88
1200	10:44:13.782	880.11
1201	10:44:13.932	873.15
1202	10:44:14.082	889.66
1203	10:44:14.232	893.70
1204	10:44:14.382	871.37
1205	10:44:14.532	897.59
1206	10:44:14.682	876.87
1207	10:44:14.832	871.05
1208	10:44:14.982	877.36
1209	10:44:15.132	889.17
1210	10:44:15.282	872.83
1211	10:44:15.431	874.61
1212	10:44:15.581	877.04
1213	10:44:15.731	877.85
1214	10:44:15.881	855.68
1215	10:44:16.031	868.30
1216	10:44:16.181	868.46

1217	10:44:16.331	867.97
1218	10:44:16.481	866.68
1219	10:44:16.631	863.44
1220	10:44:16.781	850.50
1221	10:44:16.931	868.95
1222	10:44:17.081	873.64
1223	10:44:17.231	856.00
1224	10:44:17.380	864.25
1225	10:44:17.530	862.96
1226	10:44:17.680	857.94
1227	10:44:17.830	888.85
1228	10:44:17.980	838.20
1229	10:44:18.130	854.06
1230	10:44:18.280	861.34
1231	10:44:18.430	852.93
1232	10:44:18.580	835.13
1233	10:44:18.730	843.06
1234	10:44:18.880	841.44
1235	10:44:19.030	858.27
1236	10:44:19.180	842.73
1237	10:44:19.330	842.89
1238	10:44:19.480	834.48
1239	10:44:19.630	841.28
1240	10:44:19.780	826.23
1241	10:44:19.930	834.32
1242	10:44:20.079	825.74
1243	10:44:20.229	836.91
1244	10:44:20.379	847.10
1245	10:44:20.529	847.75
1246	10:44:20.679	846.78
1247	10:44:20.829	855.03
1248	10:44:20.979	828.01
1249	10:44:21.129	831.73
1250	10:44:21.279	834.64
1251	10:44:21.429	835.94
1252	10:44:21.579	833.67
1253	10:44:21.729	828.49
1254	10:44:21.878	832.54
1255	10:44:22.028	853.09
1256	10:44:22.178	839.17
1257	10:44:22.328	837.39
1258	10:44:22.478	842.25
1259	10:44:22.628	832.70
1260	10:44:22.778	837.88
1261	10:44:22.928	846.13
1262	10:44:23.081	850.34
1263	10:44:23.226	866.68

```
1264  10:44:23.376    863.28
1265  10:44:23.526    876.87
1266  10:44:23.676    892.09
1267  10:44:23.826    913.44
1268  10:44:23.976    928.01
1269  10:44:24.126    911.66
1270  10:44:24.276    936.26
1271  10:44:24.426    944.67
1272  10:44:24.576    971.05
1273  10:44:24.726    949.85
1274  10:44:24.876    972.83
1275  10:44:25.026    964.09
1276  10:44:25.176    991.76
1277  10:44:25.325    988.85
1278  10:44:25.475    983.02
1279  10:44:25.625    972.35
```

Listing 12: 钠灯时序

```
 1  10:51:22.735    808.91
 2  10:51:22.884    809.07
 3  10:51:23.034    817.33
 4  10:51:23.184    827.68
 5  10:51:23.334    816.36
 6  10:51:23.484    837.72
 7  10:51:23.634    810.69
 8  10:51:23.784    818.46
 9  10:51:23.934    809.40
10  10:51:24.084    820.56
11  10:51:24.234    828.65
12  10:51:24.384    818.30
13  10:51:24.534    815.71
14  10:51:24.684    807.46
15  10:51:24.833    810.04
16  10:51:24.983    816.52
17  10:51:25.133    828.17
18  10:51:25.283    793.54
19  10:51:25.433    808.10
20  10:51:25.585    802.12
21  10:51:25.735    803.90
22  10:51:25.885    801.15
23  10:51:26.035    808.91
24  10:51:26.185    812.47
25  10:51:26.335    803.41
26  10:51:26.484    814.41
27  10:51:26.634    826.39
28  10:51:26.784    798.23
```

29	10:51:26.934	813.28
30	10:51:27.084	801.47
31	10:51:27.234	812.63
32	10:51:27.384	808.43
33	10:51:27.534	823.31
34	10:51:27.684	797.42
35	10:51:27.834	818.14
36	10:51:27.984	807.94
37	10:51:28.134	798.72
38	10:51:28.284	815.71
39	10:51:28.433	790.63
40	10:51:28.583	812.96
41	10:51:28.733	803.73
42	10:51:28.883	811.18
43	10:51:29.033	809.56
44	10:51:29.183	822.83
45	10:51:29.333	823.64
46	10:51:29.483	818.30
47	10:51:29.633	805.68
48	10:51:29.783	797.10
49	10:51:29.932	806.49
50	10:51:30.082	819.27
51	10:51:30.232	815.55
52	10:51:30.382	815.71
53	10:51:30.532	814.74
54	10:51:30.682	805.51
55	10:51:30.832	816.36
56	10:51:30.982	812.80
57	10:51:31.132	807.13
58	10:51:31.282	833.18
59	10:51:31.432	809.07
60	10:51:31.582	823.80
61	10:51:31.732	811.02
62	10:51:31.881	813.60
63	10:51:32.031	805.35
64	10:51:32.181	808.91
65	10:51:32.331	821.37
66	10:51:32.481	804.38
67	10:51:32.631	807.78
68	10:51:32.781	811.18
69	10:51:32.931	802.93
70	10:51:33.081	821.70
71	10:51:33.231	801.47
72	10:51:33.381	815.55
73	10:51:33.531	826.23
74	10:51:33.680	809.56
75	10:51:33.830	811.82

76	10:51:33.980	814.74
77	10:51:34.130	801.63
78	10:51:34.280	813.93
79	10:51:34.431	799.53
80	10:51:34.581	802.60
81	10:51:34.731	839.33
82	10:51:34.881	808.91
83	10:51:35.030	811.18
84	10:51:35.180	815.87
85	10:51:35.330	812.47
86	10:51:35.480	806.16
87	10:51:35.630	810.04
88	10:51:35.780	814.90
89	10:51:35.930	815.55
90	10:51:36.080	807.62
91	10:51:36.230	817.65
92	10:51:36.380	815.87
93	10:51:36.530	821.86
94	10:51:36.680	799.53
95	10:51:36.829	806.00
96	10:51:36.979	795.00
97	10:51:37.129	811.99
98	10:51:37.279	822.83
99	10:51:37.429	821.05
100	10:51:37.579	810.69
101	10:51:37.729	796.45
102	10:51:37.879	820.24
103	10:51:38.029	812.80
104	10:51:38.179	812.96
105	10:51:38.329	815.87
106	10:51:38.479	818.46
107	10:51:38.629	819.43
108	10:51:38.778	812.63
109	10:51:38.928	802.28
110	10:51:39.078	803.90
111	10:51:39.236	796.94
112	10:51:39.378	817.65
113	10:51:39.528	818.14
114	10:51:39.678	809.40
115	10:51:39.828	821.70
116	10:51:39.978	825.42
117	10:51:40.128	799.37
118	10:51:40.278	811.99
119	10:51:40.428	805.03
120	10:51:40.578	813.12
121	10:51:40.728	808.10
122	10:51:40.877	817.16

123	10:51:41.027	827.84
124	10:51:41.177	828.01
125	10:51:41.327	801.63
126	10:51:41.477	800.17
127	10:51:41.637	803.25
128	10:51:41.787	816.52
129	10:51:41.937	824.12
130	10:51:42.087	826.39
131	10:51:42.237	803.73
132	10:51:42.387	804.22
133	10:51:42.537	807.94
134	10:51:42.687	795.64
135	10:51:42.836	798.39
136	10:51:42.986	809.40
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140	10:51:43.586	801.31
141	10:51:43.736	806.65
142	10:51:43.886	810.69
143	10:51:44.036	813.77
144	10:51:44.186	796.13
145	10:51:44.336	802.60
146	10:51:44.485	809.88
147	10:51:44.635	807.94
148	10:51:44.785	817.97
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153	10:51:45.535	817.16
154	10:51:45.685	812.31
155	10:51:45.835	811.50
156	10:51:45.985	801.47
157	10:51:46.135	797.10
158	10:51:46.285	801.15
159	10:51:46.434	806.97
160	10:51:46.584	810.85
161	10:51:46.734	817.49
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166	10:51:47.484	815.71
167	10:51:47.634	820.40
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169	10:51:47.934	811.02

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172	10:51:48.383	803.90
173	10:51:48.533	808.59
174	10:51:48.683	808.75
175	10:51:48.833	814.09
176	10:51:48.983	805.35
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178	10:51:49.283	821.05
179	10:51:49.433	819.59
180	10:51:49.583	822.67
181	10:51:49.733	794.35
182	10:51:49.883	812.63
183	10:51:50.033	816.36
184	10:51:50.183	815.55
185	10:51:50.333	796.61
186	10:51:50.483	821.21
187	10:51:50.633	802.12
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189	10:51:50.933	808.26
190	10:51:51.083	827.20
191	10:51:51.233	795.32
192	10:51:51.383	809.07
193	10:51:51.533	819.59
194	10:51:51.683	812.80
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203	10:51:53.032	813.28
204	10:51:53.182	810.04
205	10:51:53.332	797.42
206	10:51:53.482	816.36
207	10:51:53.632	816.03
208	10:51:53.782	824.61
209	10:51:53.932	813.28
210	10:51:54.082	817.97
211	10:51:54.232	793.70
212	10:51:54.382	809.72
213	10:51:54.531	791.76
214	10:51:54.681	798.56
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216	10:51:54.982	808.59

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218	10:51:55.281	819.43
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220	10:51:55.581	810.37
221	10:51:55.732	808.26
222	10:51:55.882	828.17
223	10:51:56.032	800.66
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229	10:51:56.931	791.44
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233	10:51:57.531	810.37
234	10:51:57.681	820.24
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236	10:51:57.980	804.54
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239	10:51:58.430	822.18
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242	10:51:58.880	805.03
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254	10:52:00.680	821.37
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256	10:52:00.980	802.28
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271  10:52:03.228    807.94
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276  10:52:03.978    798.88
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309  10:52:08.926    799.69
310  10:52:09.076    833.99
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326  10:52:11.476    808.43
327  10:52:11.633    801.47
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332  10:52:12.382    804.54
333  10:52:12.532    806.00
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352  10:52:15.374    810.69
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355  10:52:15.833    797.10
356  10:52:15.978    810.21
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660	10:53:01.579	814.09
661	10:53:01.729	839.66
662	10:53:01.879	830.60
663	10:53:02.029	831.57
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670	10:53:03.079	836.91
671	10:53:03.229	819.59
672	10:53:03.378	814.58
673	10:53:03.528	827.20
674	10:53:03.678	826.39
675	10:53:03.828	812.31
676	10:53:03.978	833.51
677	10:53:04.128	815.06
678	10:53:04.278	831.40
679	10:53:04.428	811.82
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868	10:53:32.772	833.51
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916  10:53:39.967    846.78
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1159	10:54:16.424	840.95
1160	10:54:16.574	824.45
1161	10:54:16.724	850.82
1162	10:54:16.873	818.78
1163	10:54:17.023	839.17
1164	10:54:17.173	846.45
1165	10:54:17.323	833.35
1166	10:54:17.473	829.62
1167	10:54:17.623	831.57
1168	10:54:17.773	823.80
1169	10:54:17.923	846.13
1170	10:54:18.073	831.57
1171	10:54:18.223	830.76
1172	10:54:18.373	844.19
1173	10:54:18.523	845.64
1174	10:54:18.672	852.60
1175	10:54:18.822	825.42
1176	10:54:18.973	836.42
1177	10:54:19.123	844.84
1178	10:54:19.273	813.44
1179	10:54:19.423	840.79
1180	10:54:19.573	837.07
1181	10:54:19.723	838.36
1182	10:54:19.873	825.74
1183	10:54:20.022	830.11
1184	10:54:20.172	832.21
1185	10:54:20.323	842.57
1186	10:54:20.473	840.79
1187	10:54:20.623	842.25
1188	10:54:20.773	853.57
1189	10:54:20.923	834.16
1190	10:54:21.073	820.40
1191	10:54:21.222	845.16
1192	10:54:21.372	827.36
1193	10:54:21.522	828.65
1194	10:54:21.672	814.90
1195	10:54:21.822	834.32
1196	10:54:21.972	848.40
1197	10:54:22.122	836.91
1198	10:54:22.272	838.20
1199	10:54:22.422	829.95
1200	10:54:22.572	835.13
1201	10:54:22.722	833.18
1202	10:54:22.872	849.20
1203	10:54:23.022	822.02

1204	10:54:23.172	869.11
1205	10:54:23.322	838.85
1206	10:54:23.472	820.89
1207	10:54:23.622	828.65
1208	10:54:23.772	846.29
1209	10:54:23.921	830.60
1210	10:54:24.071	833.35
1211	10:54:24.221	834.64
1212	10:54:24.371	835.94
1213	10:54:24.521	818.14
1214	10:54:24.671	829.95
1215	10:54:24.821	830.92
1216	10:54:24.971	843.86
1217	10:54:25.121	832.86
1218	10:54:25.271	834.16
1219	10:54:25.421	825.26
1220	10:54:25.571	840.14
1221	10:54:25.721	844.35
1222	10:54:25.871	839.66
1223	10:54:26.021	821.53
1224	10:54:26.171	836.26
1225	10:54:26.320	822.02
1226	10:54:26.470	829.95
1227	10:54:26.620	839.01
1228	10:54:26.770	830.60
1229	10:54:26.920	833.51
1230	10:54:27.070	836.42
1231	10:54:27.220	823.96
1232	10:54:27.370	820.24
1233	10:54:27.520	837.88
1234	10:54:27.670	828.82
1235	10:54:27.820	849.37
1236	10:54:27.970	837.23
1237	10:54:28.120	837.39
1238	10:54:28.270	827.04
1239	10:54:28.419	830.60
1240	10:54:28.569	830.76
1241	10:54:28.719	820.72
1242	10:54:28.869	827.52
1243	10:54:29.019	831.73
1244	10:54:29.169	842.25
1245	10:54:29.319	840.47
1246	10:54:29.469	834.64
1247	10:54:29.619	842.08
1248	10:54:29.769	833.83
1249	10:54:29.919	825.58
1250	10:54:30.069	840.79

1251	10:54:30.218	843.06
1252	10:54:30.369	837.88
1253	10:54:30.519	847.10
1254	10:54:30.669	825.90
1255	10:54:30.819	833.02
1256	10:54:30.968	833.02
1257	10:54:31.118	843.70
1258	10:54:31.268	856.65
1259	10:54:31.418	840.79
1260	10:54:31.568	835.77
1261	10:54:31.718	837.88
1262	10:54:31.868	837.55
1263	10:54:32.018	826.55
1264	10:54:32.168	837.72
1265	10:54:32.318	833.67
1266	10:54:32.468	839.01
1267	10:54:32.618	838.20
1268	10:54:32.768	835.94
1269	10:54:32.917	810.53
1270	10:54:33.067	839.17
1271	10:54:33.217	827.36
1272	10:54:33.367	832.05
1273	10:54:33.517	845.16
1274	10:54:33.667	833.51
1275	10:54:33.817	837.55
1276	10:54:33.967	826.87
1277	10:54:34.117	843.86
1278	10:54:34.267	842.89
1279	10:54:34.417	850.34
1280	10:54:34.567	842.41
1281	10:54:34.717	831.89
1282	10:54:34.866	838.85
1283	10:54:35.016	824.93
1284	10:54:35.166	847.26
1285	10:54:35.322	833.99
1286	10:54:35.472	836.74
1287	10:54:35.622	845.97
1288	10:54:35.772	837.55
1289	10:54:35.922	844.19
1290	10:54:36.071	838.69
1291	10:54:36.221	820.89
1292	10:54:36.371	828.01
1293	10:54:36.521	838.69
1294	10:54:36.671	851.96
1295	10:54:36.821	830.11
1296	10:54:36.971	824.45
1297	10:54:37.121	828.65

1298	10:54:37.271	841.11
1299	10:54:37.421	833.02
1300	10:54:37.571	852.60
1301	10:54:37.721	824.12
1302	10:54:37.871	834.96
1303	10:54:38.020	852.60
1304	10:54:38.170	844.67
1305	10:54:38.320	846.62
1306	10:54:38.470	846.13
1307	10:54:38.620	839.33
1308	10:54:38.770	839.33
1309	10:54:38.920	845.64
1310	10:54:39.070	831.89
1311	10:54:39.220	840.30
1312	10:54:39.370	832.05
1313	10:54:39.520	827.84
1314	10:54:39.670	829.14
1315	10:54:39.820	836.42
1316	10:54:39.970	843.70
1317	10:54:40.120	829.62
1318	10:54:40.270	838.85
1319	10:54:40.420	841.92
1320	10:54:40.570	829.62
1321	10:54:40.719	854.71
1322	10:54:40.870	841.76
1323	10:54:41.020	830.43
1324	10:54:41.170	823.80
1325	10:54:41.320	825.09
1326	10:54:41.470	848.88
1327	10:54:41.620	840.79
1328	10:54:41.770	828.17
1329	10:54:41.920	844.67
1330	10:54:42.070	858.91
1331	10:54:42.220	835.45
1332	10:54:42.370	839.17
1333	10:54:42.520	826.39
1334	10:54:42.670	832.38
1335	10:54:42.819	834.48
1336	10:54:42.969	833.67
1337	10:54:43.119	836.74
1338	10:54:43.269	850.50
1339	10:54:43.419	832.38
1340	10:54:43.569	825.09
1341	10:54:43.719	833.02
1342	10:54:43.869	841.28
1343	10:54:44.019	829.30
1344	10:54:44.169	841.44

1345	10:54:44.319	839.82
1346	10:54:44.469	832.38
1347	10:54:44.618	845.00
1348	10:54:44.768	846.78
1349	10:54:44.919	845.16
1350	10:54:45.069	838.20
1351	10:54:45.219	844.03
1352	10:54:45.363	835.29
1353	10:54:45.513	843.06
1354	10:54:45.662	838.52
1355	10:54:45.812	843.54
1356	10:54:45.963	849.04
1357	10:54:46.113	844.35
1358	10:54:46.263	840.63
1359	10:54:46.412	833.67
1360	10:54:46.562	834.96
1361	10:54:46.715	841.44
1362	10:54:46.865	837.72
1363	10:54:47.015	837.39
1364	10:54:47.164	831.24
1365	10:54:47.314	820.72
1366	10:54:47.464	836.10
1367	10:54:47.614	828.49
1368	10:54:47.764	828.65
1369	10:54:47.914	840.79
1370	10:54:48.064	833.35
1371	10:54:48.214	829.62
1372	10:54:48.364	830.92
1373	10:54:48.514	827.52
1374	10:54:48.664	841.76
1375	10:54:48.814	832.54
1376	10:54:48.964	843.86
1377	10:54:49.113	836.42
1378	10:54:49.263	807.94
1379	10:54:49.413	839.82
1380	10:54:49.563	829.14
1381	10:54:49.713	838.52
1382	10:54:49.863	849.85
1383	10:54:50.013	833.67
1384	10:54:50.163	837.23
1385	10:54:50.313	822.67
1386	10:54:50.463	849.20
1387	10:54:50.613	844.67
1388	10:54:50.763	836.58
1389	10:54:50.913	832.86
1390	10:54:51.063	821.21
1391	10:54:51.213	819.27

1392	10:54:51.363	829.46
1393	10:54:51.513	845.81
1394	10:54:51.663	831.73
1395	10:54:51.813	831.89
1396	10:54:51.963	830.76
1397	10:54:52.113	841.60
1398	10:54:52.263	856.00
1399	10:54:52.413	836.26
1400	10:54:52.562	838.69
1401	10:54:52.712	830.76
1402	10:54:52.862	845.81
1403	10:54:53.012	841.28
1404	10:54:53.162	848.88
1405	10:54:53.312	857.78
1406	10:54:53.462	829.62
1407	10:54:53.612	835.13
1408	10:54:53.762	844.03
1409	10:54:53.912	847.91
1410	10:54:54.062	836.10
1411	10:54:54.212	848.23
1412	10:54:54.361	831.57
1413	10:54:54.511	832.86
1414	10:54:54.661	850.18
1415	10:54:54.811	858.91
1416	10:54:54.961	847.75
1417	10:54:55.111	852.76
1418	10:54:55.266	830.76
1419	10:54:55.416	845.00
1420	10:54:55.565	849.37
1421	10:54:55.715	840.79
1422	10:54:55.865	844.84
1423	10:54:56.016	841.60
1424	10:54:56.166	852.60
1425	10:54:56.316	840.63
1426	10:54:56.466	823.48
1427	10:54:56.615	833.02
1428	10:54:56.765	834.32
1429	10:54:56.920	839.50
1430	10:54:57.065	847.42
1431	10:54:57.215	852.60
1432	10:54:57.365	849.20
1433	10:54:57.515	834.16
1434	10:54:57.665	828.65
1435	10:54:57.815	825.26
1436	10:54:57.965	836.74
1437	10:54:58.115	847.59
1438	10:54:58.265	851.15

1439	10:54:58.414	839.17
1440	10:54:58.564	830.11
1441	10:54:58.714	843.86
1442	10:54:58.864	848.23
1443	10:54:59.014	833.67
1444	10:54:59.164	842.73
1445	10:54:59.314	829.30
1446	10:54:59.464	841.28
1447	10:54:59.614	845.00
1448	10:54:59.764	831.73
1449	10:54:59.914	837.07
1450	10:55:00.064	842.08
1451	10:55:00.214	844.03
1452	10:55:00.363	832.05
1453	10:55:00.513	835.13
1454	10:55:00.663	859.40
1455	10:55:00.813	836.26
1456	10:55:00.964	832.86
1457	10:55:01.114	839.33
1458	10:55:01.264	844.84
1459	10:55:01.414	844.84
1460	10:55:01.564	850.01
1461	10:55:01.714	846.94
1462	10:55:01.863	844.03
1463	10:55:02.013	843.70
1464	10:55:02.163	849.20
1465	10:55:02.313	845.97
1466	10:55:02.463	870.56
1467	10:55:02.613	856.16
1468	10:55:02.763	836.10
1469	10:55:02.913	847.91
1470	10:55:03.063	840.47
1471	10:55:03.213	842.25
1472	10:55:03.363	839.82
1473	10:55:03.513	835.61
1474	10:55:03.662	845.16
1475	10:55:03.812	828.33
1476	10:55:03.962	846.62
1477	10:55:04.112	858.43
1478	10:55:04.262	832.38
1479	10:55:04.412	849.04
1480	10:55:04.562	853.73
1481	10:55:04.712	855.68
1482	10:55:04.862	841.28
1483	10:55:05.012	851.31
1484	10:55:05.162	826.55
1485	10:55:05.314	843.86

1486	10:55:05.464	847.91
1487	10:55:05.614	834.16
1488	10:55:05.764	852.76
1489	10:55:05.914	825.90
1490	10:55:06.065	834.80
1491	10:55:06.215	842.73
1492	10:55:06.364	839.66
1493	10:55:06.514	831.08
1494	10:55:06.664	836.58
1495	10:55:06.814	854.71
1496	10:55:06.964	860.69
1497	10:55:07.114	837.07
1498	10:55:07.264	854.71
1499	10:55:07.414	853.73
1500	10:55:07.564	844.67
1501	10:55:07.714	846.13
1502	10:55:07.864	842.57
1503	10:55:08.014	834.32
1504	10:55:08.163	844.19
1505	10:55:08.313	840.63
1506	10:55:08.463	843.22
1507	10:55:08.613	844.67
1508	10:55:08.763	837.07
1509	10:55:08.913	836.42
1510	10:55:09.063	843.54
1511	10:55:09.213	833.67
1512	10:55:09.363	843.86
1513	10:55:09.513	835.61
1514	10:55:09.663	836.26
1515	10:55:09.813	853.57
1516	10:55:09.963	844.84
1517	10:55:10.112	852.28
1518	10:55:10.262	842.25
1519	10:55:10.412	861.50
1520	10:55:10.562	854.87
1521	10:55:10.712	848.23
1522	10:55:10.862	856.32
1523	10:55:11.012	849.04
1524	10:55:11.162	835.61
1525	10:55:11.312	855.35
1526	10:55:11.462	836.91
1527	10:55:11.612	860.85
1528	10:55:11.762	846.62
1529	10:55:11.919	833.99
1530	10:55:12.062	851.79
1531	10:55:12.212	824.61
1532	10:55:12.362	850.66

1533	10:55:12.512	835.45
1534	10:55:12.662	836.74
1535	10:55:12.812	855.68
1536	10:55:12.962	840.30
1537	10:55:13.112	829.62
1538	10:55:13.262	847.59
1539	10:55:13.412	839.17
1540	10:55:13.562	817.97
1541	10:55:13.712	857.29
1542	10:55:13.861	840.14
1543	10:55:14.011	839.33
1544	10:55:14.161	830.27
1545	10:55:14.311	838.20
1546	10:55:14.461	853.25
1547	10:55:14.611	829.79
1548	10:55:14.761	868.62
1549	10:55:14.911	846.78
1550	10:55:15.061	855.19
1551	10:55:15.211	857.62
1552	10:55:15.365	838.04
1553	10:55:15.515	834.96
1554	10:55:15.665	851.79
1555	10:55:15.815	843.70
1556	10:55:15.966	857.13
1557	10:55:16.116	858.75
1558	10:55:16.266	844.03
1559	10:55:16.415	857.29
1560	10:55:16.565	836.91
1561	10:55:16.715	858.91
1562	10:55:16.865	852.44
1563	10:55:17.015	857.13
1564	10:55:17.165	840.47
1565	10:55:17.315	828.49
1566	10:55:17.465	866.19
1567	10:55:17.615	841.11
1568	10:55:17.765	842.89
1569	10:55:17.915	846.62
1570	10:55:18.065	845.48
1571	10:55:18.214	842.73
1572	10:55:18.364	841.11
1573	10:55:18.514	866.36
1574	10:55:18.664	847.42
1575	10:55:18.814	844.03
1576	10:55:18.964	865.06
1577	10:55:19.114	862.31
1578	10:55:19.264	823.48
1579	10:55:19.414	865.06

1580	10:55:19.564	835.13
1581	10:55:19.714	840.47
1582	10:55:19.864	834.16
1583	10:55:20.014	854.22
1584	10:55:20.163	861.66
1585	10:55:20.313	837.55
1586	10:55:20.463	848.72
1587	10:55:20.613	841.92
1588	10:55:20.763	844.35
1589	10:55:20.913	857.78
1590	10:55:21.063	852.93
1591	10:55:21.213	865.71
1592	10:55:21.363	853.73
1593	10:55:21.512	834.80
1594	10:55:21.662	856.00
1595	10:55:21.812	853.09
1596	10:55:21.962	851.96
1597	10:55:22.112	839.98
1598	10:55:22.262	850.01
1599	10:55:22.412	843.70
1600	10:55:22.562	874.77
1601	10:55:22.712	850.50
1602	10:55:22.862	831.40
1603	10:55:23.012	876.55
1604	10:55:23.162	843.54
1605	10:55:23.311	830.11
1606	10:55:23.461	862.63
1607	10:55:23.611	859.40
1608	10:55:23.761	860.21
1609	10:55:23.911	848.56
1610	10:55:24.061	848.88
1611	10:55:24.211	830.92
1612	10:55:24.361	852.93
1613	10:55:24.517	859.72
1614	10:55:24.661	850.01
1615	10:55:24.811	865.39
1616	10:55:24.961	845.97
1617	10:55:25.111	845.16
1618	10:55:25.261	843.06
1619	10:55:25.409	843.06
1620	10:55:25.559	845.64
1621	10:55:25.709	853.25
1622	10:55:25.859	862.80
1623	10:55:26.011	859.24
1624	10:55:26.160	850.50
1625	10:55:26.311	854.22
1626	10:55:26.461	867.81

1627	10:55:26.614	843.06
1628	10:55:26.764	857.62
1629	10:55:26.914	845.00
1630	10:55:27.059	856.00
1631	10:55:27.209	865.55
1632	10:55:27.359	859.07
1633	10:55:27.509	841.76
1634	10:55:27.659	852.44
1635	10:55:27.809	868.14
1636	10:55:27.967	877.36
1637	10:55:28.117	863.77
1638	10:55:28.268	861.18
1639	10:55:28.417	863.44
1640	10:55:28.567	839.33
1641	10:55:28.717	851.31
1642	10:55:28.867	840.63
1643	10:55:29.014	866.52
1644	10:55:29.164	840.30
1645	10:55:29.314	847.10
1646	10:55:29.464	868.62
1647	10:55:29.614	859.40
1648	10:55:29.764	850.01
1649	10:55:29.914	862.80
1650	10:55:30.064	853.73
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2183	10:56:50.029	1008.75
2184	10:56:50.180	1021.21
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2632	10:57:57.385	1164.58
2633	10:57:57.535	1153.25
2634	10:57:57.685	1160.54
2635	10:57:57.835	1156.17
2636	10:57:57.984	1167.98
2637	10:57:58.134	1168.46
2638	10:57:58.284	1153.74
2639	10:57:58.434	1172.02
2640	10:57:58.584	1161.34
2641	10:57:58.734	1155.20
2642	10:57:58.884	1172.67
2643	10:57:59.034	1169.76
2644	10:57:59.184	1162.80
2645	10:57:59.334	1173.97
2646	10:57:59.484	1149.53
2647	10:57:59.634	1156.65
2648	10:57:59.784	1185.13
2649	10:57:59.933	1172.83
2650	10:58:00.083	1165.07
2651	10:58:00.233	1150.34
2652	10:58:00.383	1163.77
2653	10:58:00.533	1154.71
2654	10:58:00.683	1166.68
2655	10:58:00.833	1166.85
2656	10:58:00.983	1175.58
2657	10:58:01.133	1174.61
2658	10:58:01.283	1167.01
2659	10:58:01.433	1166.20
2660	10:58:01.583	1153.90

10:58:01.733 1166.20
10:58:01.882 1165.39
10:58:02.038 1169.44
10:58:02.183 1170.89
10:58:02.333 1171.70
10:58:02.483 1189.99
10:58:02.633 1165.71
10:58:02.783 1172.35
10:58:02.933 1179.95
10:58:03.083 1179.14
10:58:03.232 1167.17
10:58:03.382 1169.76
10:58:03.532 1171.86
10:58:03.682 1182.38
10:58:03.832 1176.07
10:58:03.982 1184.16
10:58:04.132 1190.80
10:58:04.282 1180.28
10:58:04.433 1177.53
10:58:04.583 1194.84
10:58:04.732 1185.62
10:58:04.883 1177.04
10:58:05.033 1171.86
10:58:05.183 1172.67
10:58:05.333 1188.37
10:58:05.479 1206.33
10:58:05.629 1164.42
10:58:05.779 1174.29
10:58:05.929 1185.94
Trend type: Single 波长 at 339.35
积分时间（毫秒）: 10 (USB2+H14105)
平均次数: 15 (USB2+H14105)
平滑度: 0 (USB2+H14105)
去除暗噪声: 否 (USB2+H14105)
10:58:06.079 1164.58
10:58:06.229 1200.18
10:58:06.379 1197.75
10:58:06.529 1200.02
10:58:06.679 1176.72
10:58:06.829 1192.90
10:58:06.989 1180.28
10:58:07.129 1192.58
10:58:07.279 1206.17
10:58:07.429 1177.04
10:58:07.579 1202.61
10:58:07.729 1180.28
10:58:07.879 1185.78

2708	10:58:08.029	1175.58
2709	10:58:08.179	1190.63
2710	10:58:08.329	1194.36
2711	10:58:08.478	1198.56
2712	10:58:08.628	1186.10
2713	10:58:08.778	1200.50
2714	10:58:08.928	1188.04
2715	10:58:09.078	1178.50
2716	10:58:09.238	1195.00
2717	10:58:09.378	1215.39
2718	10:58:09.538	1202.12
2719	10:58:09.688	1179.31
2720	10:58:09.828	1185.78
2721	10:58:09.978	1208.76
2722	10:58:10.138	1188.69