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# 一、 Initialization of participating teams

## 1. Environmental preparation

Equipments	Remarks
Apple xs or xsmax phone	Used to take a snapshot of the projectile trajectory
Black curtain or paperboard	Used as shooting background or used to cover the interfering light source
Main controller burner, latest version of firmware	Green color displayed by the side light bar of the Speed Monitor Module is used as a contrast of

(5.0.1.14 or higher)	projectile brightness
Ground robot (including Sentry) versus Aerial	Objects to be tested

## 2. Operation procedures

1) Prepare the objects to be tested, and place them in dark rooms

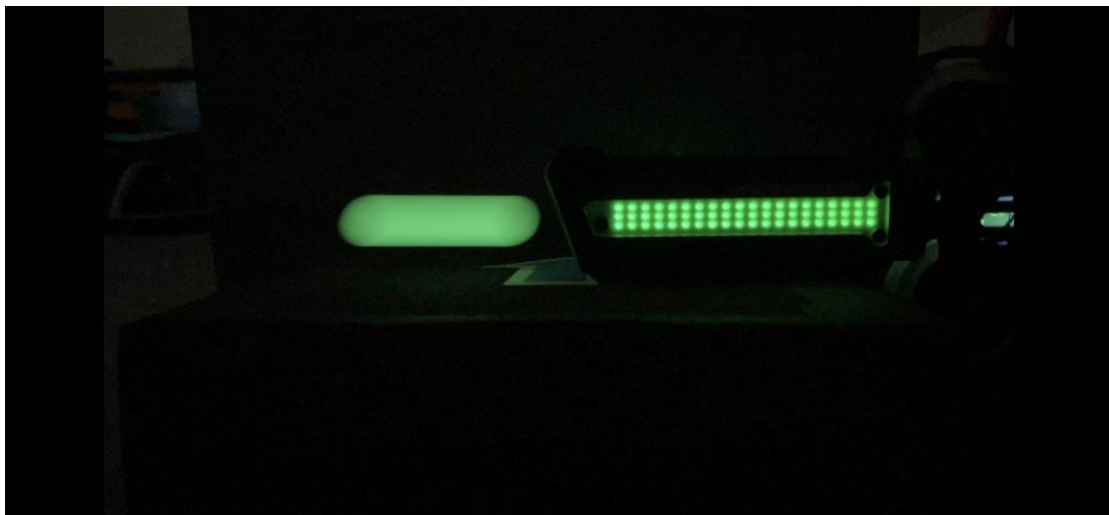
Notes: A dark room is a room in which no other objects than the speed monitor light bar can be photographed with a phone. Press and hold the "Confirm" button on the main controller to enter the Dubug mode and select Projectile\_test, light the Speed Monitor Module light bar as green.

2) Adjust the objects to be tested until they could launch fluorescent projectiles steadily;

3) Open the default camera in an Apple phone, and begin the slow motion recording;

Notes: for the convenience of shooting and self-evaluation of accurate brightness of projectiles launched from bore, it is recommended to adjust the launch speed as 12 m/s, and require images at launch frequency of 1hz and 20 hz (if the upper limit fails to reach 20 hz, then the test is performed using the upper limit) to initialize whether they meet the final competition requirements. Allow the phone to focus on the side light panel, press and hold to lock the focal distance and aperture and avoid the side light panel overexposure and aperture change of the Speed Monitor Module from affecting the final analysis results (overexposure is presented as whitening of green lights), use a slow-motion mode of 1080P, 240 frame rate, and keep the image horizontal with the light bar of the Speed Monitor Module for convenient follow-up screenshot.

4) Extract projectile trajectory images from slow motion videos, with official examples as below:



Notes: Extract the images taken at exposure when the projectiles are launched from barrel.

5) Extract the projectile trajectory image as well as the image of light panel of the Speed Monitor Module from the above photo, with official examples as below:



73bm1.png



73lm1.png

Notes: The projectile trajectory screenshot is captured at the pixel in the brightest part. The light panel screenshot should cover the whole light panel as practicable as possible, and the black edges (which will cause lower average brightness calculated for images, and higher final ratios, thus affecting self-evaluation accuracy) should not be captured.

6) Open the tool:



7) Double click and operate the tool

```
please input lamp img file name: 731ml.png  
please input bullet img file name: 73bml.png  
Please name the image you are going to save:
```

Notes: Input the names of the light panel screenshot and the projectile trajectory screenshot files where the above screenshots are saved on the window (suffix is required, and the images and tools need to be put under the same directory)

8) Press the return key; a window for calculation results will pop up.

```
result  
lamp(731m1.png)=159.01854478592068  
bullet(73bm1.png)=156.02435064935065  
bullet/lamp=0.9811707864601517
```

Notes: In the first line, input the average brightness value of side light panel screenshot of the Speed Monitor Module; in the second line, input the average brightness value of projectile trajectory screenshot; in the third line, input the ratio between the brightness of projectile screenshot and the brightness of light panel screenshot of the Speed Monitor Module.

9) Save the calculation results

Press the return key directly, and save the file name as the name combining the names of files for two images input; the information of saved file is shown as below:

```

lamp(73lm1.png)=159.01854478592068
bullet(73bm1.png)=156.02435064935065
bullet/lamp=0.9811707864601517
73bm1.png73lm1.png

```

Notes: If you want to name the file by yourself, then input the file name you want to save in the command window (image format; suffix is required to be contained).

10) Analyze the results

If the projectile trajectory brightness/light panel brightness ratio is greater than 0.85, then this basically meets the requirements for brightness in final official inspection.

Notes: This initialization method may exist some deviations, so if you want to ensure the brightness is enough and pass the final official inspection, it is recommended to adjust the way the charge device is installed to make the brightness ratio reach over 0.95.

## 二、 Official inspection

### 1. Working principle

The official authority will use the officially developed inspection device directly at outlet of the official Speed Monitor Module, and test the brightness of each projectile leaving the bore. The device will record the lowest and highest brightness values of a projectile launched, and the lowest brightness value requires to meet the officially indicated value (if the previous initialization passes, this may basically meet the value, and final official inspection results shall prevail).

### 2. Requirements for "pass"

Test item	Indicator for "pass"
Brightness at a launch frequency of 1 projectile/second; the launch speed shall not exceed the specified maximum launch speed	Greater than or equal to the minimum inspection value of the inspection device
Brightness at a launch frequency of 20 projectiles/second; the launch speed shall not exceed the specified maximum launch speed (If the maximum launch frequency is lower than 20, then the maximum launch frequency of the device shall prevail)	Greater than or equal to the minimum inspection value of the inspection device

## 三、 Question and answer (Q&A)

### 1. Initialization of the participating teams

Q: Can I use other phones for shooting?

A: Different phones have various sensors and algorithm treatment methods, which will cause greater differences in the above final results, so this has no reference significance.

Q: What if I have no any Apple phone?

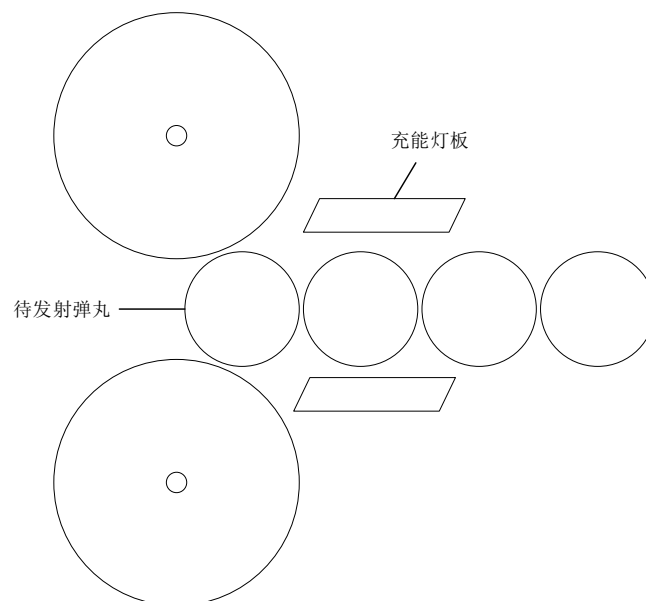
A: If you can see with your eyes that the brightness of a launched projectile is far greater than that of side light panel of the Speed Monitor Module, then it is unnecessary to analyze RGB brightness, that is, this surely meets the inspection requirements.

Q: If the side light panel of the Speed Monitor Module is not overexposed, then what if the launched projectile becomes white?

A: If the projectile becomes white in this case, this indicates that the projectile is bright enough, and the official inspection is surely not problematic.

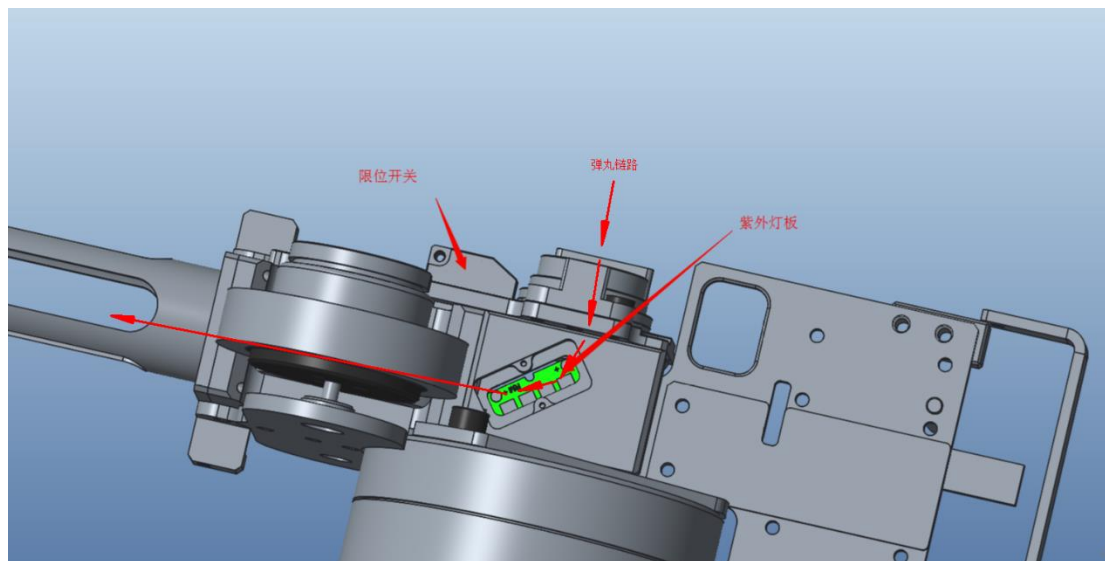
Q: If the initialization for one-launch brightness meet requirements, and the brightness for running launch is lower, is there any method to improve this?

A: If one-launch meets the brightness requirements and the running launch fails to meet the requirements, then it is highly possible that your own device light panel is installed too close in the front, and when the projectile to be launched could be illuminated and give out light, the light panel could be adjusted slightly backwards to lengthen the projectile charge time during a running launch by using the light panel scattering distance, so as to improve the brightness value of projectile during a running launch. The relative positions of projectile and light panel when the projectile is not launched are shown as a reference as below:



Key points: The light panel edge is kept parallel with the edge of the projectile to be launched, and the projectile to be launched can give out light after being illuminated by the scattered light of the

charged light panel, so this could meet the low- and high-launch frequency light scattering requirements. The optimal distance could be adjusted slightly near the distance depending on its own structure. Official device installment diagram attached:



Q: If the initialization for running launch brightness meet requirements, and the brightness for one launch is lower, is there any method to improve this?

A: If the running launch meets the brightness requirements, and one launch cannot meet the requirements, then it is highly possible that your own device's light panel is installed backwards to much, and one-launch brightness can meet the requirements by adjusting the light panel forwards slightly to allow the to-be-launched projectile can be illuminated and give out light. However, this cannot be adjusted forwards too much, as this would cause unsatisfied brightness during a running launch. Please refer the above item for schematic diagram.

## 2. Official inspection

Q: Sentry and Aerial are generally available for running launch, so is it possible for the official authority not require the inspection results for one launch?

A: If the one-launch effect is not required, the brightness of first several projectiles during a running launch and that of the running launch at a lower launch frequency are difficult to ensure, therefore, there are unified inspection requirements like other ground robots, and either the one-launch or the running launch brightness must be met.

Q: What if I fail to pass the official inspection?

A: Robots can enter on the match area only when their adjustment and modification meet the inspection requirements. The structural changes are troublesome, so an initialization must be performed to ensure the one-launch and running-launch brightness effect.