Colorlight

Calibration Pro

User Manual

Contents

Chapter1 Calibration System

Calibration Pro is a professional software developed by Colorlight for LED display calibration. It integrates advanced algorithms such as AI intelligence and machine vision, enabling LED display calibration with high accuracy and high efficiency.

1.1 Operating Environment

1.1.1 System Requirement

Operating system	Windows10 or later (64-bit or above)
RAM	16G or more (64G RAM is recommended for calibration with CCM6000 camera. RAM smaller than 64G will affect the calibration efficiency.)
Communication	With multi-media port (e.g.: HDMI), USB port, and Gigabit network port.
Display	Either with a graphics card that supports full-screen pixel-to-pixel display, or with a sender that supports controlling LED display via USB.

1.1.2 Capture Device

1.1.2.1 Industrial Camera

- Camera: CCM6000

Fig.1-1 Camera body of CCM6000

- Lens: Milvus 1.4/50 (Standard); Or, Milvus 2/35 or Milvus 2/100 (Optional)

Fig.1-2 Milvus 2/35

Fig.1-3 Milvus 1.4/50

Fig.1-4 Milvus 2/100

- Tripod head: Manfrotto 405 geared tripod head (Standard)

Fig.1-5 Manfrotto 405 geared tripod head

- Tripod: Manfrotto MT190GOC4TB tripod (Standard)

Fig.1-6 Manfrotto MT190GOC4TB tripod

- Cable: Special power adapter and USB 3.0 cable (Standard)

Fig.1-7 Power adapter and USB 3.0 cable

1.1.2.2 Canon Camera

- Camera: Support for Canon70D, 80D, 90D, 7D, and 7D MarkII. Canon 90D is recommended.

Fig.1-8 Canon camera

- Lens: Canon EF 70-300mm f/4-5.6L IS USM is recommended.

Fig.1-9 Canon EF 70-300mm f/4-5.6L IS USM

- Tripod head: Manfrotto-410 tripod head is recommended.

Fig. 1-10 Tripod head

- Tripod: MT190GOC4TB -190GO tripod is recommended.

Fig.1-11 Tripod

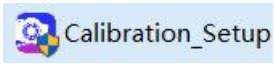
- Power adapter:

Fig.1-12 Power adapter

- Cable: Subject to the model of Canon camera.

1.2 Install and Uninstall

1.2.1 Install Calibration Pro

Download the latest version of *Calibration Pro* from Colorlight's official website first. Then, double-click the installer 

to start the installation.

1) Select the default software language.

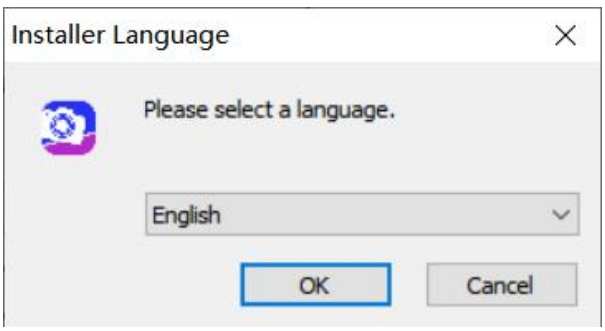


Fig. 1-13 Select the default language

2) Select an installation method at the first page of the setup wizard.

Fig.1-14 *Calibration Pro* setup wizard

- **Quick Install**: Select **Quick Install** and then click **Next** to start auto installation.
- **Custom Install**: Select **Custom Install** and then click **Next** to continue.
  - Select a path for the installation and then click **Next.**

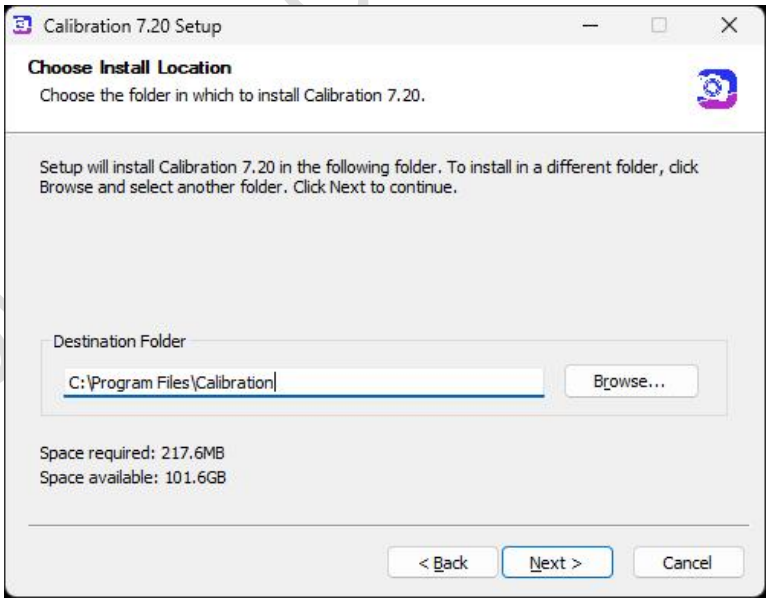


Fig 1-15 Select Installation path

- Select the components you want for *Calibration Pro*, and then click **Install** (in order to ensure the full functioning of *Calibration Pro*,

please select all components for the first-time installation or version update).

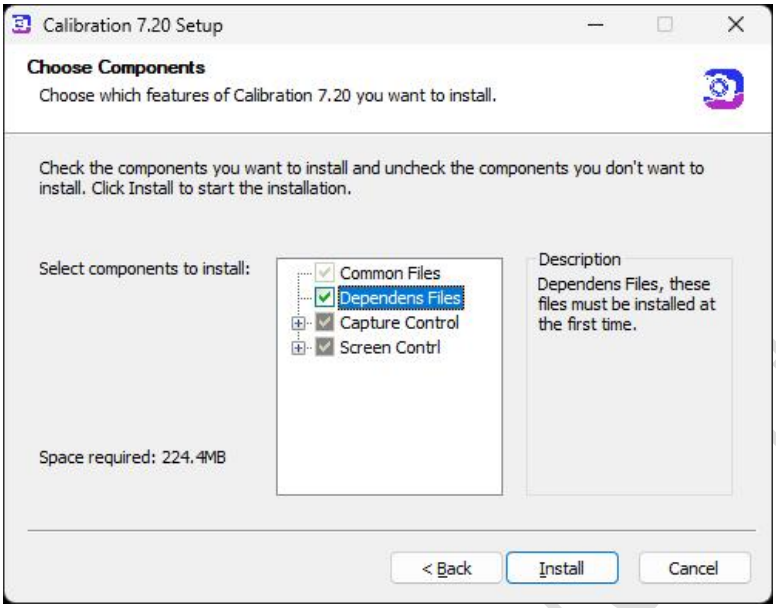


Fig.1-16 Select components

- Click **Finish** to exit the setup wizard. *Calibration Pro* is now ready for use.

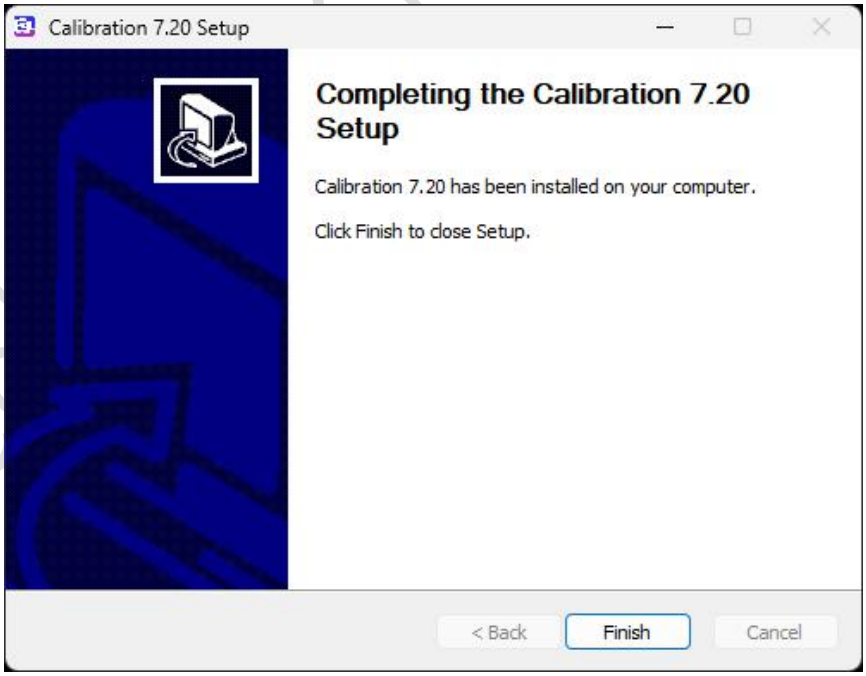


Fig.1-17 Installation complete

Once you have finished the installation, the icon of *Calibration Pro*

will automatically appear on the PC desktop. You can double-click the icon to launch the software.

1.2.2 Uninstall Calibration Pro

Taking the Windows 10 operating system as an example, if you want to uninstall *Calibration Pro*, you can navigate to **Start** > **Calibration**, and then right-click on any icon under the **Calibration** folder to bring up a context menu. Next, select **Uninstall** to access the uninstallation guide.

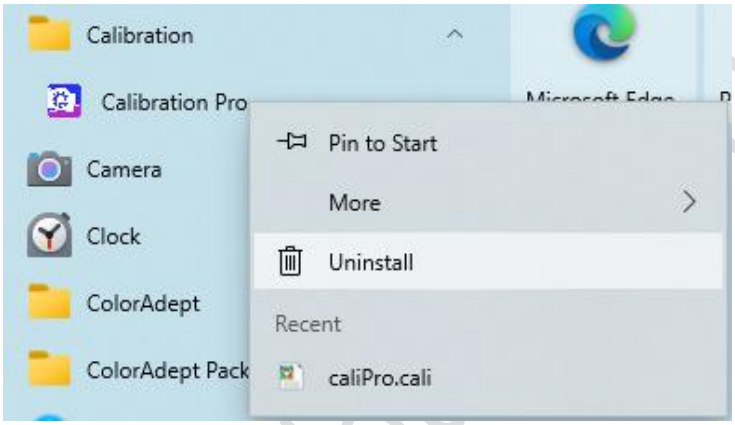


Fig.1-18 Uninstall *Calibration Pro*

Chapter2 Quick Start

2.1 Before Calibration

2.1.1 Complete System for Calibration

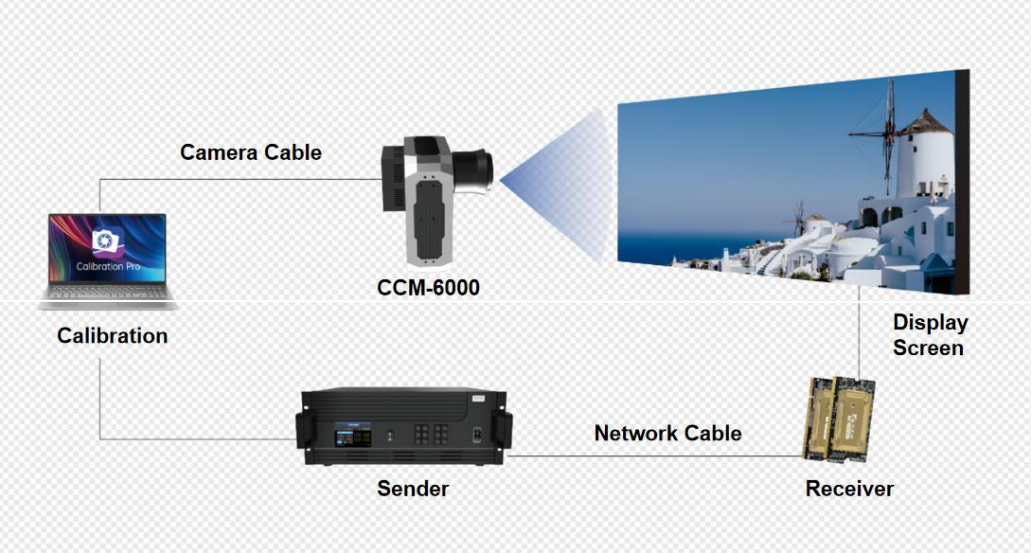


Fig.2-1 The complete system for calibration

- Install *Calibration Pro* on your PC.
- Connect your PC to the sender using network cable.
- Connect your PC to the camera using the camera cable.

2.1.2 Parameter Configuration

Configure the screen parameters (receiver parameter and topology) properly using the software *LEDVISION*. During parameters configuration, disable calibration and other adjustment functions to ensure the original display effect of the screen. Once you have finished the configuration, send and save the parameters to the receiver. Next, exit *LEDVISION* and other LED display control software.

2.2 Start Screen

The start screen of *Calibration Pro* is as shown in Figure 2-2.

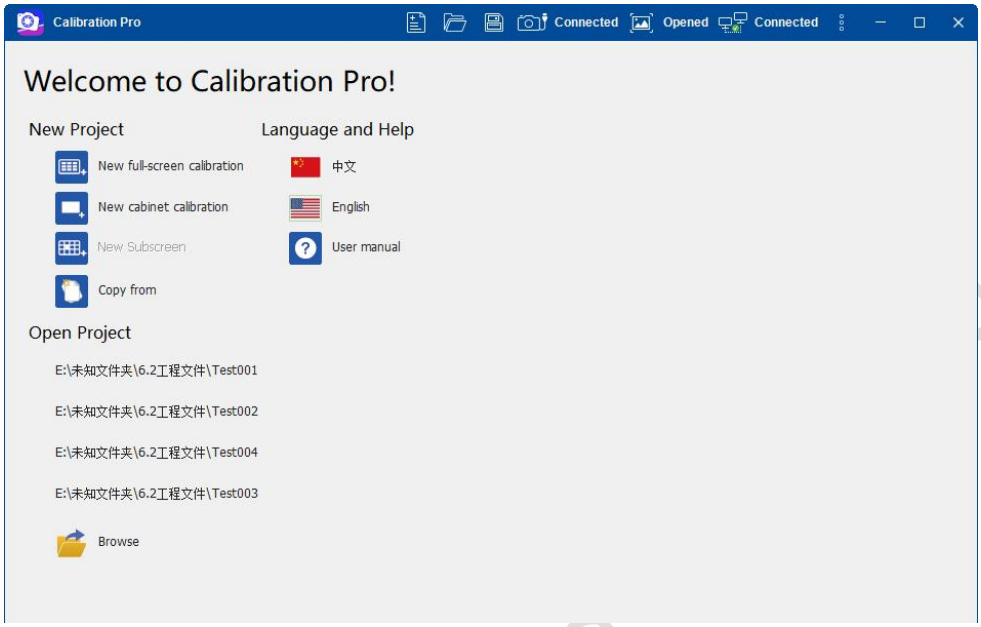


Fig.2-2 *Calibration Pro* start screen

2.2.1 New Project

New full-screen calibration: Click to start creating a new full-screen calibration project.

New cabinet calibration: Click to start creating a new single-cabinet calibration project.

Copy from: Click to apply project setup wizards of a saved project for calibrating multiple screens with the same specification.

2.2.2 Language and Help

中文: Click to set Chinese as the software language.

English: Click to set English as the software language.

User manual: Click to access the *Calibration Pro User Manual*.

2.2.3 Open Project

You can find your recent projects below **Open Project** and click on any one of the projects to access its editing interface.

Browse: Click to select a calibration project from a desired folder.

2.2.4 Status Bar

The status bar is located at the top right of the main interface, allowing users to obtain information about the current status through icons and text prompts.

Fig.2-3 Status bar

- **New:** Click the icon to access the calibration project setup wizard.
- **Open:** Click the icon to select a saved project file.
- **Save:** Click the icon to save the current project parameters.
- **Connect:** Click the icon to connect to the camera. The icon will appear as once the camera has been connected.
- **Start EVF:** Click the icon to enable EVF. The icon will appear as once the EVF has worked successfully, and you can view the image captured in the monitoring area in real time.
- **Display control connection:** Click the icon to access the interface for connecting the control PC. The icon will appear as once the control PC has been connected.

Chapter3 Calibration with Industrial Camera

3.1 CCM6000 Assembly

3.1.1 Tripod Setup

Unfold the tripod and adjust its height, making it face the screen center, or at a height close to the user's eye level.

Fig.3-1 Unfold the tripod

3.1.2 Mount Tripod Head

Align the screw hole at the bottom of the tripod head with the mounting screw of the tripod, and then screw the tripod head clockwise.

Fig.3-2 Mount the tripod head

3.1.3 Mount Camera

1) Adjust the quick-release lever of the tripod head to the left.

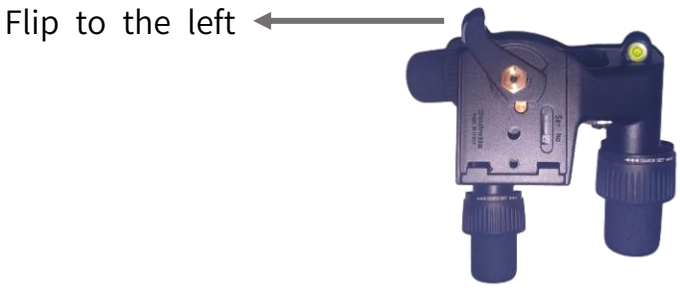


Fig.3-3 Mount tripod head

2) Adjust the lens direction to make it align with that of the tripod head.

3) Mount the camera onto the plate of the tripod, and the lever will be automatically released to fix the camera.

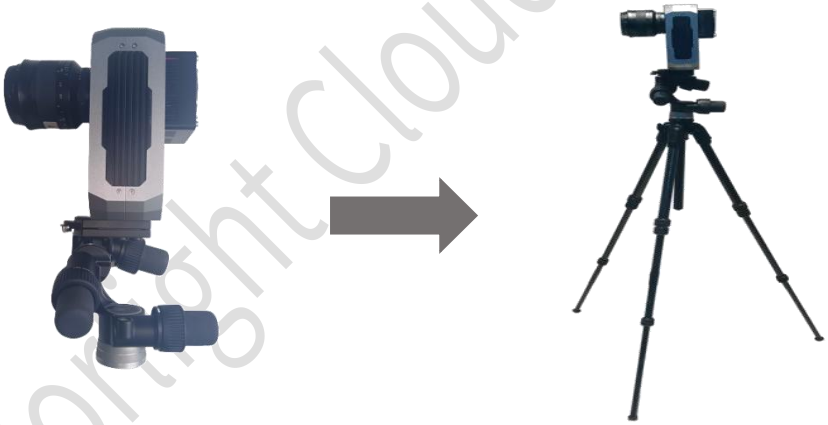


Fig. 3-4 Mount the camera

3.2 Full-Screen Calibration

3.2.1 New Full-Screen Calibration

Step 1: Full-screen project wizard-1

In the start screen, click **New full-screen calibration** to access the **Full-screen project wizard-1**. See Figure 3-5.

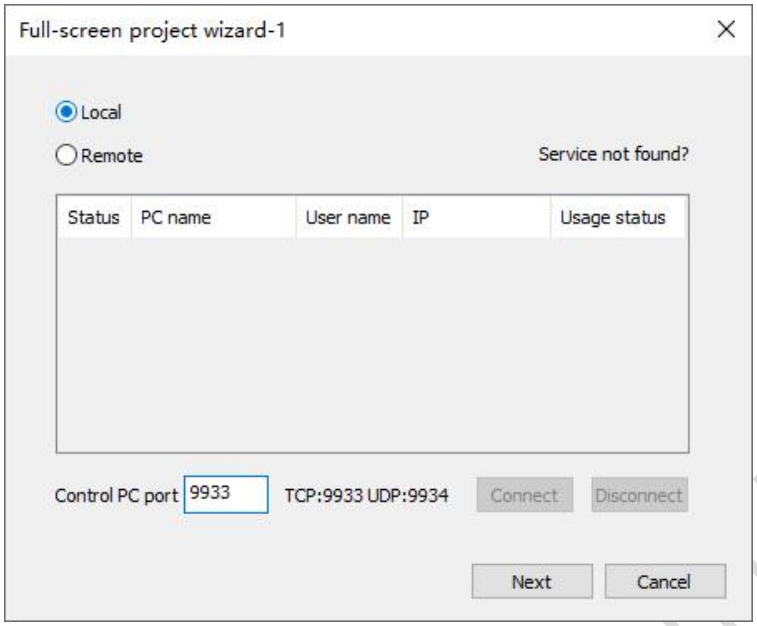


Fig.3-5 Select **Local**

1) For calibration with a single control PC, select **Local** to connect to the control PC.

2) For calibration with 2 PCs, select **Remote** and then select a PC from the sheet below as the control PC (available PCs in the currently used LAN will automatically be shown in the sheet). Once you have selected the target PC, click **Connect**.

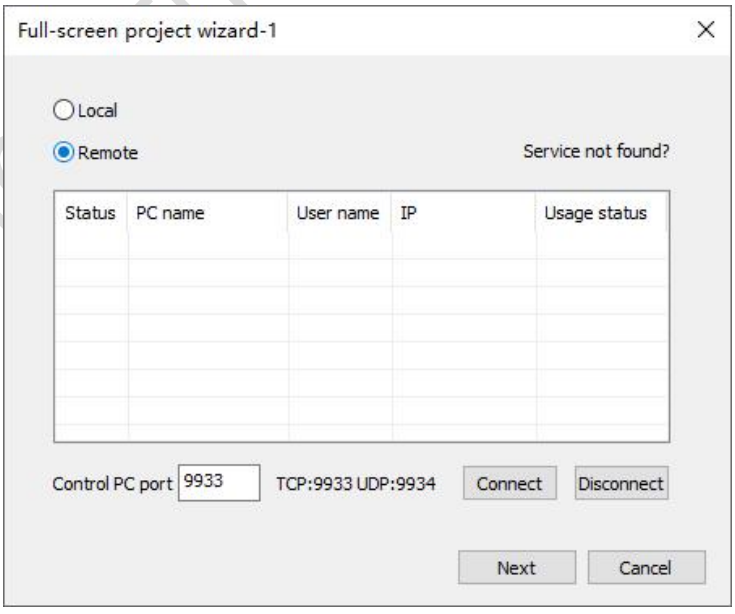


Fig.3-6 Select **Remote**

Notes:

① It is recommended that you select **Remote** when the sender is placed far from the LED screen, and the control PC cannot physically connect to the sender via a cable.

② For calibration with 2 PCs, the PCs should share the same LAN (connected via WIFI or network cable), and the firewalls of them should be turned off. The 2 PCs should install *Calibration Pro* of the same version.

③ The PC for display capture will automatically launch *CaliPro Server* and should be connected to the control PC.

④ The **Control PC port** is 9933 by default. If the default port has been occupied by other devices, you will need to set a port number for both the control PC and the PC for display capture. To modify the port number, right-click the software interface or minimize the interface in the control PC, and then access the network setup window to enter a new port number. See Figure 3-7.

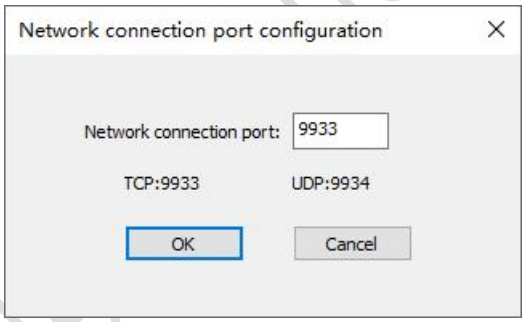


Fig.3-7 Network connection port configuration

After the control PC finished network connection, click **Next** to bring up the **Full-screen project wizard-2**.

Step 2: Full-screen project wizard-2

In the **Full-screen project wizard-2**, you will be able to view information about the amount of the connected sender and receiver, their model, and their program version. See Figure 3-8.

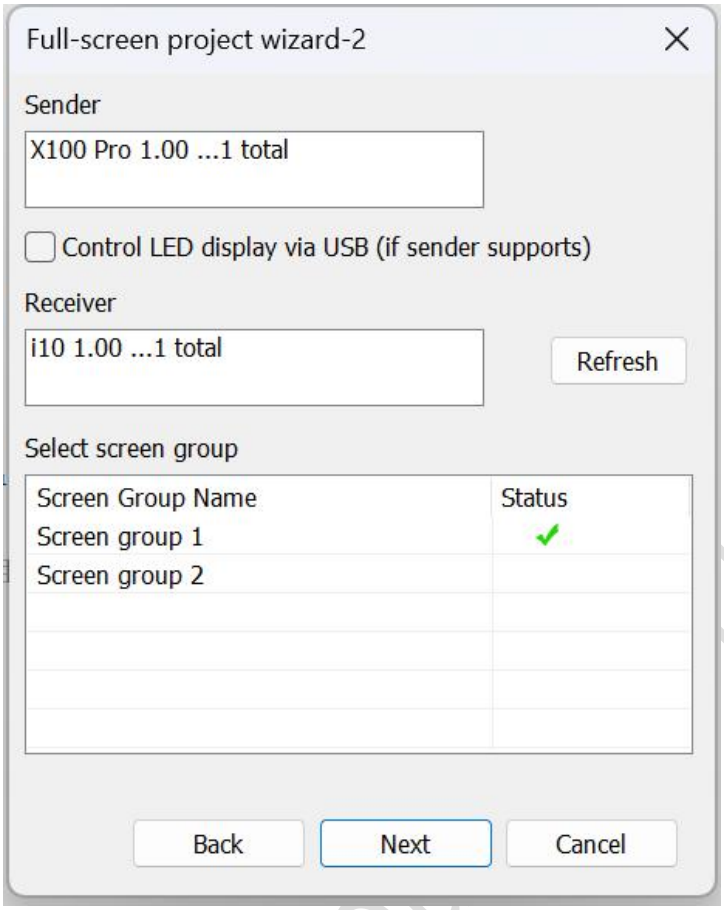


Fig.3-8 Full-screen project wizard-2

- If the sender supports display control via USB, you can select the **Control LED display via USB (if sender supports)** checkbox. This will allows for pixel-to-pixel calibration image display without video signal.
- If the sender does not support USB control, you can perform calibration using video signal. Note that you should perform calibration with an extended screen in this case (see **Project settings-Canvas settings** in the following descriptions for reference).
- If the sender supports controlling screen group, you will be able to select the desired group for control in this window.

Then, you can click **Next** to move on to the **Full-screen project wizard-3**.

Step 3: Full-screen project wizard-3

You can finish camera settings in this step. See Figure 3-9.

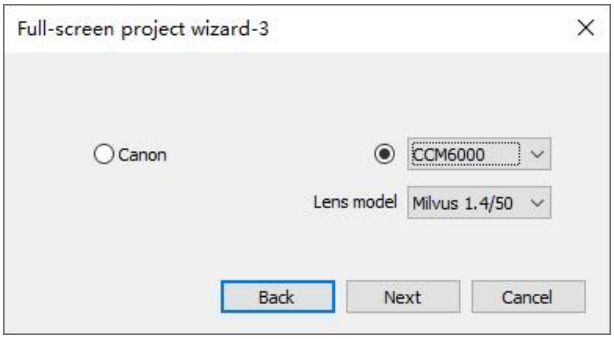


Fig.3-9 Full-screen project wizard-3

- If your PC has not connected to the camera, you should finish settings in this step according to the camera you use. Supported camera models include: CCM1600, CCM2600, CCM6000, and CCM900C.
- If your PC has connected to the camera, the camera model will be automatically selected.
- If the camera you use is the CCM6000, you will need to select the lens model. The supported lens include: Milvus1.4/50, Milvus2/35, Milvus2/100, Canon 35, and Canon 70-300.

Once you have finished the camera settings, you can click **Next** to bring up the **Full-screen project wizard-4**.

Step 4: Full-screen project wizard-4

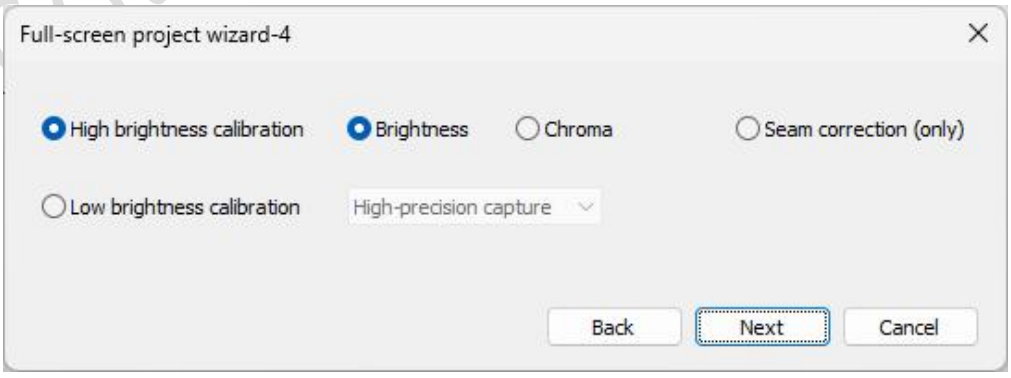


Fig.3-10 Full-screen project wizard-4

You can select the calibration mode in this step. See Figure 3-10. You should first select **High brightness calibration** or **Low brightness calibration** according to your need. Then, you can select calibration mode among **Brightness**, **Chroma**, and **Seam correction (only)**. **High-precision capture** and **Quick capture** are supported in **Low brightness calibration** mode.

- **Brightness**: Supports calibrating screen for brightness uniformity.
- **Chroma**: Supports calibrating screen for brightness and color uniformity.
- **Seam correction (only)**: Supports calibrating the bright and dark lines that appears on the screen after the assembling.

After the selection, you can click **Next** to move on to the **Full-screen project wizard-5**.

Step 5: Full-screen project wizard-5

You can finish the setup of the module, cabinet, and screen in this step. See Figure 3-11.

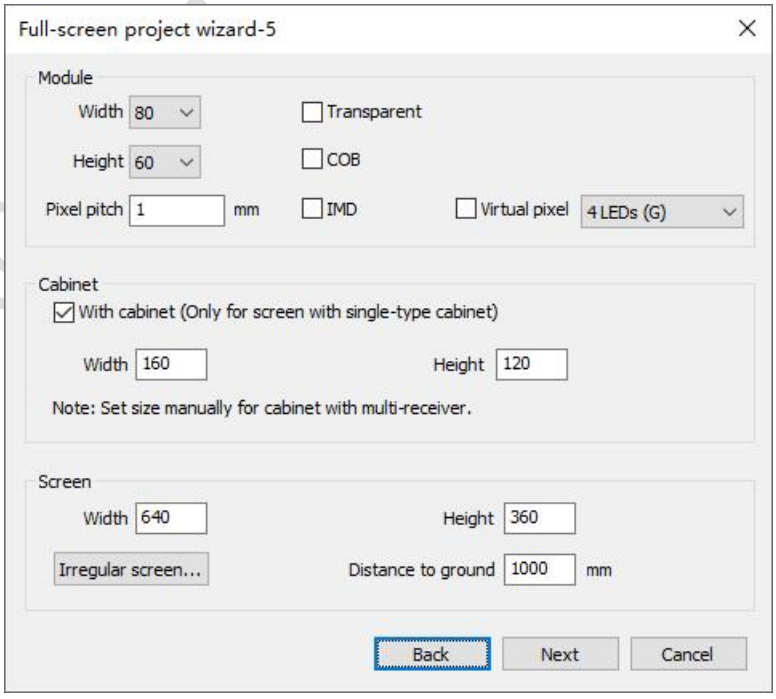


Fig.3-11 Full-screen project wizard-5

- **With Cabinet (Only for screen with single-type cabinet):** This checkbox is selected by default. Select this checkbox when the screen is composed of cabinets of only one type.
- **Transparent:** This checkbox should be selected when the horizontal pixel pitch is different from the vertical one.
- **COB:** Select this checkbox when COB module is used for the currently calibrated screen.
- **IMD:** Select this checkbox when IMD module is used for the currently calibrated screen.
- **Virtual pixel:** Select this checkbox when virtual pixel is used for the currently calibrated screen. Available options for this include: **4 LEDs (R)**, **4 LEDs (G)**, **4 LEDs (B)**, and **6 LEDs**.
- **Pixel pitch:** *Calibration Pro* will recommend a proper pixel pitch once the receiver is detected. Normally it is 0 by default, and you can enter a new pitch according to the real situation.
- **Irregular screen settings**

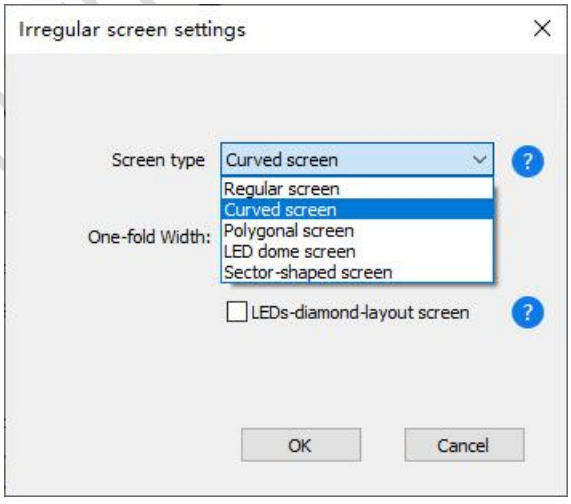


Fig.3-12 Irregular screen settings

- **Curved screen:** Select this checkbox when the screen is a curved one assembled by modules with the same LEDs in row and in column. You

should also enter a value in the **One-fold Width** input box for a curved screen according to the real situation. See Figure 3-13.

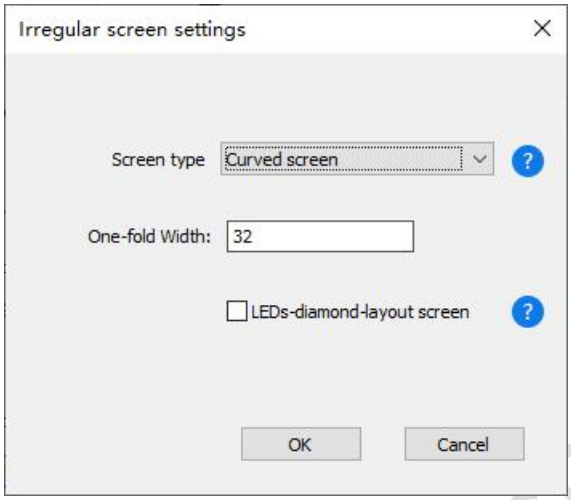


Fig.3-13 Curved screen settings

- **Polygonal screen:** Select this checkbox when the screen is an irregular one assembled by rectangular modules with the same LEDs in row and in column.
- **LED dome screen:** Select this checkbox when the screen is an irregular one assembled by modules with the same LEDs in row or in column. You will need to set the module layout for this type of screen according to the real situation.

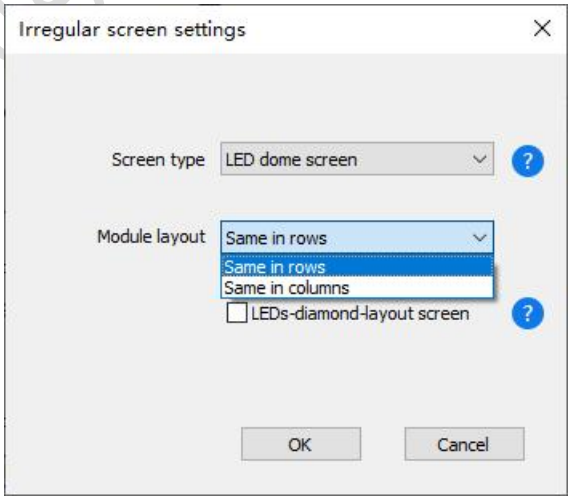


Fig.3-14 LED dome screen settings

- **Sector-shaped screen:** Select this checkbox when the screen is sector-shaped and is formed by identical triangular modules. You will need to select the corresponding module layout and enter a value in the **Sector Width** input box according to the real situation.

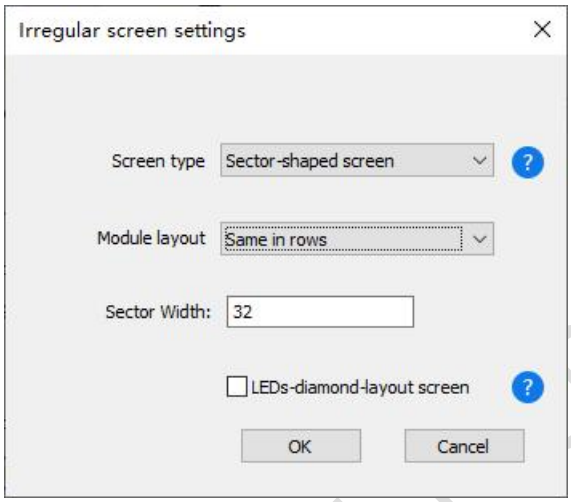


Fig.3-15 Sector-shaped screen settings

- **Distance to ground:** This field indicates the real distance between the bottom of the screen and the ground (unit: mm).

Click **Next** when you finish this step.

Step 6: Full-screen project wizard-6

You can set the margins of the screen in this step. See Figure 3-16.

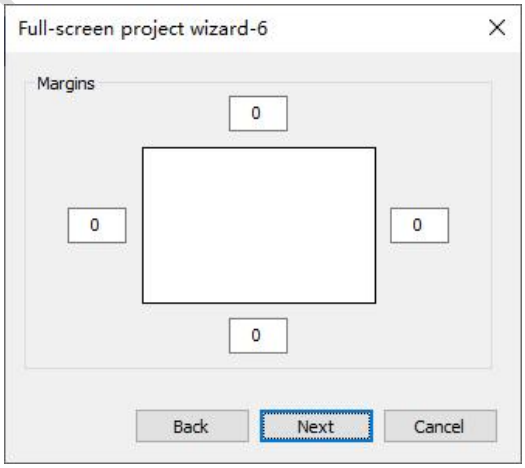


Fig.3-16 Full-screen project wizard-6

In this step, the screen will display a white frame. In this window, you can enter the number of LEDs that will not be lit during calibration respectively in the four input boxes around the frame, according to the installation of the screen at site.

- When *Calibration Pro* has detected more than 1 sender, you will need to set the sender layout before continuing the wizard-6. See Figure 3-17.

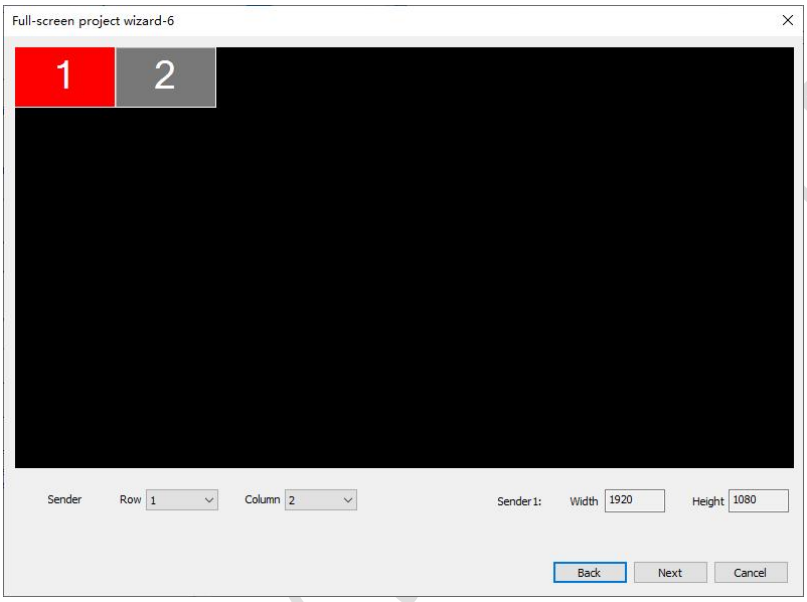


Fig 3-17 Sender layout settings

In this step, you should enter the rows and columns of the senders according to their real layout. Click a sender to set its size and position in the load area. You can also exchange the control area and position of two senders by dragging them in this interface. Once you have finished the sender settings, you can click **Next** to move on to the setup of **Margins** and do as described above. See Figure 3-16.

Once you have finished setting the margins, click **Next** to continue.

Step 7: Full-screen project wizard-7

You can name the calibration project and select a path for saving it in this step. See Figure 3-18.

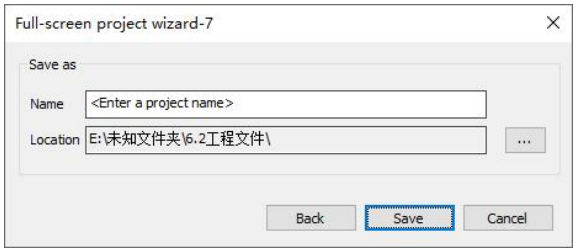


Fig.3-18 Full-screen project wizard-7

Name: Enter the name of the calibration project in this field.

Location: Select a path for saving the project file and data in this field.

Once you have finished this step, you can click **Save** to apply all the settings finished in the above 7 steps, and you will be prompted the recommended shooting distance (see Figure 3-19). Next, click **OK** to finish the full-screen calibration project setup and access the main interface for this project.

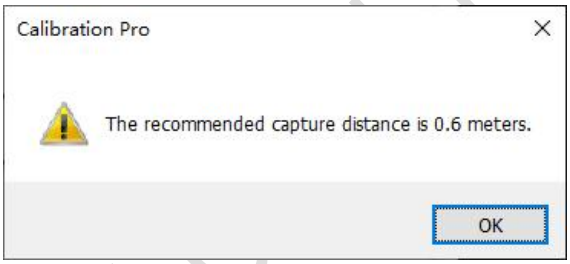


Fig.3-19 The reminding message for the recommended shooting distance

3.2.2 Project Settings

The main interface of the full-screen project is as shown in Figure 3-20. You should first set the basic parameters for the project in the **Project Settings** tab.

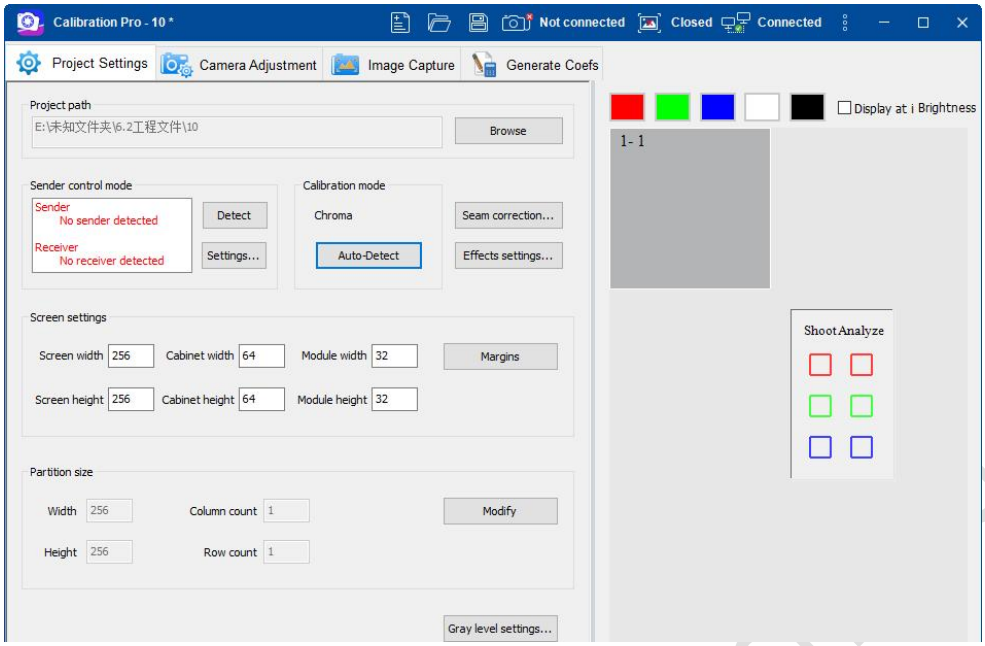


Fig.3-20 Main interface of full-screen project

3.2.2.1 Sender Mode

In the **Project Settings** tab, *Calibration Pro* will automatically detect senders and receivers once the control PC has been connected, and the senders and receivers that have been detected will be shown in the tab. See Figure 3-21.

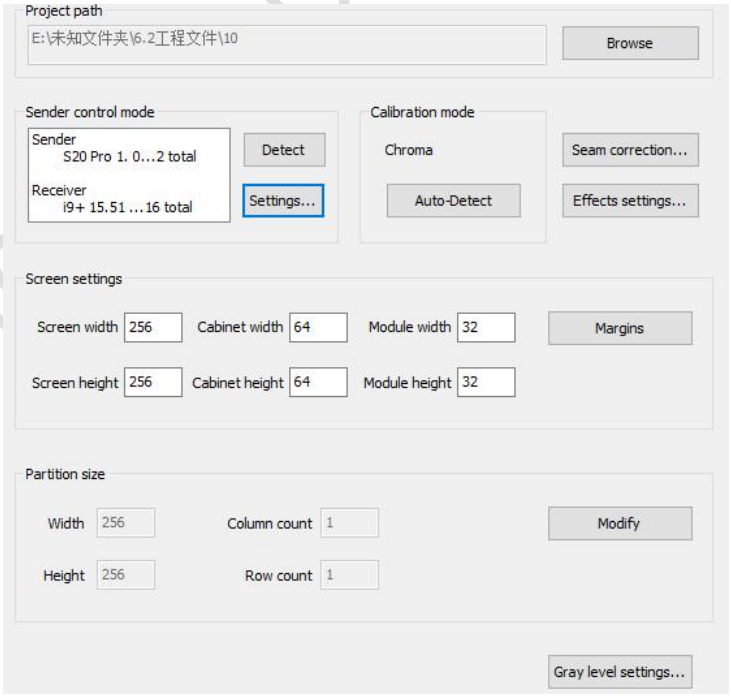


Fig.3-21 Basic information in sender mode

- **Detect**: Click **Detect** to detect the currently connected senders and receivers, and then you will be able to view information about the model, version number, and amount of the detected senders and receivers.

- **Settings...**:

1) Click **Settings...** to bring up a pop-up window for setting the sender control mode. If there is no more than 1 sender detected, you can only enable or disable the option **Control LED display via USB (if sender supports)**. See Figure 3-22.

Fig.3-22 Control LED display via USB (if sender supports)

Note: When the serving end is connected, selecting **Control LED display via USB** will maximize the canvas to foreground, and deselecting the option will minimize the canvas to background.

2) If the amount of the senders that have been detected exceeds 1 (there are multiple senders cascaded for calibration), you will be able to set the layout of the senders in sender setup wizards.

➢ **Sender setup wizard-1**

In **Sender setup wizard-1**, you can divide the screen into several partitions according to the load capacity of the sender. There are 2 ways available, as shown in Figure 3-23.

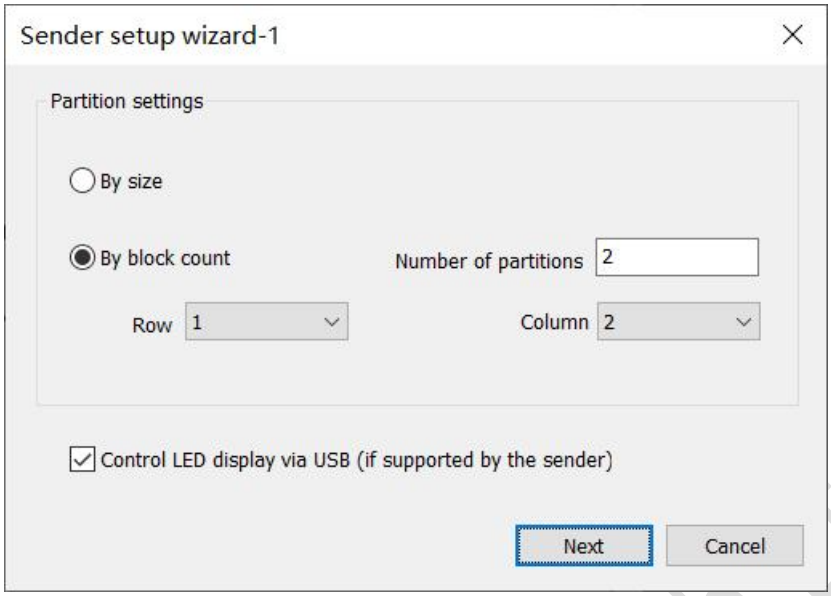


Fig.3-23 Sender setup wizard-1

① **By size**: Divide the screen based on the size of each partition.

② **By block count**: Divide the screen according to the rows, columns, and number of partitions you set.

Once you have set up the principle for screen partitions based on the real control area of the senders, you can click **Next** to continue.

➢ **Sender setup wizard-2**

In this step, you can set up the partitions. See Figure 3-24.

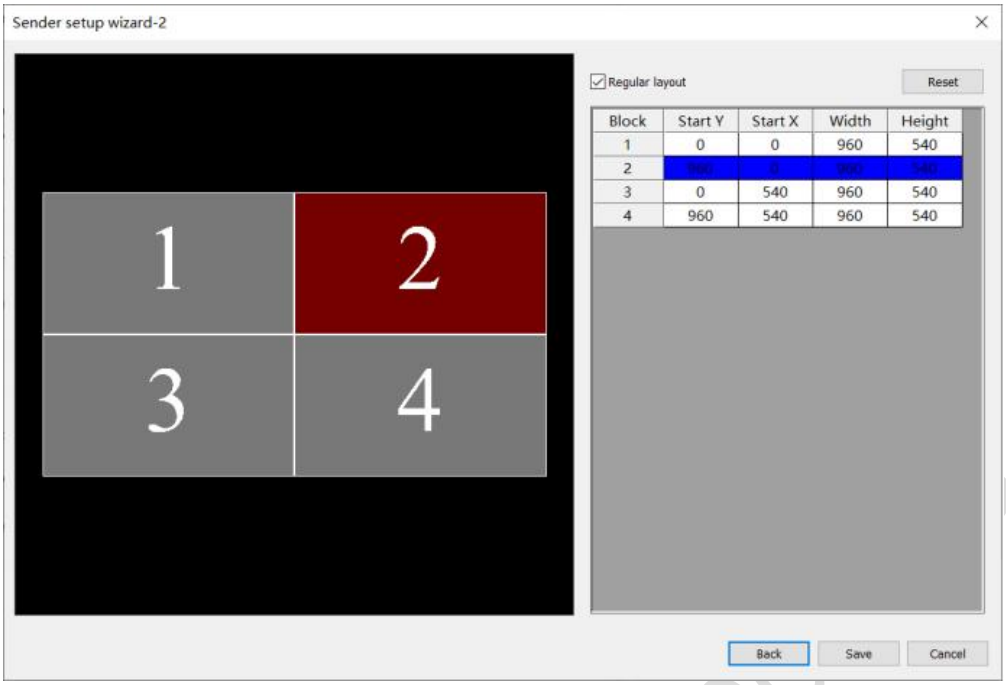


Fig.3-24 Sender setup wizard-2

- **Regular layout**: If you select this checkbox, you can only set the size of the sender-control area in a way that makes the partitions align in rows and columns. You can modify the size of each sender-control area individually after deselecting this checkbox.
- **Reset**: Click to reset the positions and size of the sender-control area.

Click **Save** once you have finished the setting process.

3.2.2.2 Calibration Mode

Click **Switch** to choose a calibration mode. Available options include: **Brightness**, **Chroma**, and **Seam correction (only)**. See Figure 3-25.

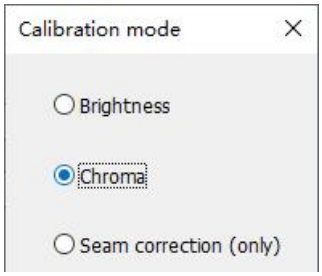


Fig.3-25 Available calibration modes

3.2.2.3 Seam Correction

A dark line will appear when the seam between modules or cabinets is too wide. Similarly, a bright line will appear when the width of the seam is less than the pixel pitch. Such dark or bright line issue can be fixed by adjusting the brightness of the LEDs on the target seam.

- **Seam correction:** Click **Seam correction** in the **Project Settings** tab, and then select the **Enable** checkbox in the pop-up window to enable the seam correction function. See Figure 3-26.

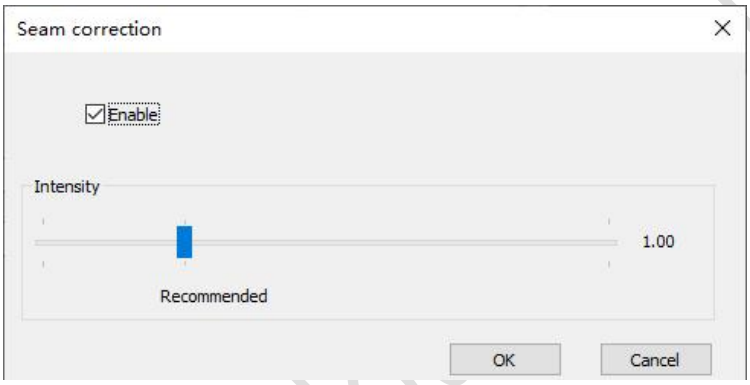


Fig.3-26 Seam correction settings

- **Intensity:** If you find the correction effect not as expected, you can move the slider below to change the adjusting intensity for seam correction. The default intensity is 1. If the original dark (or bright) line turns to be too bright (or too dark) after seam correction, you can lower the intensity appropriately. However, if you find the line still relatively dark (or bright) after the correction, you can increase the intensity appropriately.

Note: If you have selected **Seam correction (only)** before, you cannot perform the brightness/chroma calibration, and the seam correction function will be enabled by default. See Figure 3-27.

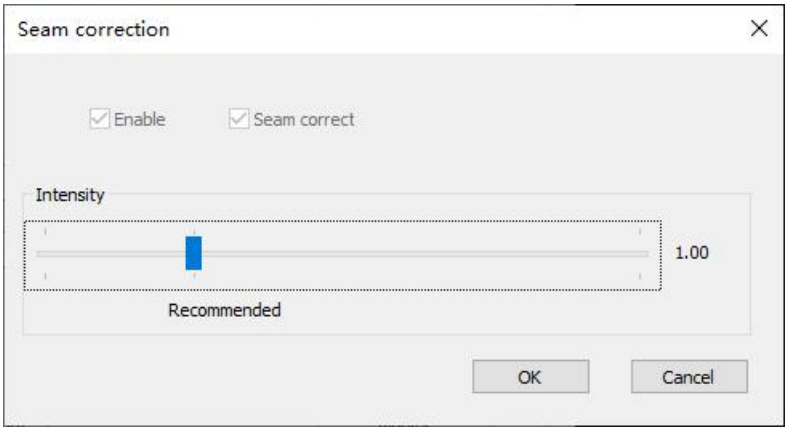


Fig.3-27 Seam correction (only) settings

3.2.2.4 Effects Settings

You can click **Effects settings** to access the corresponding interface. See Figure 3-28.

- **Interchangeable after calibration**: This option is selected by default to enable eliminating differences between the partitions after calibration.
- **Image dust off**: This option is selected by default to enable eliminating the post-calibration bright spots caused by dust from camera/lens.
- **Ambient light intensity**: The industrial camera can work for calibration when ambient light exists, but the camera cannot adjust itself automatically to match the light. Therefore, you can select **Strong**, **Weak**, or **None** according to the real situation of the ambient light at site.
- **Dead pixel rate**: This field shows the ratio of dead pixels to the entire screen. You can adjust the ratio based on the actual situation (0-50‰). Note that if the actual dead pixel rate exceeds the rate you have set, a failure will occur.

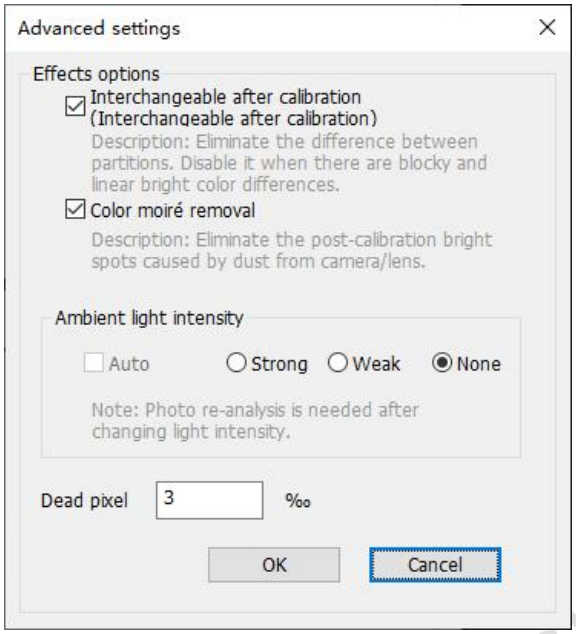


Fig.3-28 Effects settings for the CCM-6000 camera

COB: If you have selected **COB** before, the available options in **Effects settings** will not include **Interchangeable after calibration** and **Image dust off**, as shown in Figure 3-29.

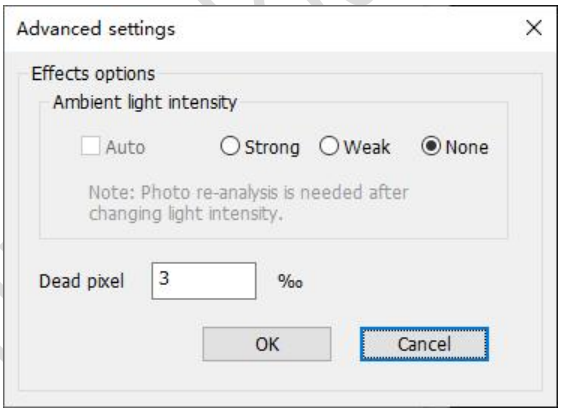


Fig.3-29 Effects settings for CCM6000 (COB module)

3.2.2.5 Screen Settings

Fig.3-30 Screen settings

Screen width and height: Set the width and height of the full-screen.

Cabinet width and height: Set the width and height of a single cabinet.

Module width and height: Set the width and height of a single module.

- **Margins:** Please refer to relevant description in **Step 6: Full-screen project wizard-6** above.

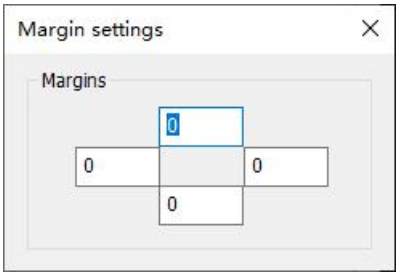


Fig.3-31 Margin settings

- **Canvas settings:** If you have not selected **Control LED display via USB (if sender supports)**, you will find the **Canvas settings** option in **Screen settings**. Click this option to access the pop-up window where you can set the start coordinates of the canvas.

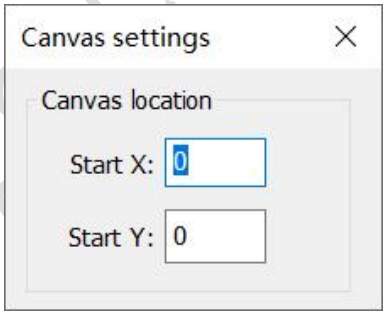


Fig.3-32 Canvas settings

3.2.2.6 Partition Size

- Regular screen calibration

Calibration Pro will recommend a proper partition size according to the size of the screen. You can click **Modify** to change the partition size if necessary.

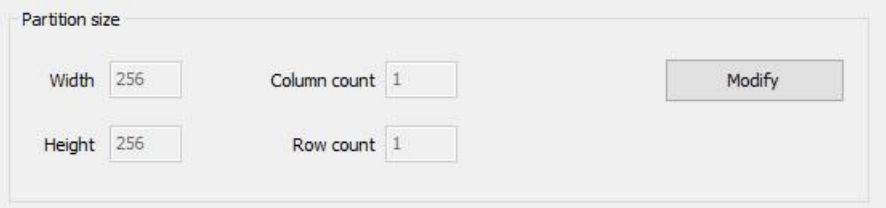


Fig.3-33 Partition size settings

Note:

1) For a regular screen by default, 16 LEDs will overlap between partitions, and for a COB screen, 256 LEDs will overlap between partitions by default.

2) Once you have finished modifying the partition size, the number of intervals will automatically be calculated. Below the **Number of intervals** field, you can view a reminder telling you the number of photos that will be captured in each partition. See Figure 3-34.

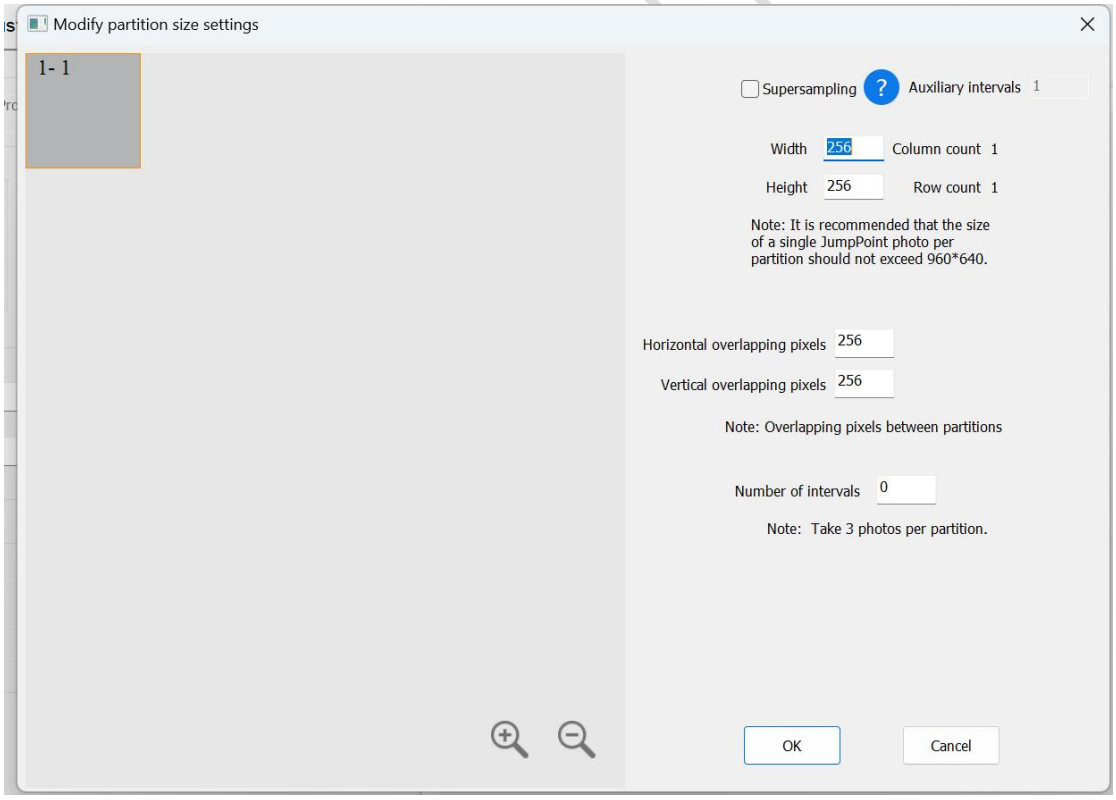


Fig.3-34 Modify the partition size

3) **Supersampling** can be enabled to reduce the impact of display coupling on calibration. The **Auxiliary intervals** is 1 by default and is modifiable.

4) If **LEDs-diamond-layout screen** has been selected before, an additional option **Photo capture settings** will be available in the **Modify partition size settings** window. You can select photos captured at intervals for metering based on your need.

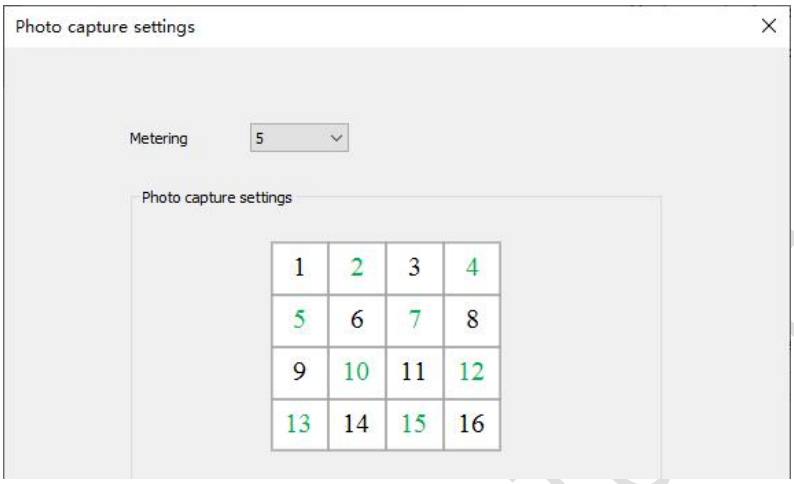


Fig.3-35 Photo capture settings for screen with diamond-layout LEDs

You can select a partition from the **Partition preview** window or from the right side of the **Project Settings** tab. The selected partition will then be displayed with a white frame on the LED screen.

- LED dome screen and sector-shaped screen calibration

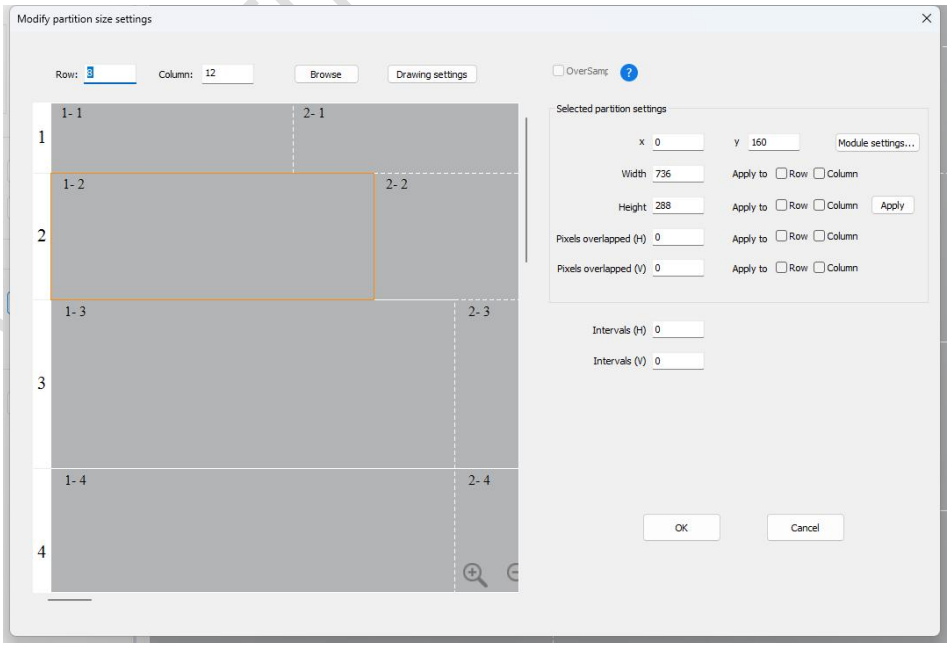


Fig.3-36 Modify partition size of LED dome screen and sector-shaped screen

1) In the window, you can see the recommended partition size based on the module size. You can modify the size and apply the new partitions to corresponding rows or columns. You can also modify the partition size by changing the row count and column count.

2) By default, there is no pixel overlapping both horizontally and vertically. You can modify the number according to your need and then apply the change to corresponding rows or columns.

3) The default horizontal and vertical intervals are recommended results from *Calibration Pro*, and you can modify them manually according to your need.

4) If you have selected **Same in rows** (i.e., the modules are the same horizontally) before, you should click **Drawing settings** and then enter the receiver row count in corresponding field. Next you can import the actual pixel drawing table.

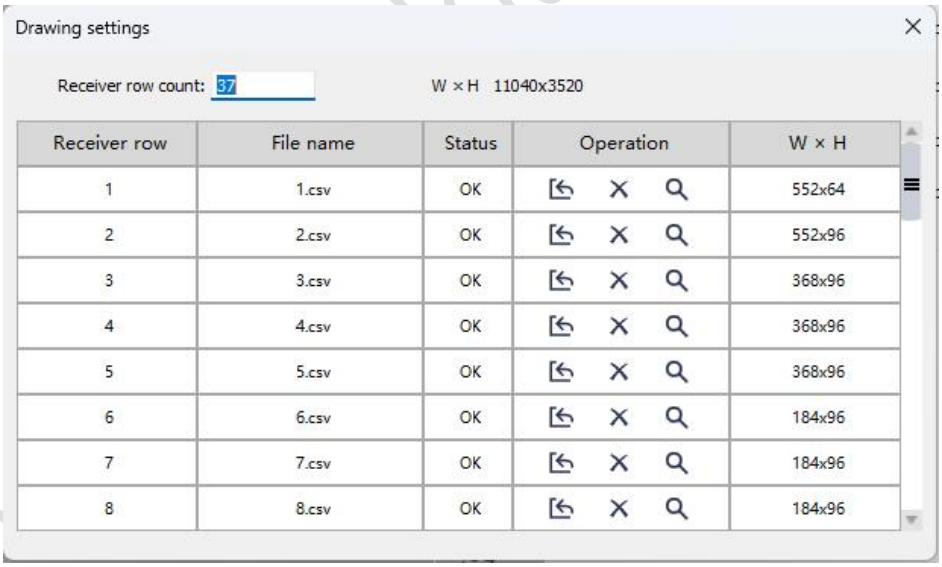


Fig.3-37 Drawing settings when modules are the same horizontally

5) If you have selected **Same in columns** (i.e., the modules are the same vertically) before, you should click **Drawing settings** and then enter the receiver column count in corresponding field. Next, you can import the actual pixel drawing table.

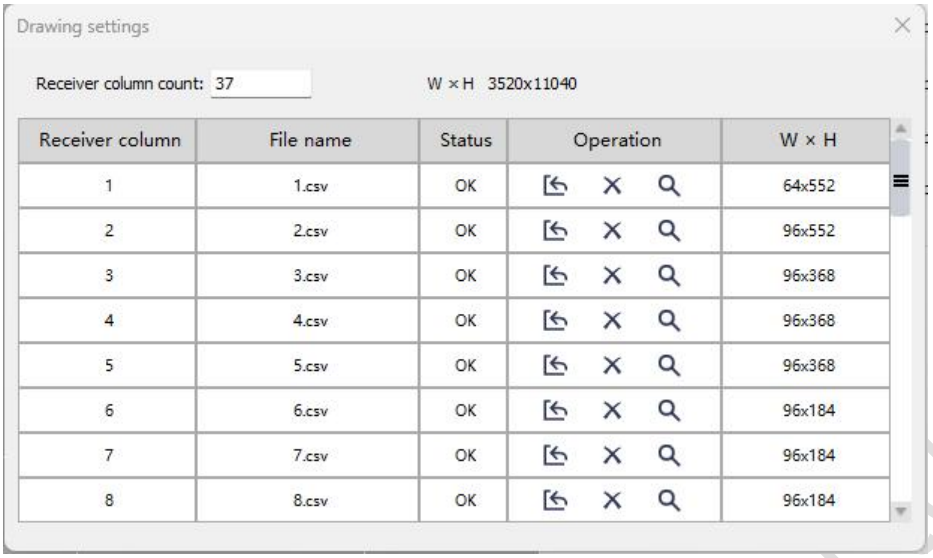


Fig.3-38 Drawing settings when modules are the same vertically

Note: The only supported unit of the drawing table is module.

6) If you have selected **Same in rows** before, you can click **Module settings** and then import the actual LEDs count in each row.

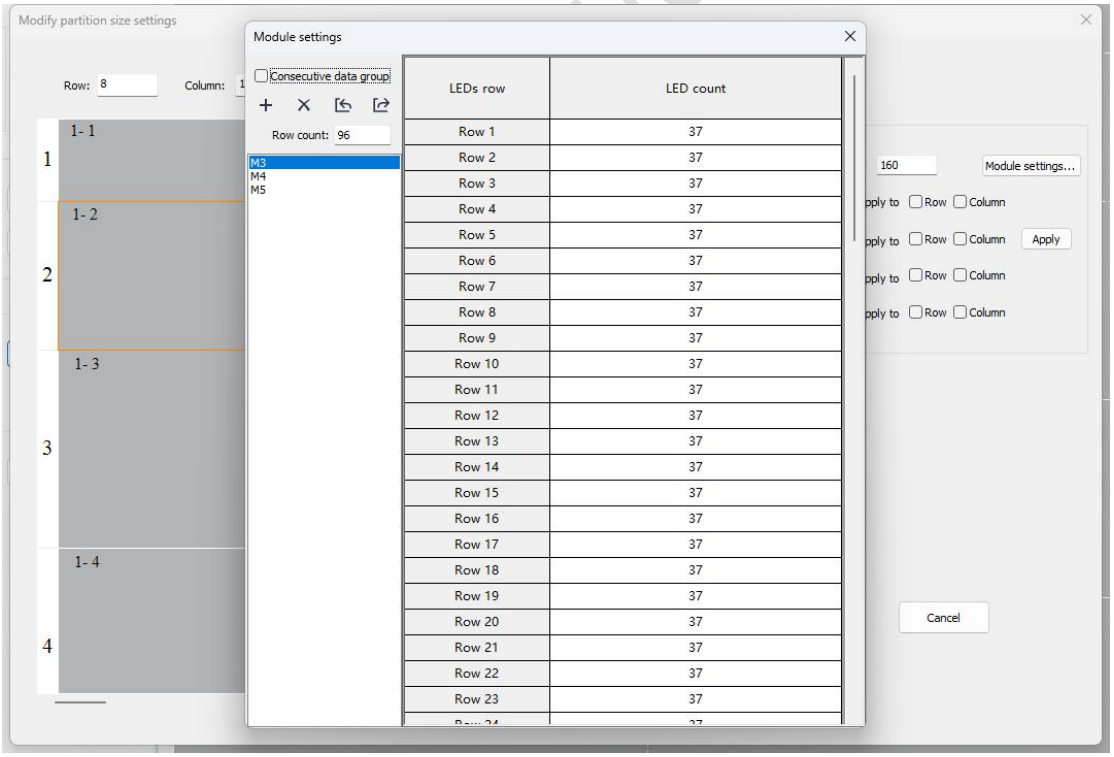


Fig.3-39 Module settings when modules are the same horizontally

7) If you have selected **Same in columns** before, you can click **Module settings** and then import the actual LEDs count in each column.

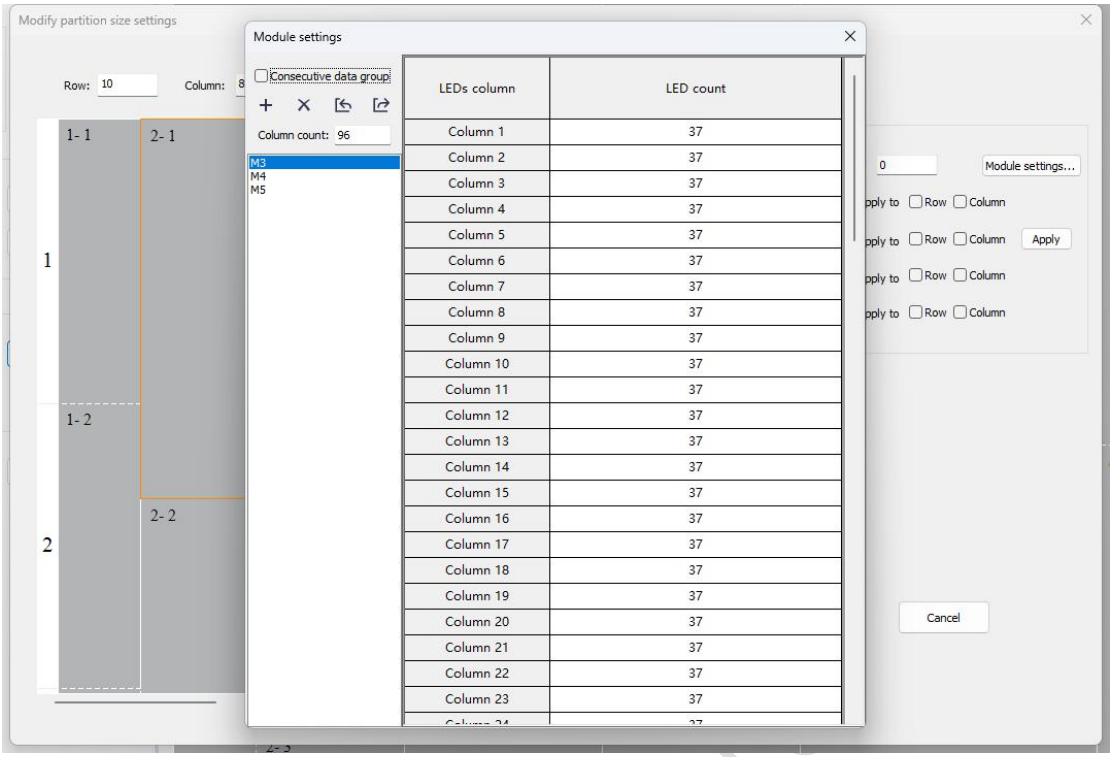


Fig.3-40 Module settings when modules are the same vertically

3.2.2.7 Gray Level

1) High Brightness calibration:

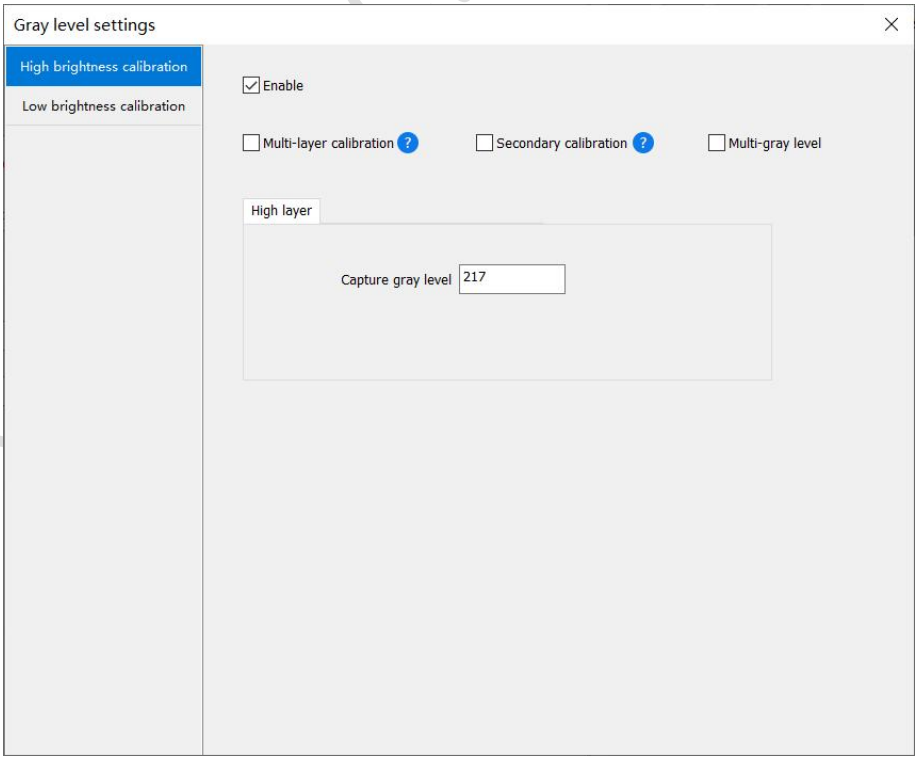


Fig.3-41 Single-layer single-gray level calibration settings

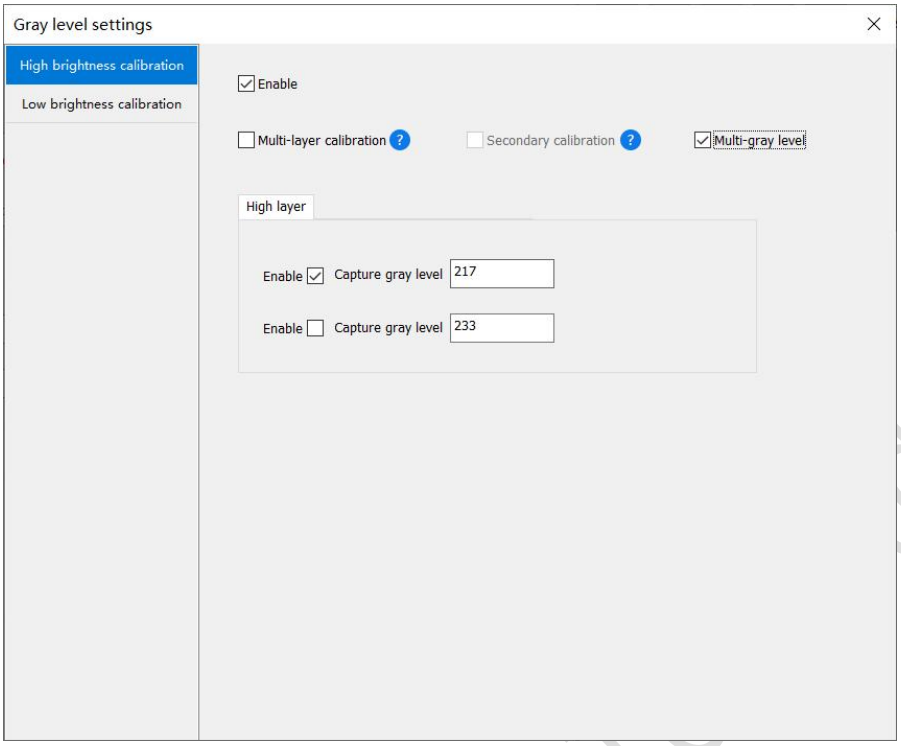


Fig.3-42 Single-layer multi-gray level calibration settings

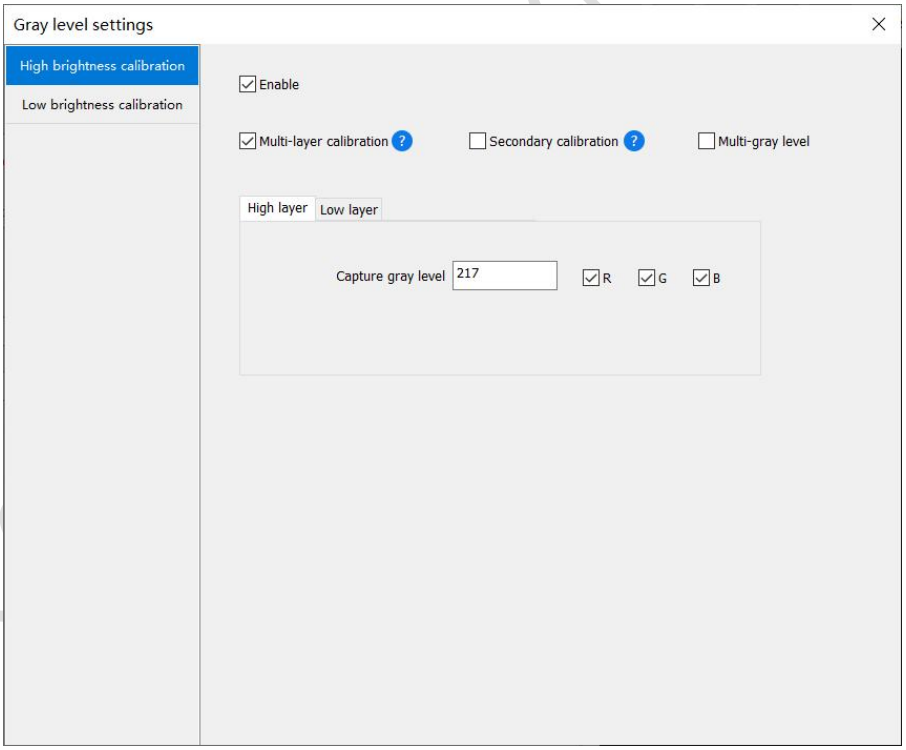


Fig.3-43 Multi-layer single-gray level calibration settings

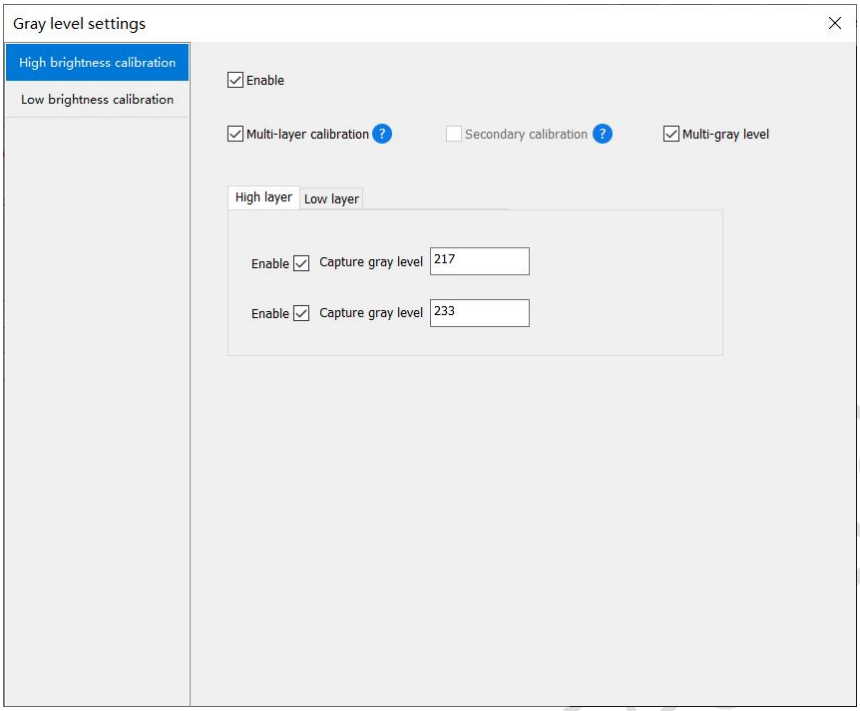


Fig.3-44 Multi-layer multi-gray level calibration settings

① **Secondary calibration**: Once you have selected this option, the currently selected gray level will be calibrated for the second time.

② **Gray level**: You can enter the gray level you want to display on the screen when the camera is capturing photos. If it is multi-gray level calibration, you must finish capturing the gray level before obtaining the corresponding parameters. You can select the checkbox in this field to decide whether to capture the corresponding gray level or not.

③ **Multi-layer calibration**: The **R**, **G**, and **B** are enabled by default and those in the higher layer are independent to those in the lower layer. If you deselect **R**, **G**, or **B**, the corresponding color will not be captured for calibration. Note that **R**, **G**, and **B** should all be selected for at least one layer.

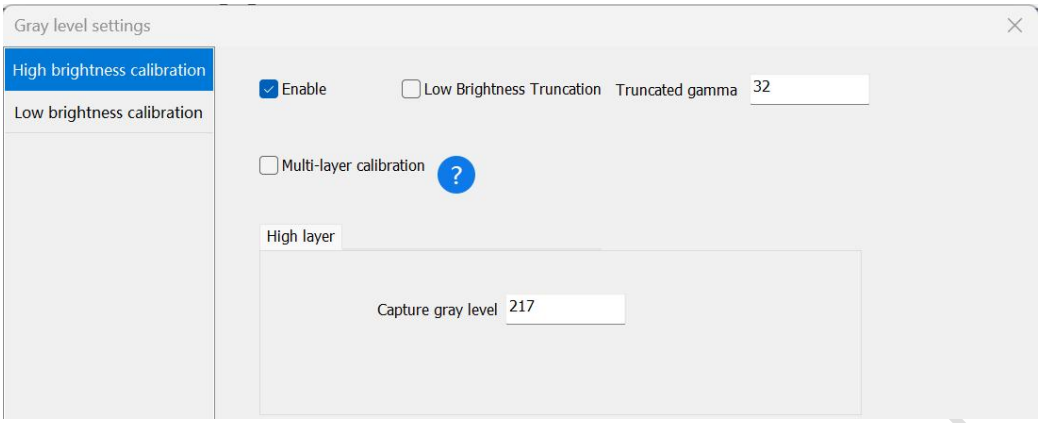


Fig.3-45 Low brightness truncation

④ **Low brightness truncation**: If supported by the receiver, this option will be available in the window together with the setting field for **Truncated gamma**.

2) Low brightness calibration:

- **Single level iterative:**
  - **Chip type**: Options include XM, SCL6bit, SCL16bit, ICN2260, ICN2270, LYD23221.
  - **Gamma capture**: Set the Gamma value (64 by default) that is needed to be captured.
  - **Initial value**: You can set the coefficients according to the color temperature and initial gray level you need.
  - **Capture times**: You can set the times for iterative calibration. By default, it is 3 times.
  - **Step**: This should not exceed the set initial value.
  - **IC color block**: You can calibrate the IC color block separately in low brightness when this option is selected.

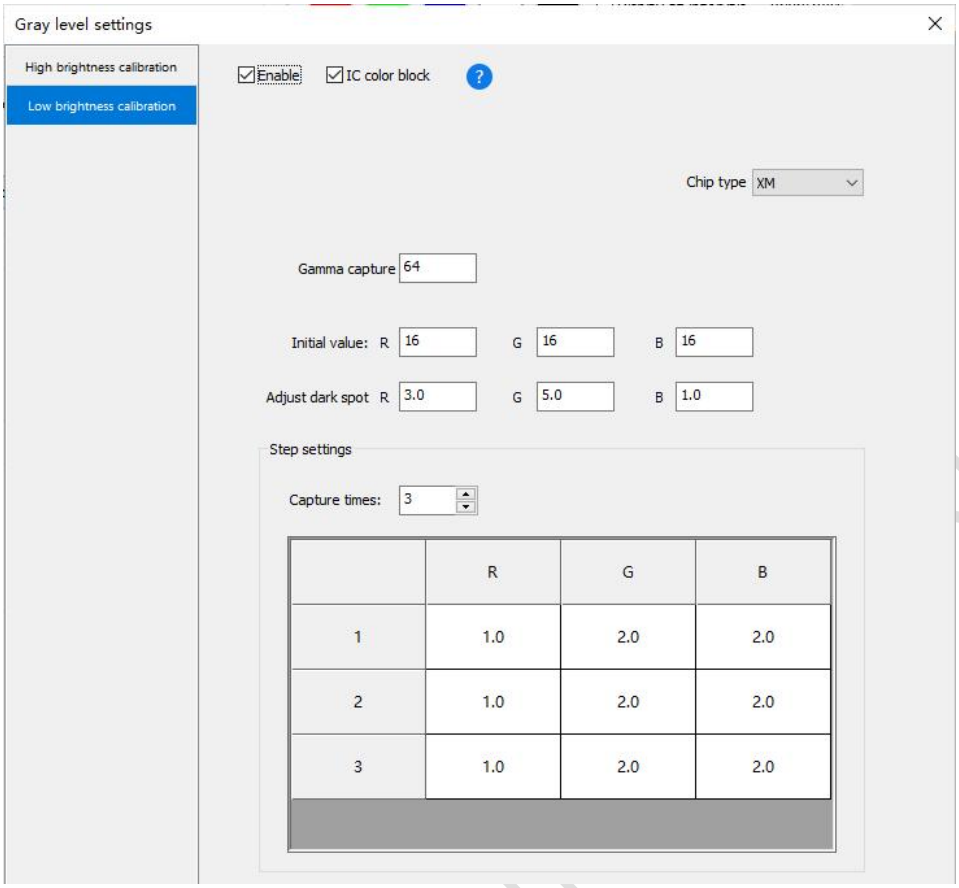


Fig.3-46 Single level iterative

3.2.3 Camera Adjustment

1) Adjust camera for framing: Position the camera so that it faces the center of the screen. Adjust the camera's height to align it with the target screen area. If the screen is positioned too high or too low, it is recommended to adjust the camera's height to align it with the user's view.

2) Select the central partition of the screen as the area for adjusting camera. Adjust the camera's capturing distance so that the shooting area aligns with and fills the camera frame. (Make sure the shooting view is between the red and white frames.) See Figure 3-47.

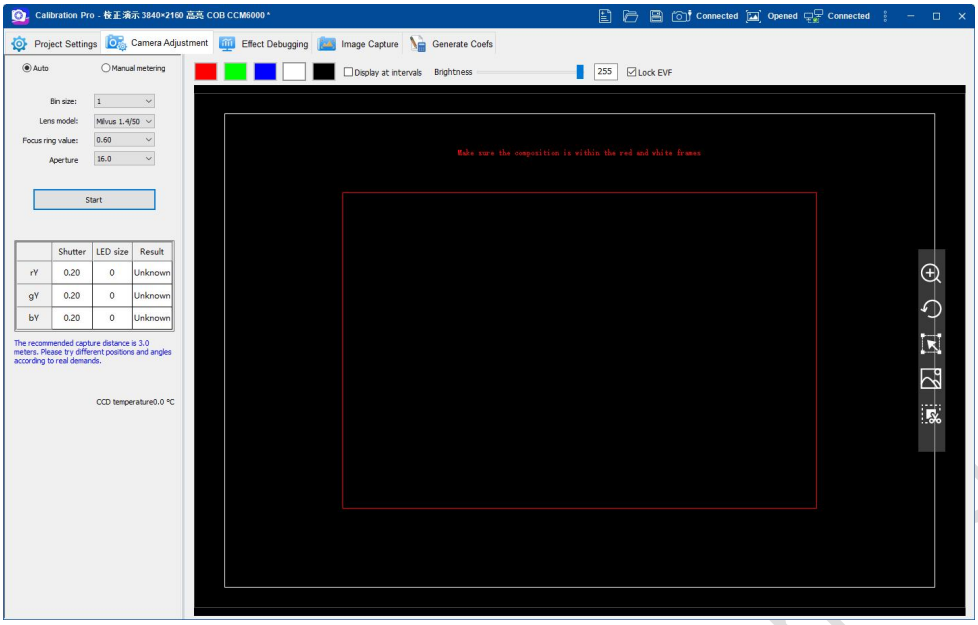


Fig.3-47 Adjust camera for framing

3) Select one color from **R**, **G**, and **B**, and then select **Display at intervals** and **Lock EVF**. Then, adjust the focus ring on the lens to ensure a clear focus for framing. Next, zoom in on the image in the camera frame using the tool of the camera or the mouse wheel to get a view on the LEDs. You can adjust the focus of the lens appropriately for a clear view. The assistance tools for framing can be found on the right side of the camera frame. From top to bottom, the tools allow zooming in on the image around the cursor, resuming full view (1:1), zooming in on a selected part, and viewing photos.

A clear focus ensures that the lamp beads in the image are separated from each other, and the brightness of each individual lamp bead gradually darkens from the center to the periphery. See Figure 3-48.

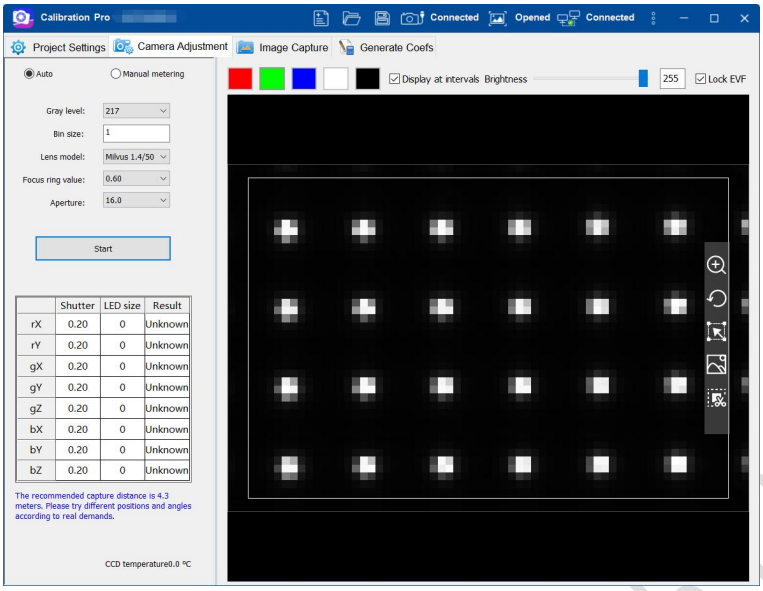


Fig.3-48 Lamp beads in the image

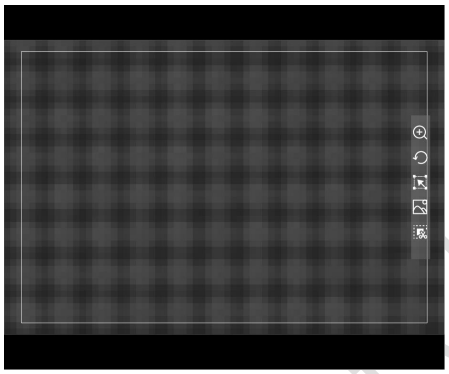


Fig.3-49 Lamp beads not separated

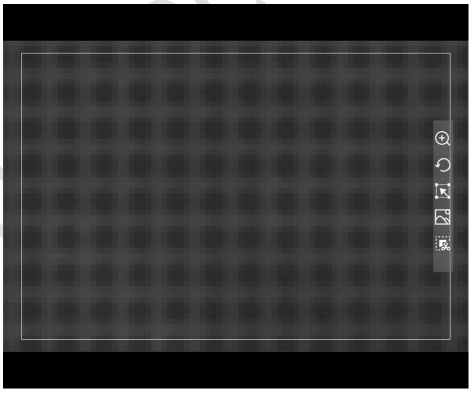


Fig.3-50 Brightness distribution error

4) Metering component: Metering component can be different depending on the calibration mode you select. If you have selected **Seam correction (only)**, you only need to conduct metering for Green; If you have selected **Brightness** (including **Receiver low brightness compensation** and **Chip low brightness**), you need to conduct metering for Red, Green, and Blue; If you have selected **Chroma**, you need to conduct metering for 8 color components, namely, rX, rY, gX, gY, gZ, bX, bY, and bZ.

	Shutter	LED size	Result
rY	0.20		Unknown
gY	0.20	0	Unknown
bY	0.20		Unknown

Fig.3-51 Metering components for **Seam correction (only)** mode

	Shutter	LED size	Result
rY	0.20	0	Unknown
gY	0.20	0	Unknown
bY	0.20	0	Unknown

Fig.3-52 Metering components for **Brightness** (calibration) mode

	Shutter	LED size	Result
rX	0.20	0	Unknown
rY	0.20	0	Unknown
gX	0.20	0	Unknown
gY	0.20	0	Unknown
gZ	0.20	0	Unknown
bX	0.20	0	Unknown
bY	0.20	0	Unknown
bZ	0.20	0	Unknown

Fig.3-53 Metering components for **Chroma** (calibration) mode

5) Auto metering: Select the aperture and the current focus ring value, and then click **Start**. *Calibration Pro* will automatically adjust the shutter time for normal metering. Once the shutter time has been adjusted appropriately, you will be prompted "Succeeded. Switch to "**Image Capture**" for shoot. "

6) Manual metering: Select **Manual metering** in the **Camera Adjustment** tab. Then, select the aperture and the current focus ring value. Next, adjust the shutter time manually and then click **Detect**. If you are prompted "Too dark" or "Too bright", you can increase or decrease the shutter time respectively and then click **Detect**. You can repeat this step until you get a normal results.

7) Multi-layer calibration: You need to conduct metering for each layer individually.

8) Secondary calibration: Metering is required for both calibrations. After you have finished the first-time calibration, you should enable calibration again and conduct metering for the second-time calibration.

3.2.4 Effect Debugging

If the project is for chip low brightness calibration and you have selected **Single level iterative**, you can perform **Effect Debugging** for adjusting the step. In this tab, you can click **Start auto-adjustment**, and then *Calibration Pro* will automatically adjust the step to an appropriate value. See Figure 3-54.

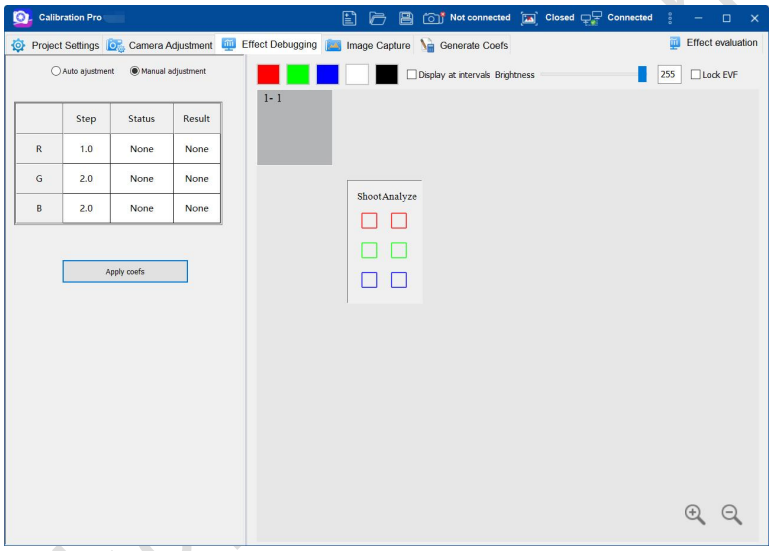


Fig.3-54 Auto step adjustment

You can also manually adjust the step if you find the auto adjustment effect not as expected. You can enter step values for R, G, and B respectively, and then click **Apply coefs**. The larger the step value, the greater the adjustment to the initial value will be.

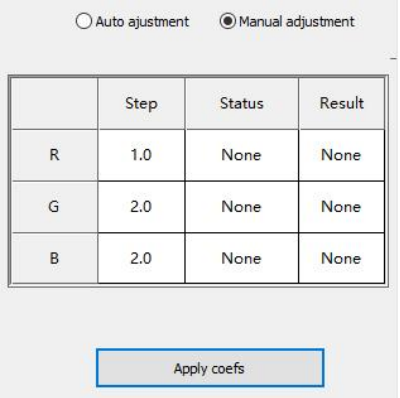


Fig.3-55 Manual adjustment

3.2.5 Image Capture

3.2.5.1 Capture Manually

Once you have finished setting the **Camera Adjustment** and **Effect Debugging**, you can click **Image Capture** to access corresponding tab. In the tab, select a gray level and then select the shooting area. Align the camera with the target shooting area and then click **Shoot**. *Calibration Pro* will automatically control the camera to capture images of the target gray level. You can place the mouse on the shooting area to view the shooting and analyzing progress. See Figure 3-56.

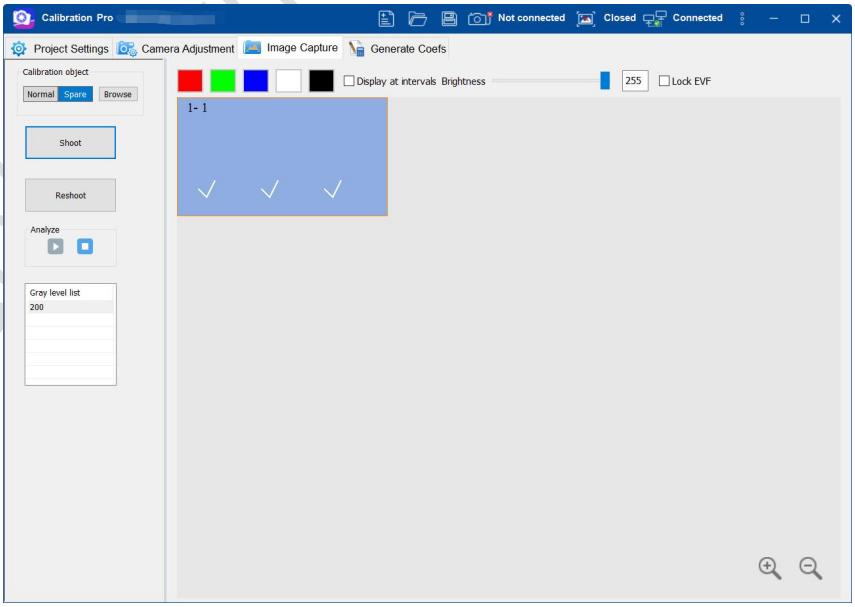


Fig.3-56 Image capture (**Delete photo** is selected by default)

When all components of one color have been captured, the capture area will show a rectangle in the corresponding color. Once the analysis of the components is completed, a check mark will appear below the corresponding color. Once all colors have been captured, the background color of the area will change to light blue (see Figure 3-57). When the analysis of all colors is completed, the background color will change to dark blue (see Figure 3-58).

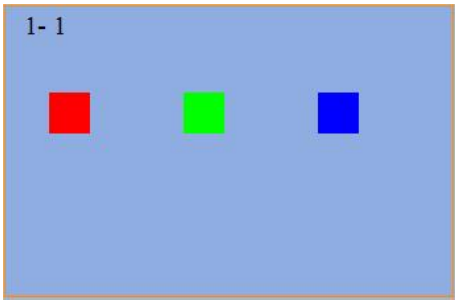


Fig.3-57 Shooting complete

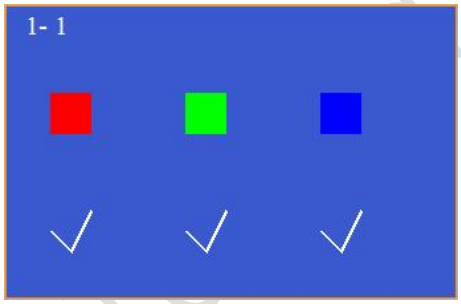


Fig.3-58 Shooting and analysis complete

Virtual pixel calibration: For brightness calibration, the virtual pixel will be added after every RGB captured (color component gvY will be added in the case of 4 LEDs virtual Green). For chroma calibration, the virtual pixel will be added after every RGB captured (color components gvX, gvY, and gvZ will be added in the case of 4 LEDs virtual Green).

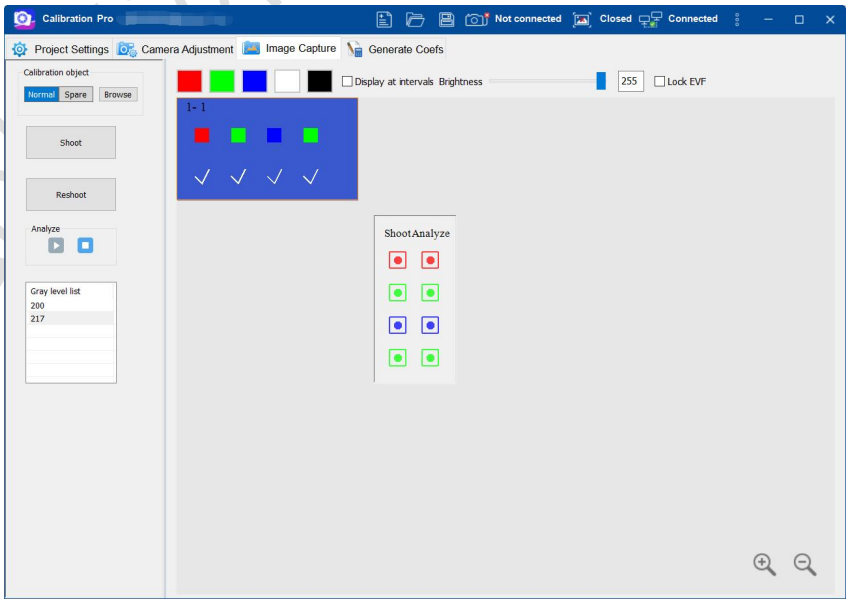


Fig.3-59 Shooting and analyzing complete

Crop: Select **Auto crop** in the **Project Settings** tab to let *Calibration Pro* automatically select partition before shooting each partition of the full screen. Right-clicking on the selected partition can delete it. You can also click the icon for crop on the right side to freely select area within the camera frame.

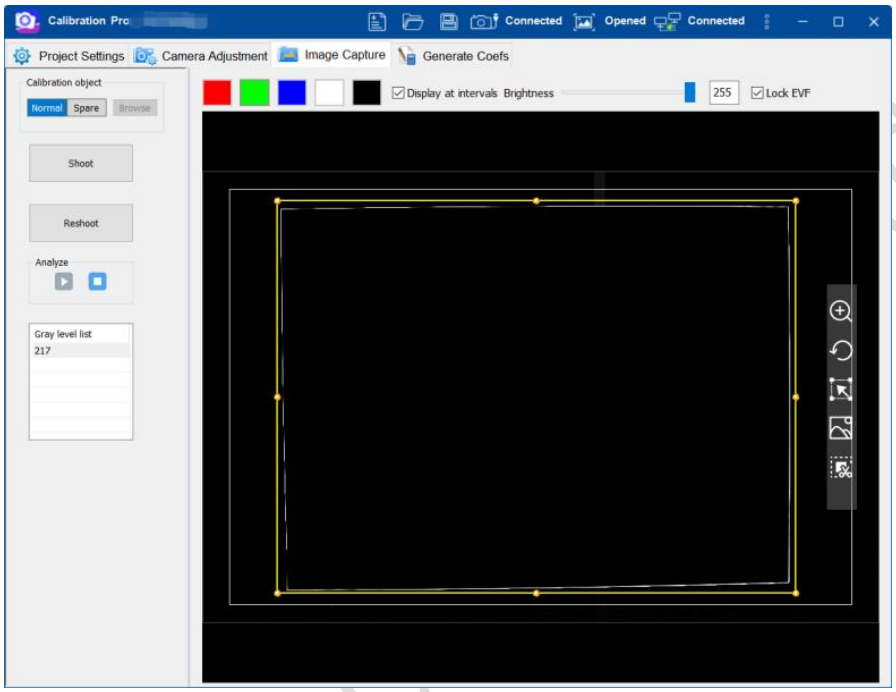


Fig.3-60 Shooting and analyzing complete

3.2.5.2 Automatic Calibration-Secondary Calibration

When **Secondary calibration** is selected, and **Analyze** is enabled (the software will analyze the image captured automatically), once you click **Shoot** after selecting -1 gray level in the **Gray level list**, a window for secondary calibration will pop up and perform secondary calibration automatically.

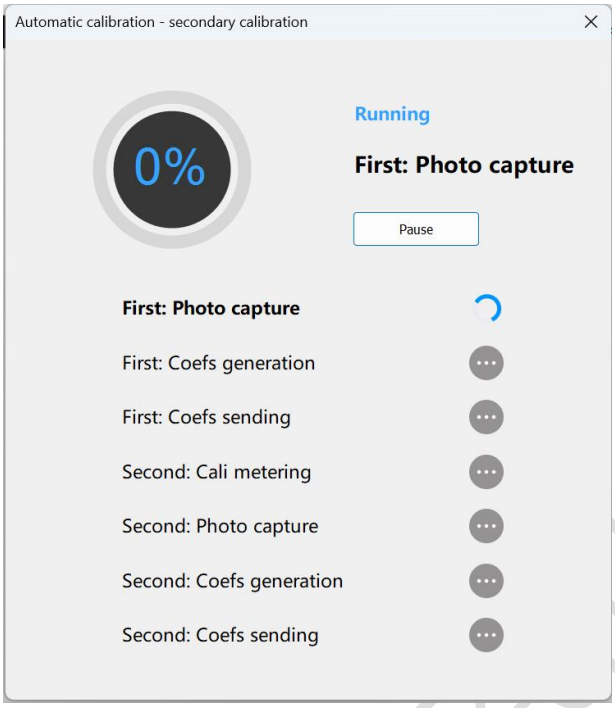


Fig.3-61 Automatic calibration -secondary calibration

3.2.6 Generate Coefs

3.2.6.1 Brightness After Calibration

Once the shooting and analyzing have been completed, you can access the interface for generating coefficients. Next, you can click **Generate luminance map** to view the luminance map of the current gray level. The brightness loss will also be automatically calculated and displayed.

- Chroma calibration mode: The brightness of Red, Green, and Blue will share the same brightness loss after the calibration.

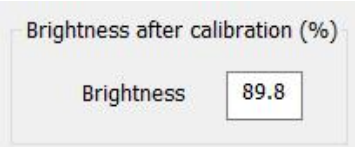


Fig.3-62 Chroma calibration

- Brightness calibration / Seam correction (only): The brightness loss of Red, Green, and Blue can be set individually.

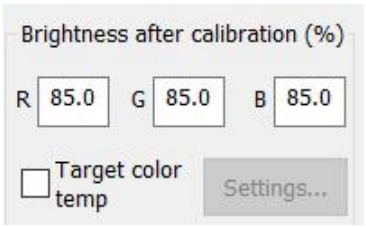


Fig.3-63 Brightness calibration

3.2.6.2 Settings

- In brightness calibration mode, you can select a target color for settings. See Figure 3-64.

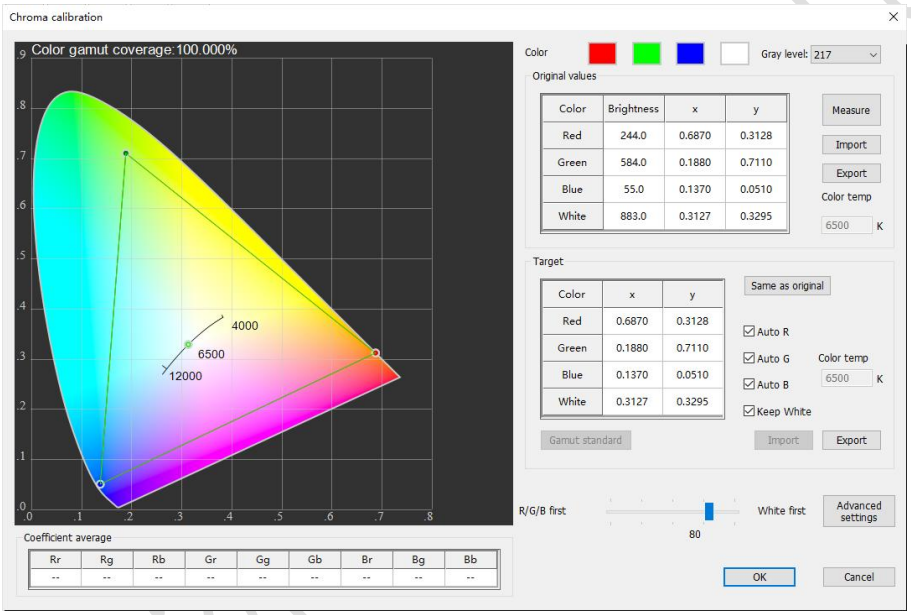


Fig.3-64 Target color temperature settings in brightness calibration mode

- **Color:** Click on a colored box to let the screen display the corresponding color.
- **Original values**: You can measure the original values by clicking **Measure** after connecting to the color meter. Besides, you can also import the existing brightness value and coordinates, or double-click the value to modify (the original values of all gray levels can be set as needed; you can also set the values for the higher gray level and let the software automatically calculate the values for the lower gray level). *Calibration Pro* will calculate the white point's color temperature based on the

original values. You can export the original values by clicking **Export**. If you don’ t need to adjust the target temperature, you can simply skip this step.

- **Target**: You can adjust the coordinates of the target white point in this sheet. Click **Import** to import the existing target values. Clicking **Export** allows for saving the new target values. You can also click **Set as D65** to set the color temperature to the standard 6500K. In addition, you can double-click the brightness, x, and y of White in the sheet, and then enter the new values.
- **Coefficient average**: Shows the average value of the color components generated after the latest calibration.

3.2.6.3 Color Gamut Settings

Color gamut settings is only available in **Chroma calibration** mode. The settings allows for adjusting target color gamut and color temperature.

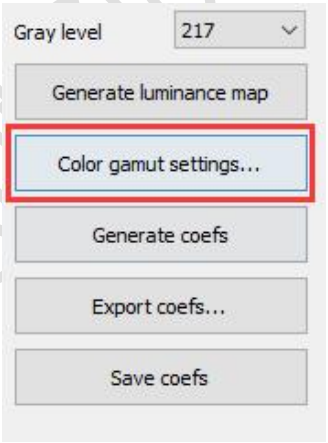


Fig.3-65 The option **Color gamut settings**

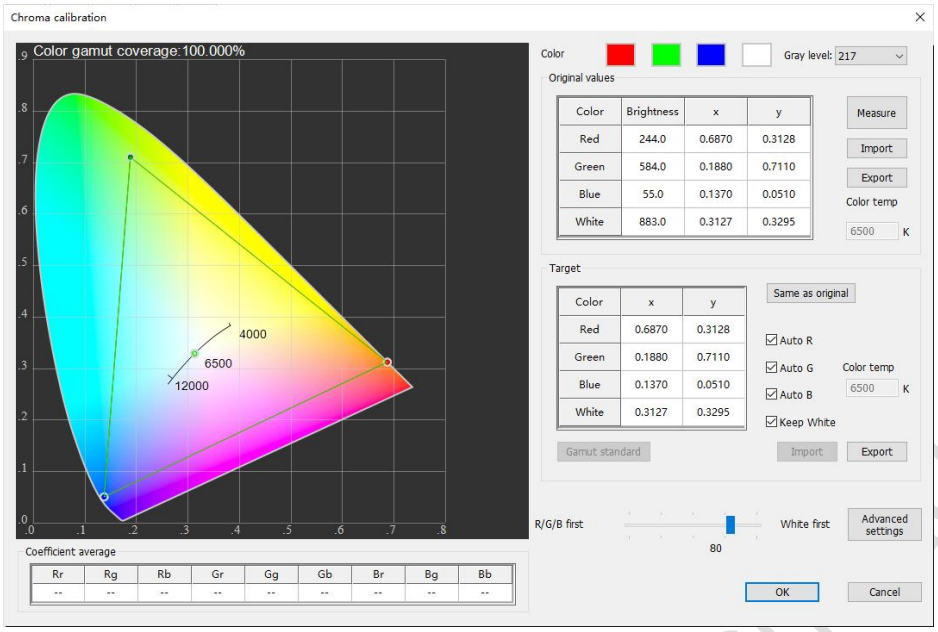


Fig.3-66 Color gamut settings interface

- **Color**: Click on a colored box to let the screen display the corresponding color.
- **Gray level**: Select the gray level for the settings.
- **Original values**: You can measure the original values by clicking **Measure** after connecting to the color meter. Besides, you can also import the original screen brightness and color gamut, or double-click the input boxes to modify the value. Clicking **Export** allows for exporting and saving the original values. If you don’ t need to modify the values, you can simply skip this step.
- **Target**: You can adjust the target color gamut and the color temperature coordinates in this sheet. By default, the values in this sheet are calculated automatically. You can deselect **Auto** and double-click the input boxes to enter the new values if necessary. Besides, you can also apply the standard color gamut settings (*Calibration Pro* provides parameters of sRGB, AdobeRGB, PAL, NTSC, Rec.601, Rec.709, Rec.2020, and DCI-P3). If you select **Same as original**, there will not be color gamut loss.

- Priority: You can move the slider toward **R/G/B first** or **White first** to adjust the effect of the calibration to the color Red/Green/Blue and the color white.
- **Advanced settings**: In **Advanced settings**, you can adjust the **Color block intensity** (only available when you have selected **COB**) and the **Compensation intensity**.

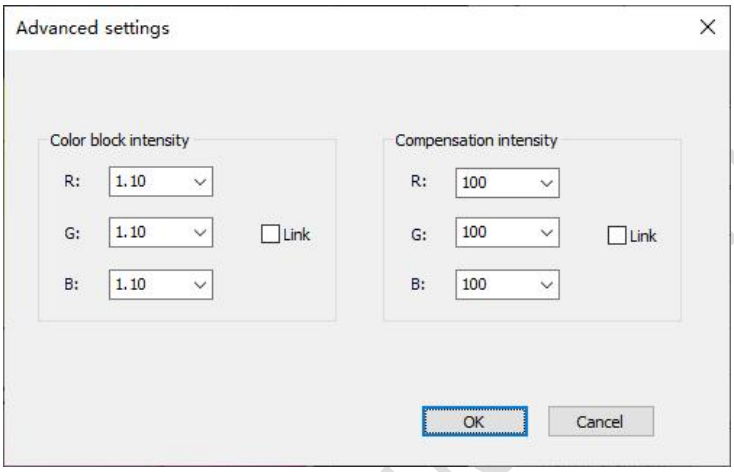


Fig.3-67 Advanced settings

- **Color spot reduction**: This option is available during chroma calibration for regular screen. You can select this option to optimize the color spot issue after the calibration.
- **Coefficient average**: This sheet shows the average value of each color component’ s coefficients generated in the last calibration.

3.2.6.4 Sending and Exporting Coefficients

1) Generate luminance map

You can click **Generate luminance map** and then control the screen color and brightness on the control bar. In addition, you can also select **Zoom in**, **Zoom out**, or **1:1** to control the display of the selected gray level of the luminance map. If you want to view the distribution of the shooting area on the screen, you can select the **Show partition line** checkbox.

Fig.3-68 Display control bar

- In the chroma calibration mode, all of the color components will appear on the upper left corner of the luminance map. You can select one component to switch to its luminance map. When the screen resolution exceeds 8K (7680×3840), the color components will not be shown and you can only switch the luminance map in the display control bar.

Fig.3-69 Luminance map of color components

Fig.3-70 Luminance map of color components of 4 LEDs (Green)

2) Generate coefs

You can obtain coefficients of all gray levels by clicking on **Generate coefs**. Once the coefficients have been successfully generated, you can click **Save coefs** to save the coefficients to all areas or a specified area. You can then switch on/off the calibration.

3) Export coefs

You can click **Export coefs** and then select **Export all**, **Export coefs by sender**, or **Export by partition** based on your need to save the calibration coefficients.

Note: In the **Chip low brightness calibration** mode, you should select the coefficients from the last iterative capture so as to obtain the final effect. You don’t need to generate luminance map or coefficients again in multi-gray level mode. The map and coefficients of all gray levels will be generated all at once, and you can directly select a gray level for the export. After modifying the color gamut settings or the target settings, you need to

generate the new luminance map to let the modification take effect.

For virtual pixel calibration, the coefficients from brightness calibration will be generated in .4wCoef format, and those from chroma calibration will be generated in .12wCoef format.

4) Spare calibration

Select **Calibration object** > **Switch** > **Spare**, and then click **OK**. You will then access the interface for spare calibration. Next, you can select the partition that you want to replace with a spare. And then you can click **Shoot** to start the spare calibration.

5) LED dome screen calibration

Select **Same in rows** in the project wizard. Then, click **Gradient settings** to set the gradient of the LED dome screen.

- **Reference pitch**: The reference pixel pitch auto calculation for the first and last row.
- **Start row pitch** / **End row pitch**: This value will be saved individually according to the actual pixel pitch between modules in the first / last row.
- **Auto**: Automatically calculate the pixel pitch of each row of the module based on the reference pixel pitch, and the pixel pitch of the start row and the end row.
- **Module row count**: This valued can be calculated based on the set module layout.
- **Confirm**: Click **Confirm** to save the new pixel pitch data and update the pixel pitch table located in the project file path accordingly.

- **Adjust pitch**: Select this checkbox to adjust the gradient of the row pixel pitch based on the pixel pitch value of the module on each row.

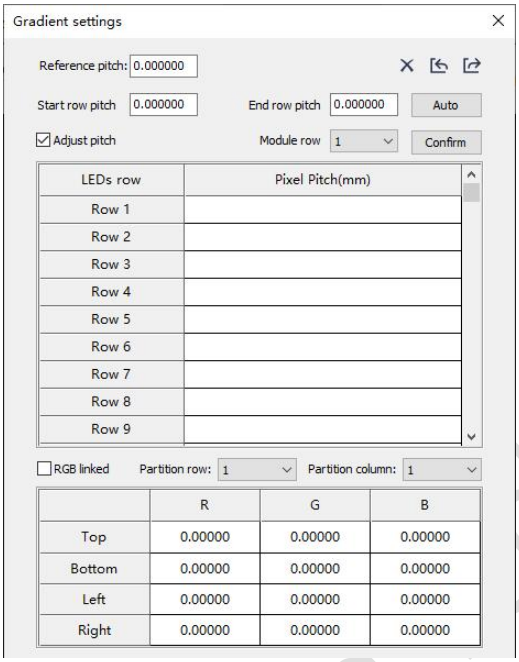


Fig.3-71 Gradient settings for the same module in rows

Select **Same in columns** in the project wizard. Then, click **Gradient settings** to set the gradient of the LED dome screen.

- **Reference pitch**: The reference pixel pitch auto calculation for the first and last column.
- **Start col pitch** / **End col pitch**: This value will be saved individually according to the actual pixel pitch between modules in the first / last column.
- **Auto**: Automatically calculate the pixel pitch of each column of the module based on the reference pixel pitch, and the pixel pitch of the start column and the end column.
- **Module column count**: This valued can be calculated based on the set module layout.
- **Confirm**: Click **Confirm** to save the new pixel pitch values and update the pixel pitch table located in the project file path accordingly.

- **Adjust pitch**: Select this checkbox to adjust the gradient of the column pixel pitch based on the pixel pitch value of the module on each column.

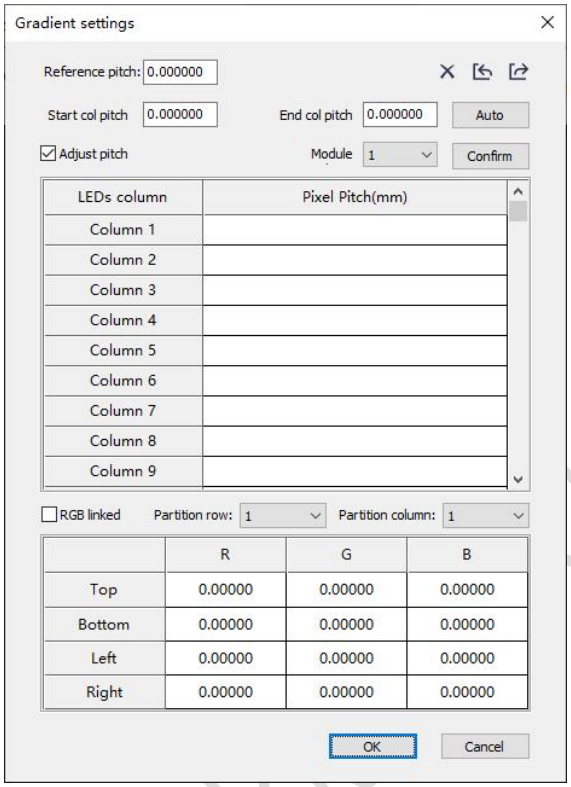


Fig.3-72 Gradient settings for the same module in columns

- **Partition row** / **Partition column**: Select the partition row and column, and then set the actual gradient of the borders of the corresponding row/column so as to adjust the gradient between partitions.

3.2.7 Effect Evaluation

In **Brightness calibration** mode, once a partition has finished calibration, the calibration parameters can be saved to receivers. With the calibration function enabled, you can capture the calibrated partition again to evaluate the calibration effect. You can access the evaluation window by clicking on the icon  at the right end of the toolbar.

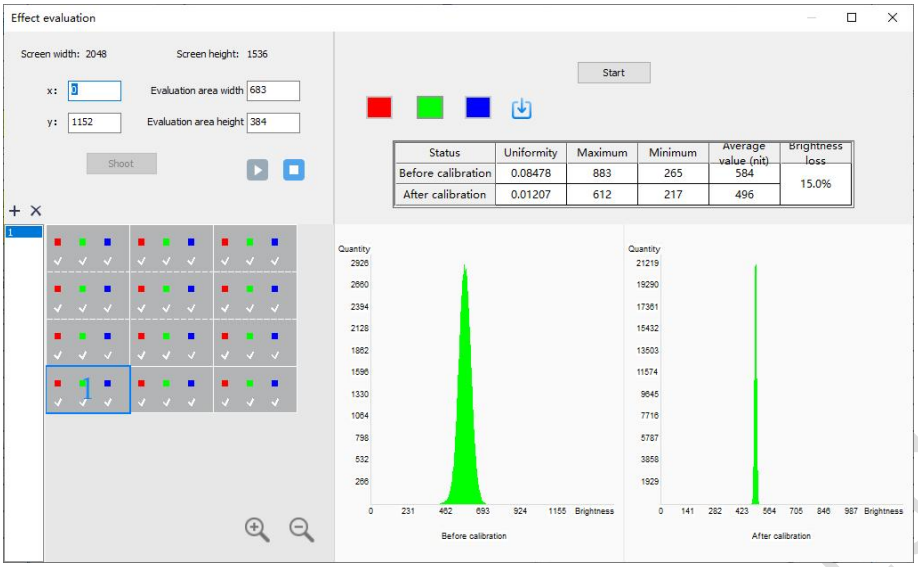


Fig.3-73 Effect evaluation window

1) The **Screen width** and **Screen height** represent the width and height of the full-screen of the current project.

2) The **x** and **y** indicate the initial coordinates of the selected partition. Modifying the coordinates can change the evaluated partition. Also, you can add partitions for evaluation by clicking on the + icon above the evaluated partition list. Each partition is seen as an individual evaluation area, which is marked by a number that corresponds to its number in the evaluation list.

3) Select one evaluated partition from the list, and then adjust the tripod head to make the camera face the lit part of the screen. Then, with the calibration function enabled, click **Shoot** to let *Calibration Pro* capture and analyze images of the evaluated partition. Next, click **Start** to begin the evaluation. The right side of the interface will display a statistical table that contains data before and after the calibration respectively. Below the table are 2 histograms representing the situation before and after the calibration.

4) The statistical table shows information about the evaluated partition before and after calibration, including **Uniformity**, **Maximum** (brightness), **Minimum** (brightness), **Average value (nit)**, and **Brightness loss**.

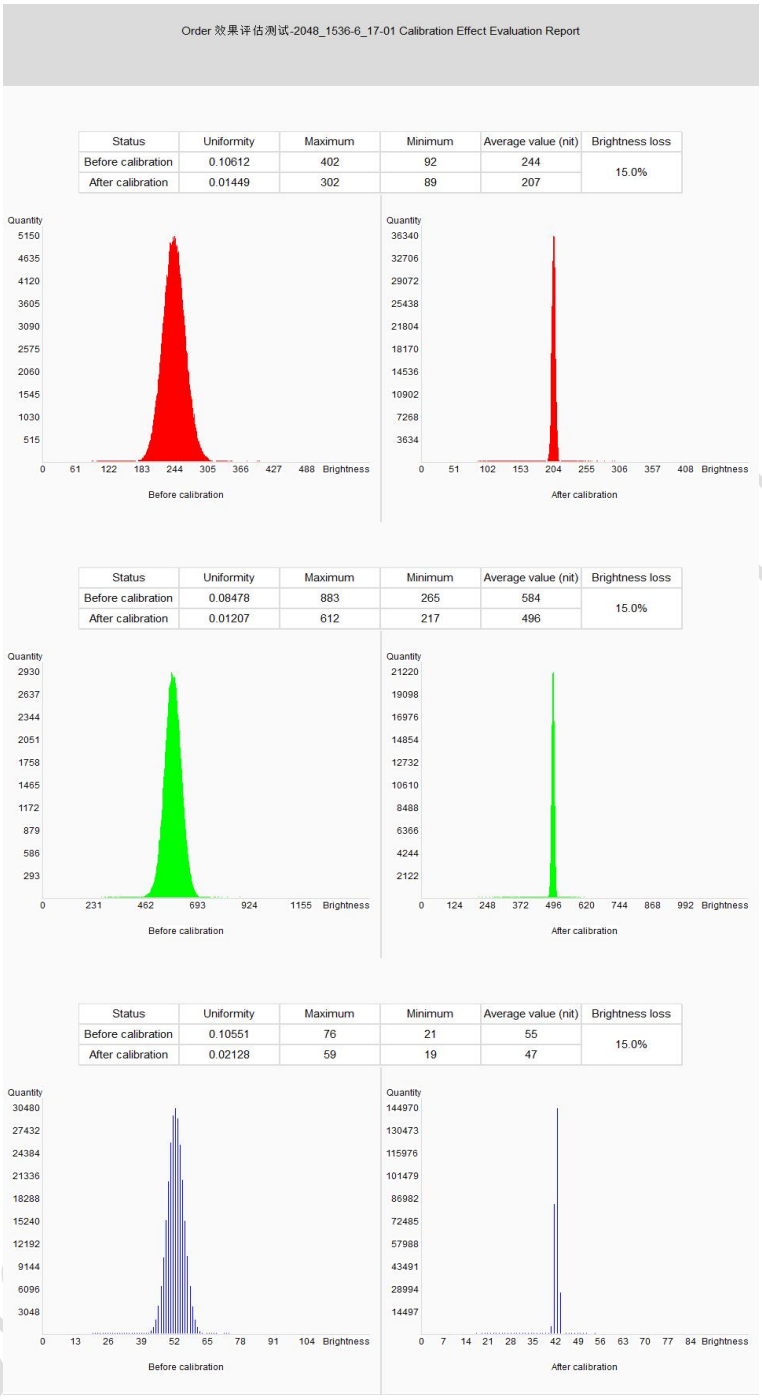


Fig.3-74 Effect evaluation report

5) You can view the statistical information and the layout of the LEDs (Red, Green, and Blue) by clicking on the icons , , and respectively. Then, you can click the icon to save the evaluation report to your PC.

3.3 Cabinet Calibration

3.3.1 New Cabinet Project

Step 1: Cabinet project wizard-1

In the start screen of *Calibration Pro*, click **New cabinet project** to access the **Cabinet project wizard-1** (see Figure 3-75). Then, select a way for control PC connection.

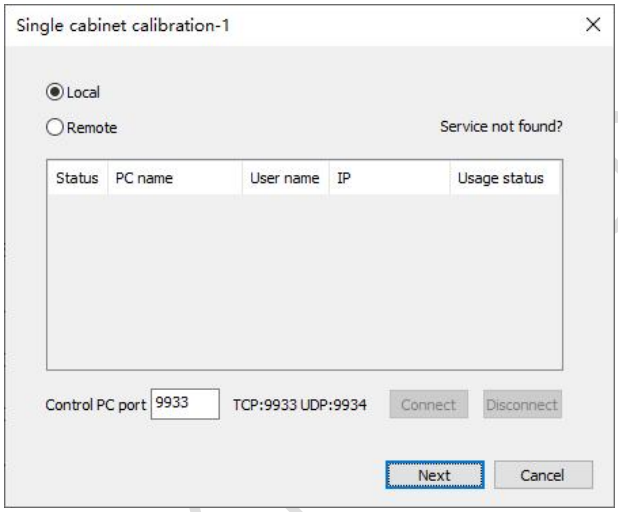


Fig.3-75 Select **Local**

Step 2: Cabinet project wizard-2

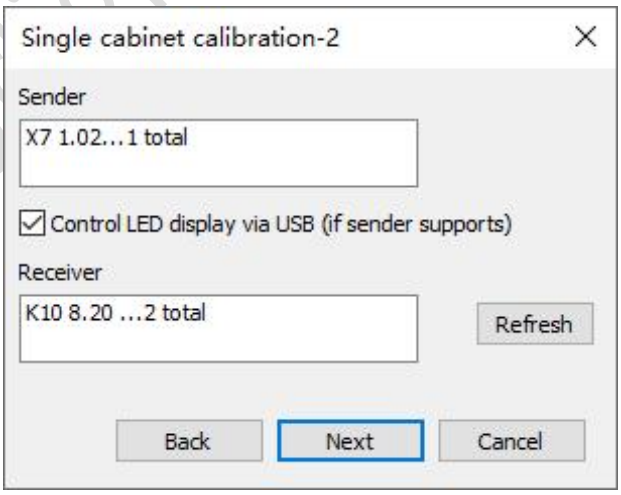


Fig.3-76 Cabinet project wizard-2

Note: You can refer to **Full-screen project wizard-2** for reference.

Step 3: Cabinet project wizard-3

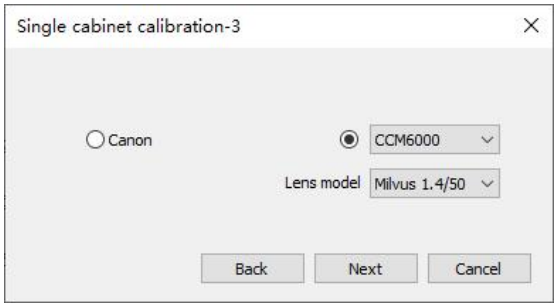


Fig.3-77 Cabinet project wizard-3

Note: You can refer to **Full-screen project wizard-3** for reference.

Step 4: Cabinet project wizard-4

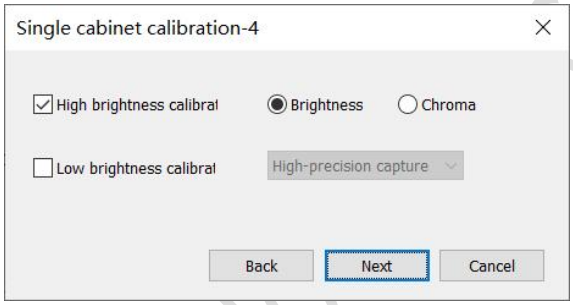


Fig.3-78 Cabinet project wizard-4

Note: You can refer to **Full-screen project wizard-4** for reference. **High brightness calibration** and **Low brightness calibration** can be selected and performed at the same time.

Step 5: Cabinet project wizard-5

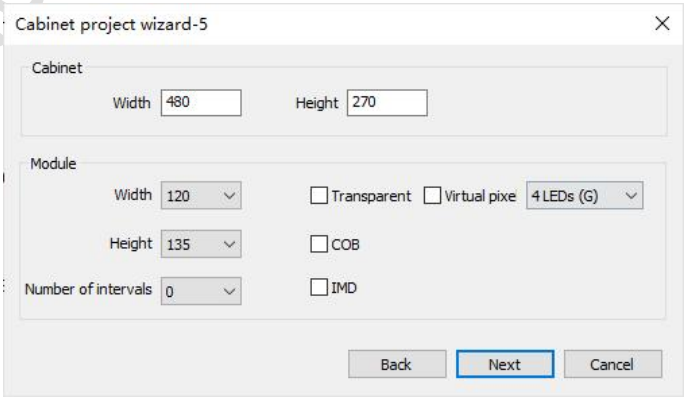


Fig.3-79 Cabinet project wizard-5

- **(Cabinet) Width/Height:** The resolution of the currently calibrated cabinet.
- **(Module) Width/Height:** The resolution of the currently calibrated module.
- **Number of intervals:** *Calibration Pro* will recommend a number once the cabinet width and height have been adjusted. You can also modify it manually.
- **Transparent:** This checkbox should be selected when the horizontal pixel pitch is different from the vertical one.
- **COB:** Select this checkbox when COB module is used for the currently calibrated screen.
- **IMD:** Select this checkbox when IMD module is used for the currently calibrated screen.
- **Virtual pixel**: Select this checkbox when the calibrated screen employs virtual pixel. Available options include: **4 LEDs (R)**, **4 LED (G)**, **4 LED (B)**, and **6 LEDs**.

Step 6: Cabinet project wizard-6

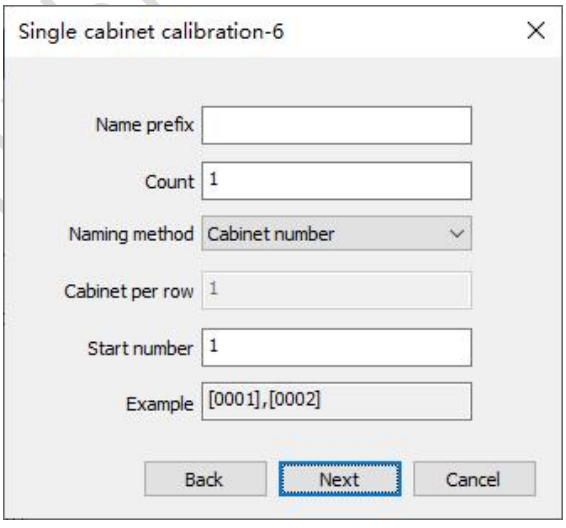


Fig.3-80 Cabinet project wizard-6

- **Prefix:** Enter the prefix for the name of the new cabinets.
- **Counts:** The number of cabinets that have been added to the cabinet list

automatically.

- **Naming method:** Available options include: **Cabinet number**, **Row-Column**, and **Column (ABC)-Row**.
- **Cabinet per row:** Enter the number of cabinets on each row. The number you enter in this field will automatically change the cabinet name.
- **Example**: This field shows the example of a cabinet name automatically based on the **Prefix**, **Naming method**, and **Cabinet per row** you set before.

Step 7: Cabinet project wizard-7

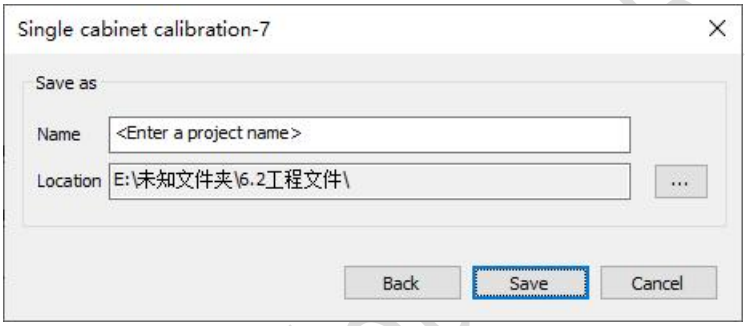


Fig.3-81 Cabinet project wizard-7

Note: You can refer to **Full-screen project wizard-7** for reference.

3.3.2 Project Settings

3.3.2.1 Sender Mode

In the **Project Settings** tab, *Calibration Pro* will automatically detect senders and receivers once the control PC has been connected, and the senders and receivers that have been detected will be shown in the tab. See Figure 3-82.

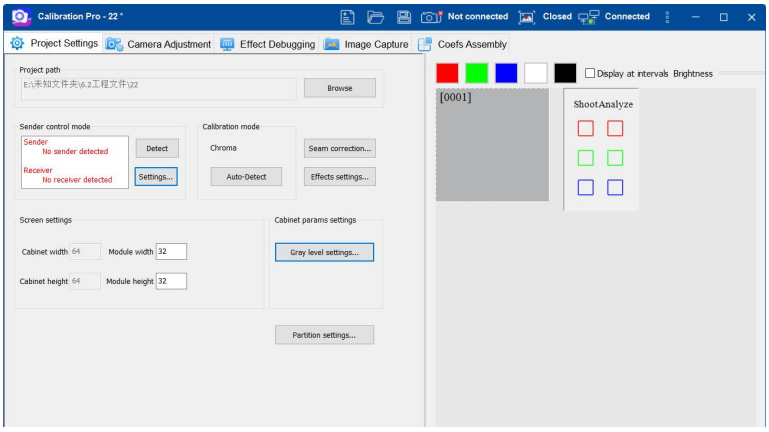


Fig.3-82 Main interface of cabinet project

- **Detect**: Click **Detect** to detect the currently connected senders and receivers, and then you will be able to view the model, version number, and amount of the senders and receivers detected.
- **Settings...:** Click **Settings...** to bring up a pop-up window where you can enable or disable the option **Control LED display via USB (if sender supports)**. See Figure 3-84.

Fig.3-83 Control LED display via USB (if sender supports)

3.3.2.2 Calibration Mode

Click **Switch** to choose a calibration mode. Available options include: **Brightness** and **Chroma**. See Figure 3-84.

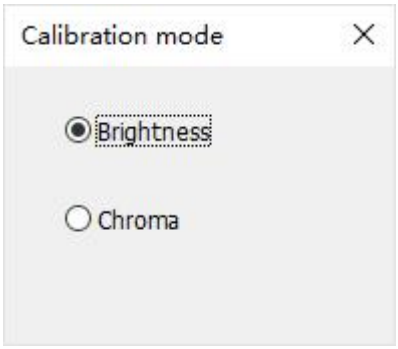


Fig.3-84 Available calibration modes

3.3.2.3 Seam Correction

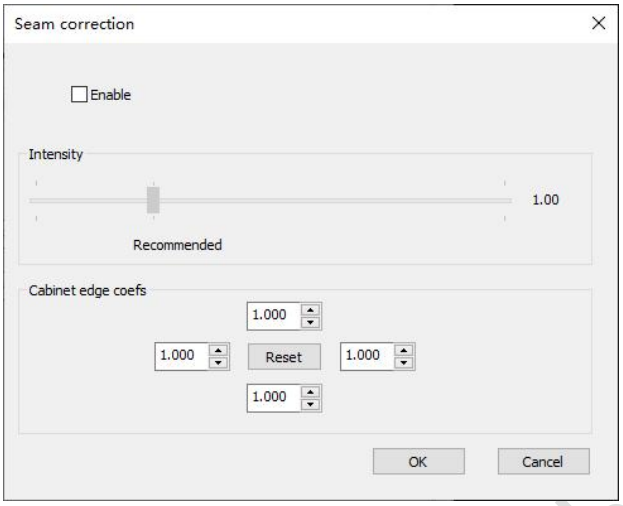


Fig.3-85 Seam Correction

- **Seam correction**: This function is enabled by default. You can disable it according to your need. See Figure 3-85.
- **Intensity**: This field indicates the intensity of brightness adjustment for LEDs at the edges of the cabinet. The default intensity is 1. If the dark (or bright) line turns to be too bright (or too dark) after seam correction, you can lower the intensity appropriately. However, if you find the line still relatively dark (or bright) after correction, you can then increase the intensity appropriately.

If you have selected **Seam correction (only)** before, you cannot perform the brightness/chroma calibration, and the seam correction function will be enabled by default. See Figure 3-86.

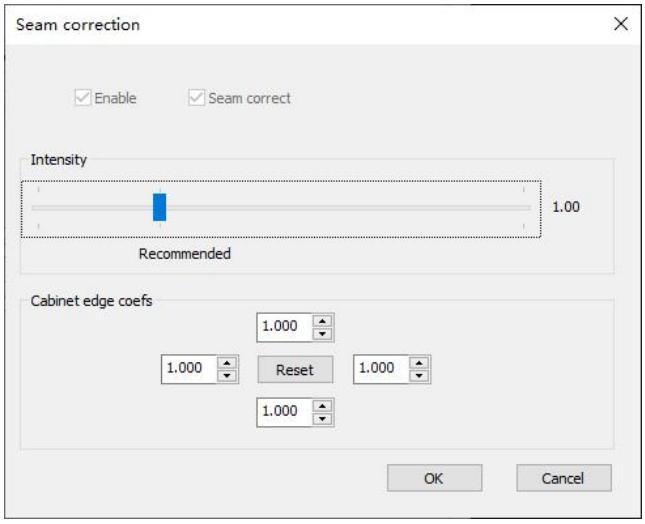


Fig.3-86 Seam correction (only) settings

- **Cabinet edge coefs**: You can fine tune the coefficients of the cabinet edge based on the existing calibration coefficients in this field. This operation can fix the dark and bright lines between cabinets.

3.3.2.4 Effect Settings

You can refer to **Section 3.2.2.4 Effect Settings** for reference.

3.3.2.5 Screen Settings

In this field, you can set the width and height of the current cabinets and modules.

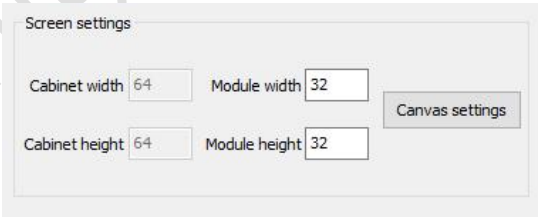


Fig.3-87 Screen settings

Canvas settings: If you have not selected **Control LED display via USB (if sender supports)**, you will find the **Canvas settings** option in **Screen settings**. Click this option to access the pop-up window where you can set the start coordinates of the canvas.

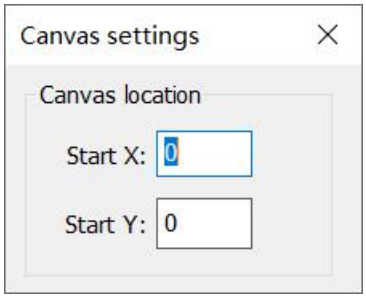


Fig.3-88 Canvas settings

3.3.2.6 Cabinet Parameters Settings

Connect to the sample cabinet that has saved receiver parameters and topology. Then, click **Read params** to save the parameters and topology from the sample cabinet. Once the parameters have been successfully read, you can select **Save params before shoot** so that the real-time parameters and topology will be automatically sent to the receivers before shooting photo for cabinet calibration. See Figure 3-89.

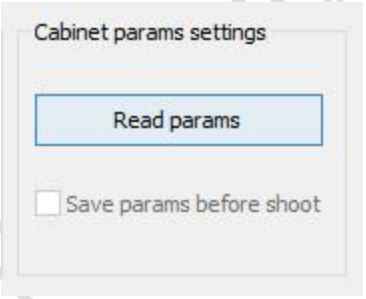


Fig.3-89 Cabinet parameters settings

If you have selected **High brightness calibration** and **Low brightness calibration**, you will find the option **Gray level settings** in the **Cabinet params settings** field.

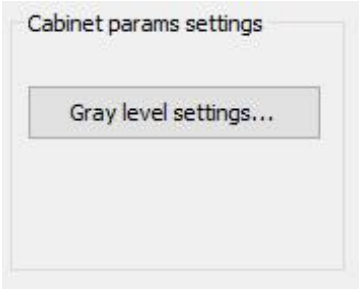


Fig.3-90 Parameter settings

3.3.2.7 Partition Settings

You can modify the intervals if necessary.

Supersampling allows for increasing the number of LEDs per capture (which means, you can halve the number of intervals for cabinet of the same size). However, it will also increase the analyzing duration.

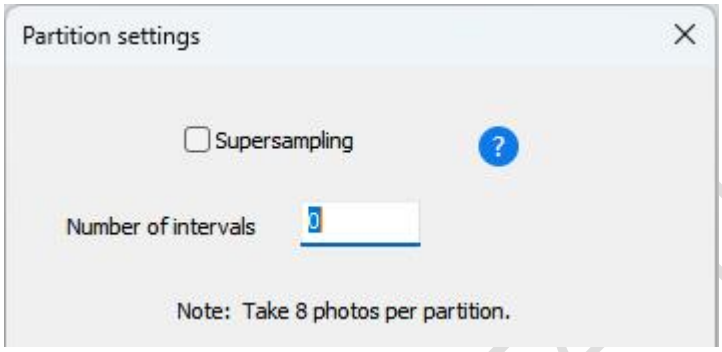


Fig.3-91 Partition settings

3.3.2.8 Gray level

1) High brightness calibration

In chroma calibration or high brightness calibration mode, the interface of **Gray level settings** is as shown in Figure 3-92 and Figure 3-93. You can select **Single-layer calibration** or **Multi-layer calibration**. The **R**, **G**, and **B** options are selected by default. If you unselect **R**, **G**, or **B**, the corresponding color will not be captured for calibration. Note that you should select all **R**, **G**, and **B** for at least one layer.

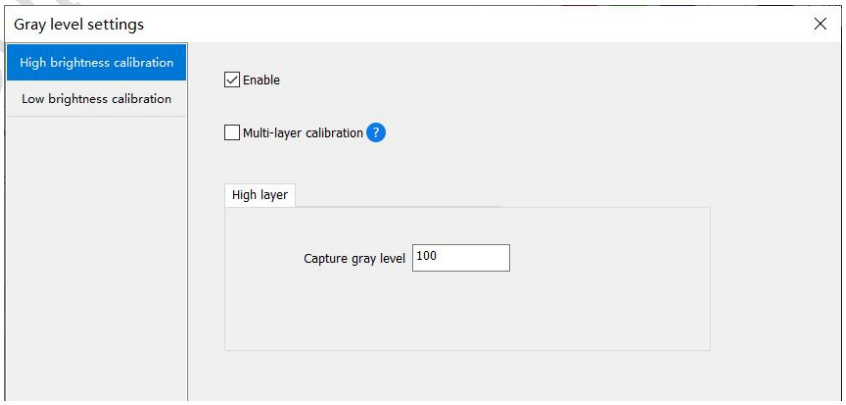


Fig.3-92 Single-layer calibration settings

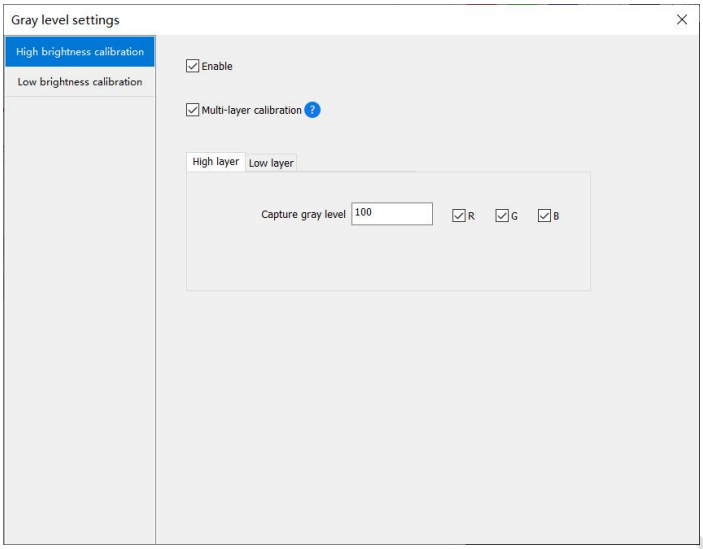


Fig.3-93 Multi-layer calibration settings

- **Low brightness truncation**: If supported by the receiver, this option will be available in the window together with the setting field for **Truncated gamma**.

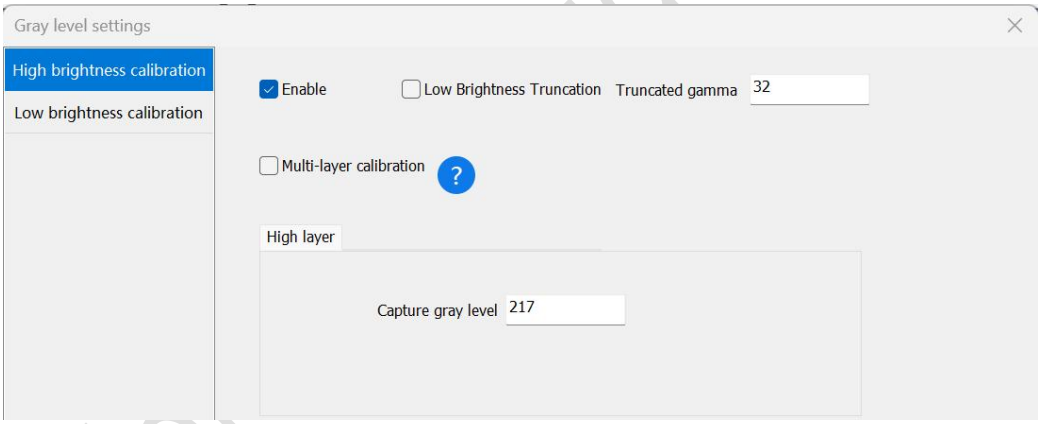


Fig.3-94 Low brightness truncation

2) Low brightness calibration

- **Single level iterative**

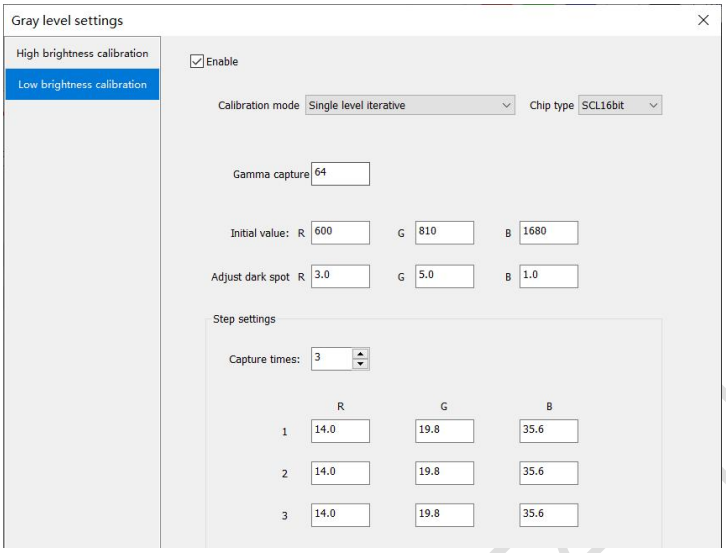


Fig.3-95 Single level iterative settings

- **Chip type**: Available options include: XM, SCL6bit, SCL16bit, ICN2260, ICN2270, and LYD23221.
- **Gamma capture**: Set the Gamma value (64 by default) that is needed to be captured.
- **Initial value**: You can set the initial calibration coefficients based on the required color temperature and initial gray level.
- **Capture times**: You can set the times for iterative calibration. By default, it is 3 times.
- **Step**: This should not exceed the set initial value.

3) Perform high brightness calibration and low brightness calibration together

- **Single level iterative and high brightness calibration**

Select the **Enable** checkbox respectively in **High brightness calibration** and **Low brightness calibration** tabs. Select **Single level iterative** as the

calibration mode and **XM** as the chip. You can find the field for **High/Low brightness calibration params**, and the options of **Load** and **Read** at top of the tabs.

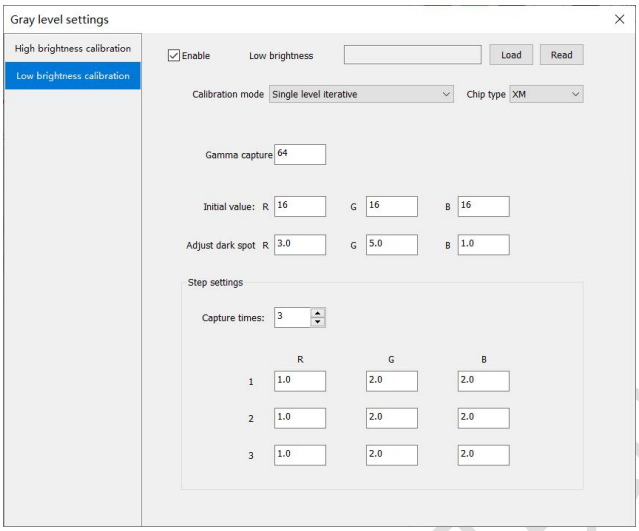


Fig.3-96 Single level iterative in high/low brightness calibration mode

- **IC color block**: You can calibrate the IC color block separately in low brightness when this option is selected.

3.3.3 Camera Adjustment

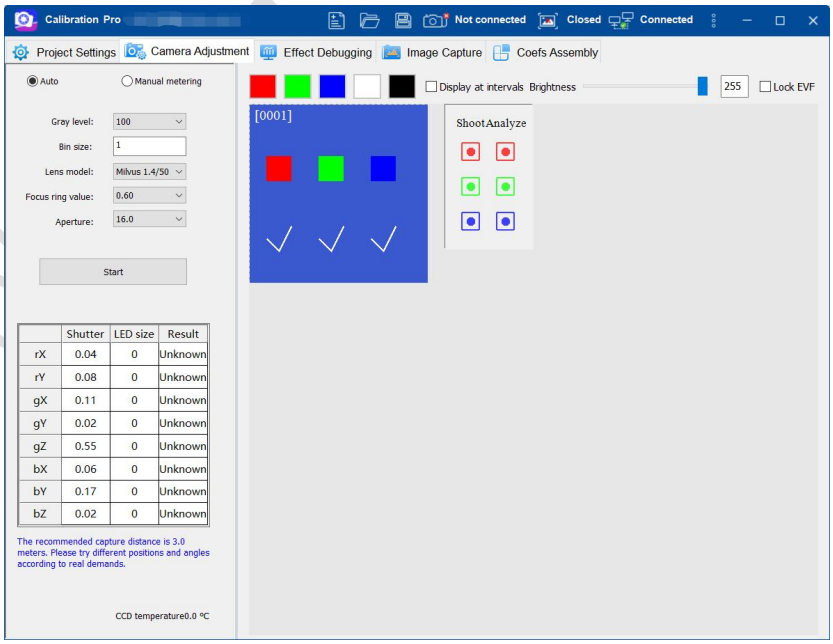


Fig.3-97 **Camera Adjustment** tab

Note: You can refer to **Section 3.2.3 Camera Adjustment** for reference.

- In the case when high and low brightness calibration are performed at a time, when the **XM** chip is selected for low brightness calibration, you should select **Auto** at top of the **Camera Adjustment** tab. Then, *Calibration Pro* will first send low brightness parameters before sending low brightness initial coefficients. Next, the software will automatically perform metering from low brightness gray level. After the end of low brightness auto metering, the software will send high brightness parameters and start metering for high gray level. This way, the software completes metering for all gray levels in both high and low brightness calibration modes.

- When the other type of chip is selected for low brightness calibration, you should select **Auto** at top of the **Camera Adjustment** tab. Then, *Calibration Pro* will automatically start metering from low brightness gray level. After the end of low brightness auto metering, the metering for high brightness gray level will be performed. This way, the software completes auto metering for all gray levels in both high and low brightness calibration modes.

- The interface of metering for brightness calibration will be shown in low brightness auto metering mode. For high brightness metering, the exact interface depends on the exact calibration mode selected.

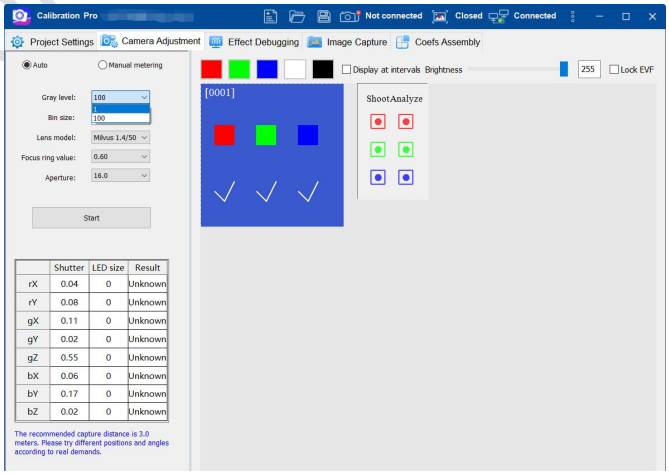


Fig.3-98 **Camera Adjustment** tab

3.3.4 Effect Debugging

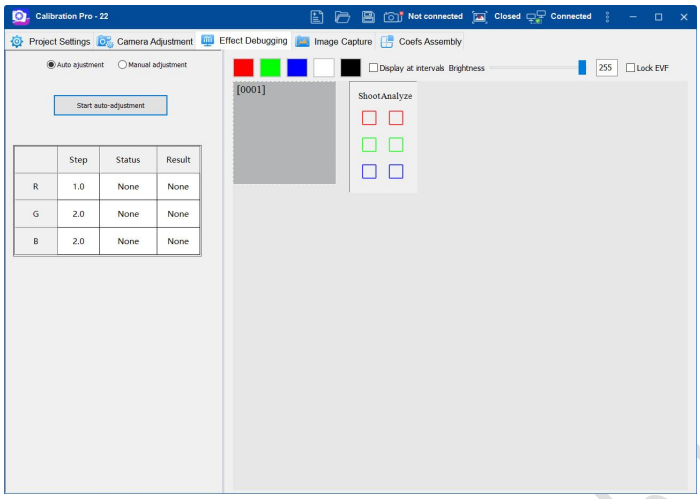


Fig.3-99 Step change in Auto adjustment mode

Note: You can refer to **Section 3.2.4 Effect Debugging** for reference.

3.3.5 Image Capture

3.3.5.1 Capture Settings

The interface of image capture for single cabinet calibration is as shown in Figure 3-100.

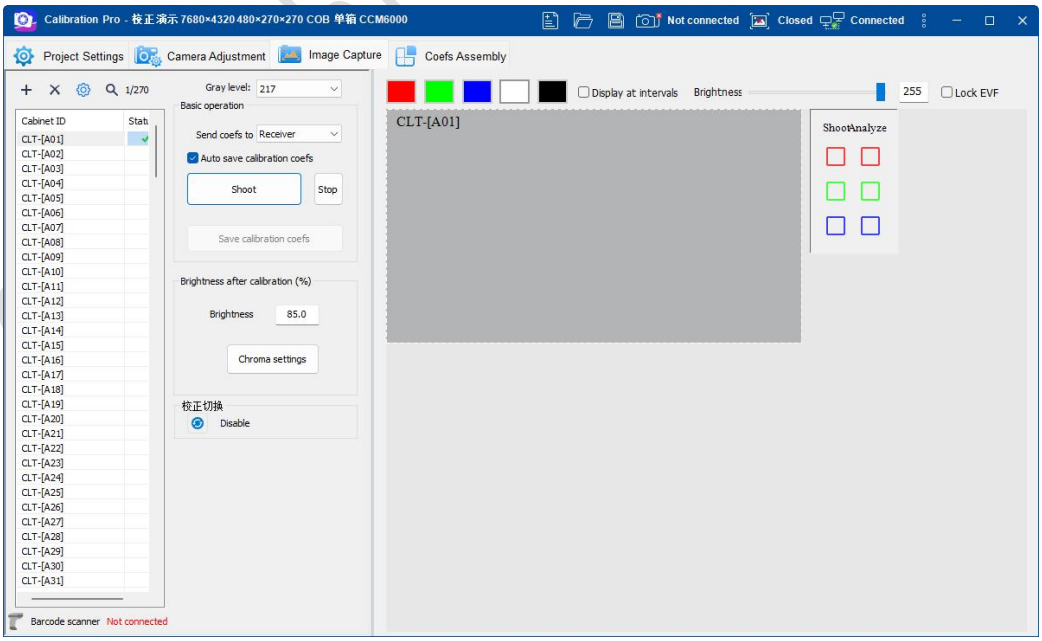


Fig.3-100 Single cabinet image capture in chroma calibration mode

1) Settings

In **Image Capture** tab, available options above the cabinet list include: ＋ (Add cabinet), ✕ (Delete the selected cabinet), ⚙ (Settings), and 🔍 (Search in cabinet list).

- **Pre-warm before shoot**: Control the temperature of the captured gray level before the capture.

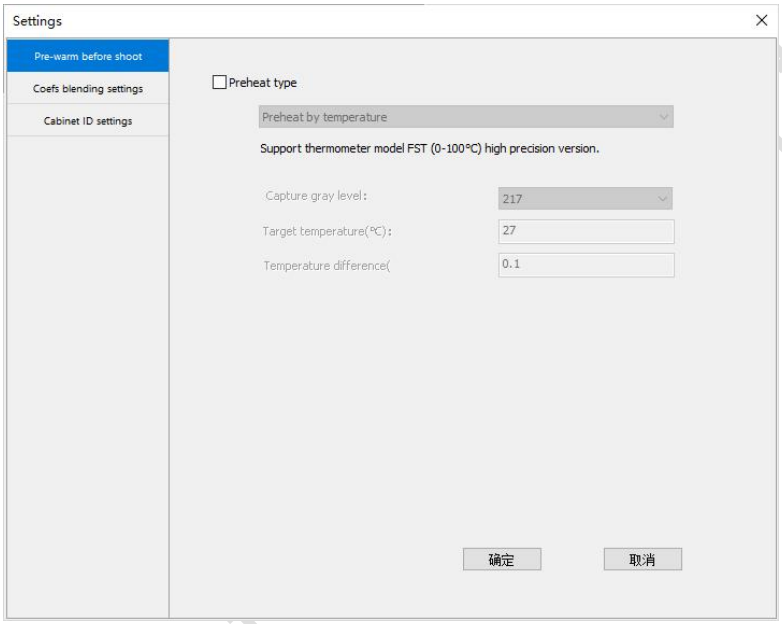


Fig.3-101 Pre-warm before shoot

  - **Pre-warming type**: Available options include **Pre-warm by temperature** and **Pre-warm by time**.
  - **Capture gray level**: Switch capture gray level for current settings.
  - **Target temperature(℃)**, **Temperature difference(℃)**: Start capture the set gray level when the temperature detected by the thermometer reaches the value calculated by target temperature ± temperature difference.
  - **Pre-warming time**: Start shoot after this set time.

- High brightness calibration: Select **Coefs blending settings** to access the tab. See Figure 3-102.

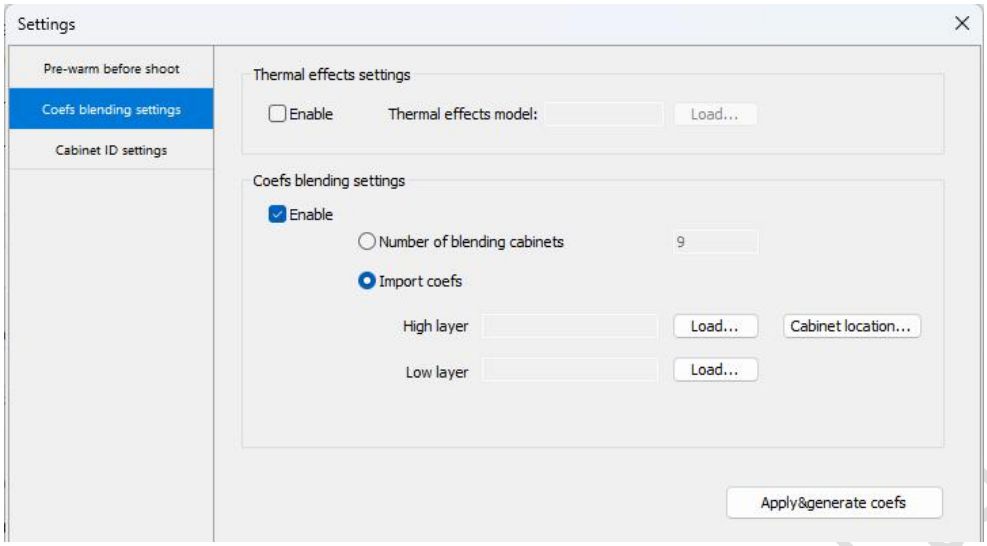


Fig.3-102 Single cabinet calibration settings

- Select **Import coefs**, and then click **Load** to import high brightness model coefficients. Next, click **Cabinet location** to set the place for importing the warm cabinet coefficients.

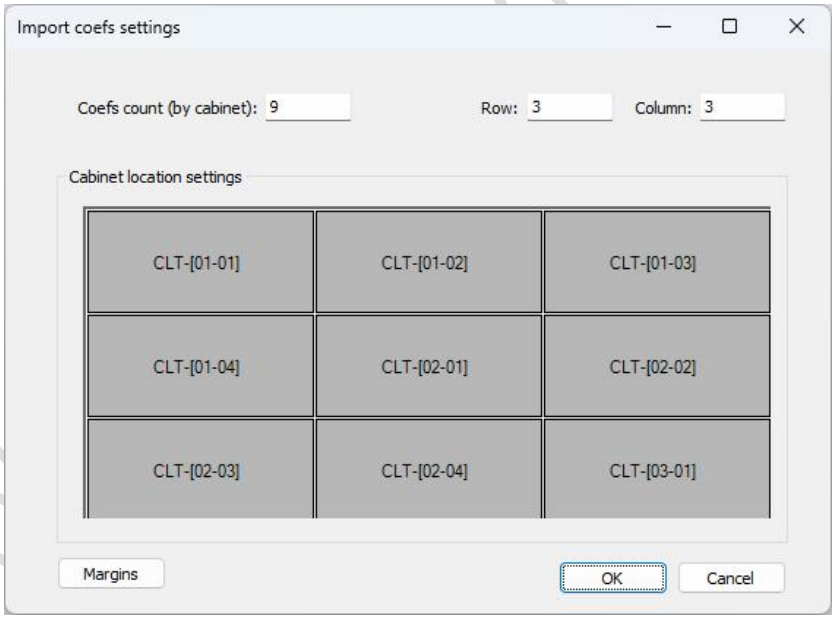


Fig.3-103 Import coefficients settings

- **Margin settings**: The default margin is 0. You can enter the actual margin of the model coefficients.

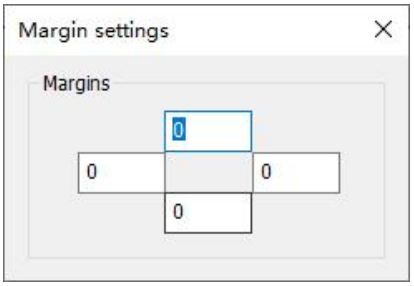


Fig.3-104 Margin settings

- Click **Apply & generate coefs** in the **Coefs blending settings** tab once you have finished the above steps, and a model file will automatically be generated.

- Low brightness calibration: Select **Coefs blending settings** to access the tab. See Figure 3-105.

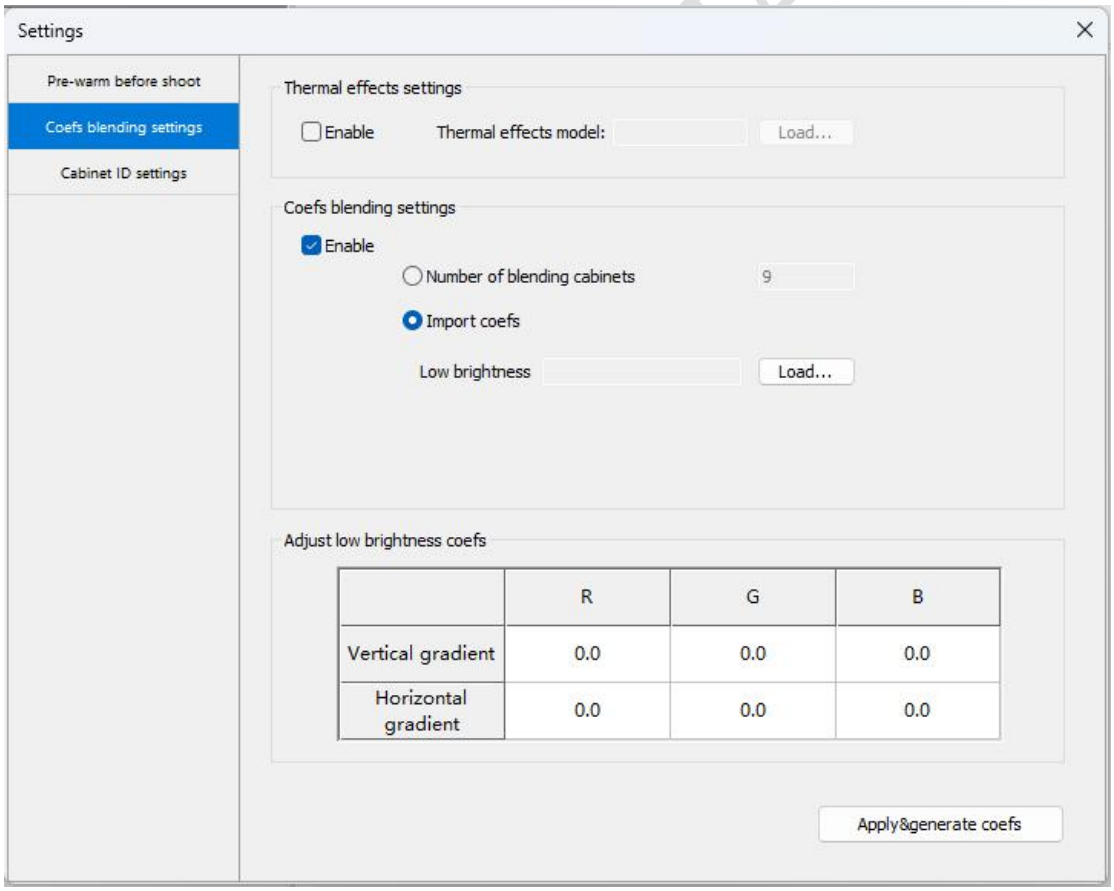


Fig.3-105 Coefficient blending settings in low brightness

- Select **Import coefs**, and then click **Load** to import low brightness coefficients. A model will be generated automatically.

- The default gradient in the **Adjust low brightness coefs** table is 0. You can manually set the R, G, and B values for the horizontal and vertical gradients to adjust the gradient.

- Perform high and low brightness calibration at a time: Select **Coefs blending settings** to access the tab. See Figure 3-106.

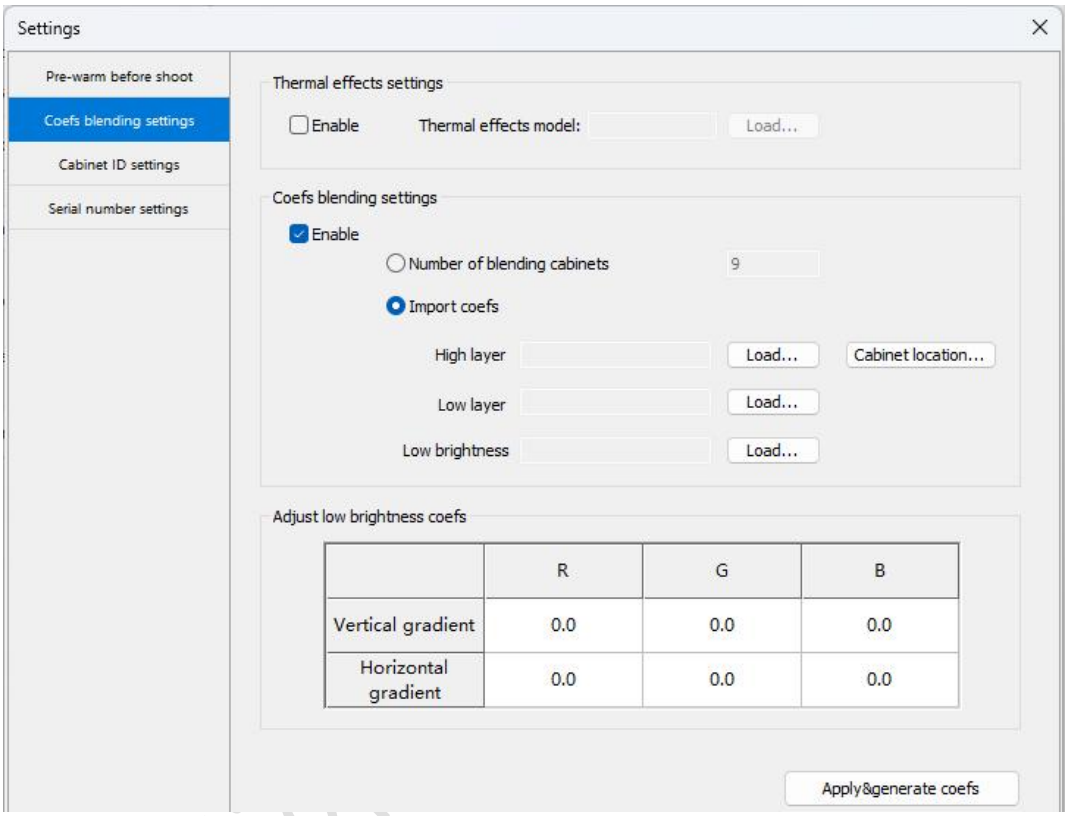


Fig.3-106 High and low brightness coefficients blending settings

- Click **Import coefs** to import the high brightness coefficients and low brightness coefficients separately.

- **Thermal effects settings**: This option is for importing the thermal effects removal model to eliminate the negative effects caused by warm screen.

- **Apply & generate coefs**: Click to let the software automatically generate cabinet coefficients of all the calibrated cabinets based on the reference model and the coefficients blending settings.

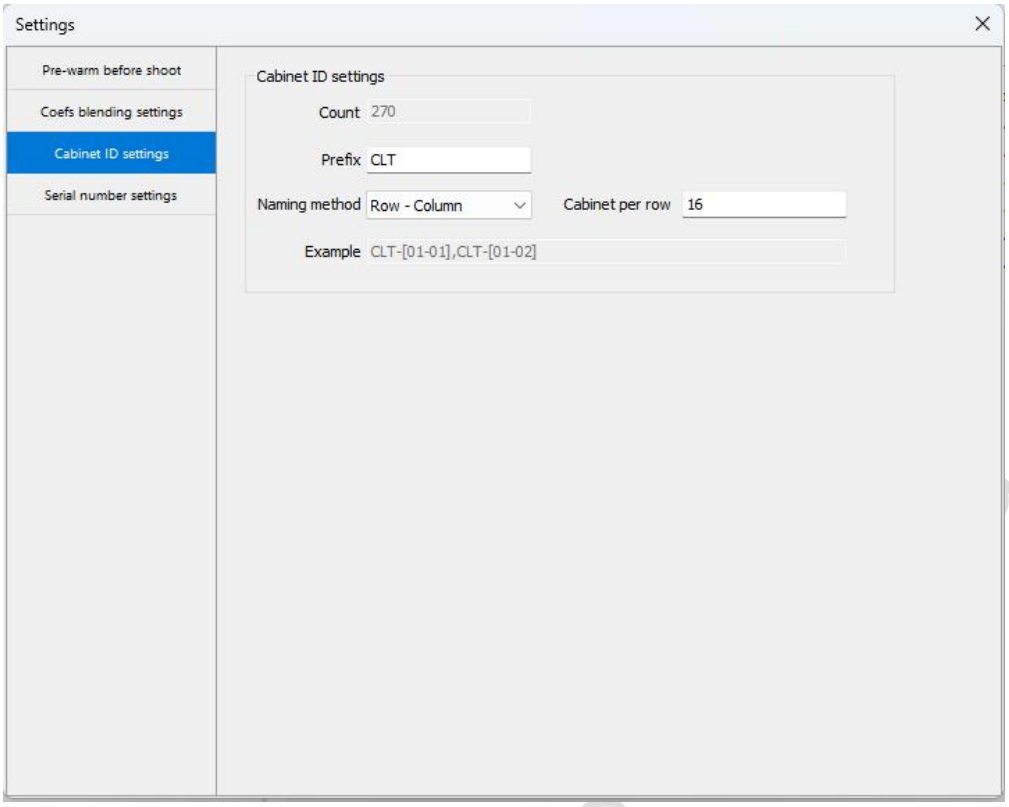


Fig.3-107 Cabinet ID settings

- **Cabinet ID settings**: You can refer to **Cabinet project wizard-6**.

Double-click the target cabinet ID in the cabinet list to bring up the window where you can modify the ID. Once you have changed the cabinet ID, the calibration data will also change accordingly. After the end of shooting and analyzing, the background color of the cabinet list will change to light blue, and when the coefficients have been successfully sent, a green check mark will appear on the status column.

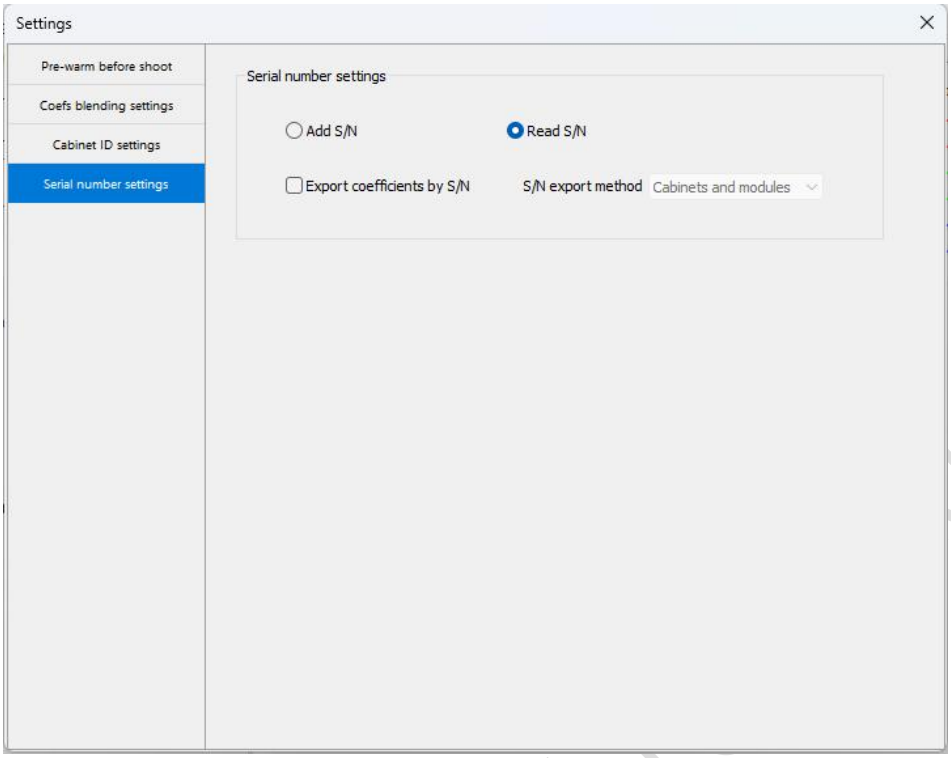


Fig.3-108 Serial number settings

- **Serial number settings**: The option **Read S/N** is selected by default. When you click **Shoot**, the software will read the cabinet’ s serial number and then automatically create a cabinet named by that serial number in the cabinet list. The newly created cabinet will then be automatically selected.

- Select **Add S/N**, and then click **Shoot**. Then, a pop-up window will appear and you can set the rule for writing serial number according to the real situation.

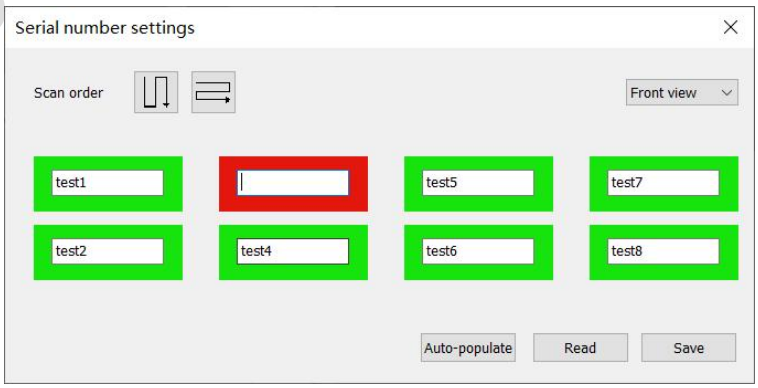


Fig.3-109 Read/Write S/N

- Select **Export coefficients by S/N**, and then select a way to export the coefficients. The coefficients will be exported to your PC in the selected way once generated.

Note: The receiver must support writing and reading S/N, and a smart module is required. Besides, you must select **Detect smart module** in the **Project Settings** tab first.

2) Coefficient saving

- **High brightness calibration**

The coefficients will be sent to receivers in high brightness calibration mode by default. When smart module is adopted, you can send the coefficients to either **Receiver**, **Receiver&module**, or **Module**.

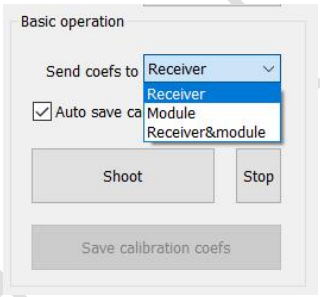


Fig.3-110 High brightness capture

- **Chip low brightness**

The coefficients will be sent to the chip in chip low brightness mode by default. When smart module is adopted, you can select a target to send the coefficients. Available options include: **Chip**, **Module**, and **Chip&module**.

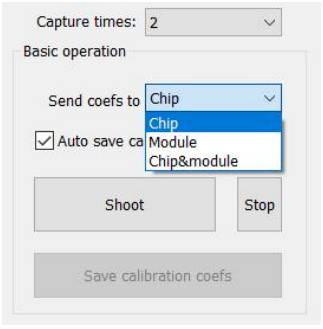


Fig.3-111 Chip low brightness

- Perform high brightness calibration and low brightness calibration together

The coefficients will be sent to the chip in chip low brightness mode and to the receiver in high brightness calibration mode by default. The coefficients will be saved to the selected place in both modes.

- **Auto save calibration coefs** is selected by default. When the coefficients are generated after image analyzing, the coefficients will automatically be sent to the receivers, modules, and chips.

3) Chroma calibration mode

The brightness after calibration is 85% by default. You can click the input box in the **Brightness after calibration** field to modify the brightness. Click **Chroma settings** to bring up the window where you can change the original color gamut and the target gamut. You should do the settings once for the first calibrated cabinet. The settings will then be applied to the subsequent cabinets.

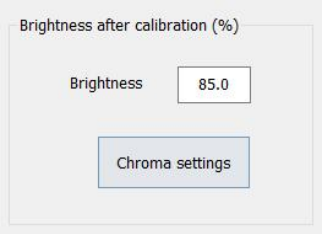


Fig.3-112 Brightness after calibration

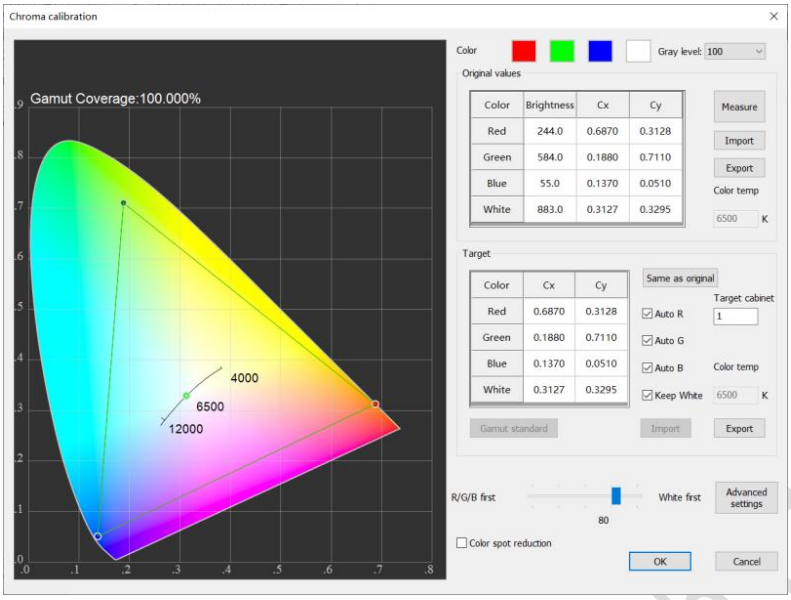


Fig.3-113 Chroma settings

- **Original values**: You can measure the original values by clicking **Measure** after connecting to the color meter. Besides, you can also import the existing brightness value and coordinates, or click the value to modify. Clicking **Export** allows for exporting and saving the original values.
- **Target**: *Calibration Pro* will give a target gamut based on the data captured by the camera. If you want to modify the target gamut, you can deselect **Auto R/G/B**. If you want to apply standard gamut, you can select the standard (available standards include sRGB, AdobeRGB, PAL, NTSC, Rec.601, Rec.709, Rec.2020, and DCI-P3), and then click **Import** to import the target gamut. Besides, you can also double-click the input boxes to enter the desired values. If you select **Same as original**, the target gamut will not be adjusted after calibration.
- Priority: You can move the slider toward **R/G/B first** or **White first** to adjust the effect of the calibration to the color Red/Green/Blue and the color white.

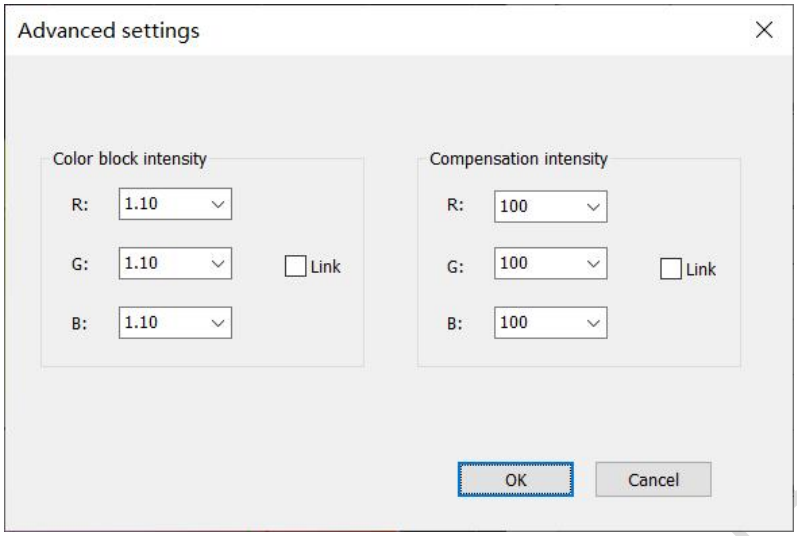


Fig.3-114 Advanced settings for chroma calibration

- **Advanced settings**: The **Color block intensity** is used for setting the range of color block adjustment. If the block is relatively too bright (or too dark) after calibration, you can increase the intensity.
- **Compensation intensity**: The default intensities for Red, Green, and Blue are 100, 100, and 50 respectively. You can change the intensity for any one of the 3 colors (Red, Green, and Blue). The higher the intensity, the more color compensation is.
- **Color spot reduction**: This can enhance the uniformity of the color compensation.
- Target cabinet count: When the target cabinet count is 0, each cabinet will calculate its own target color gamut based on its tristimulus values(R, G, B). When the count is 1, the cabinet’ s RGB values will be followed by the subsequent cabinets for their own gamut. When the count is N (N＞1), a common target gamut will be calculated based on the RGB values of all the N cabinets, and the subsequent cabinets will adopt this gamut to generate coefficients.
- After you set the target cabinet count, you can click **Apply & generate coefs** to make the settings take effect.

- In **Multi-layer calibration** mode, the gamut settings for each layer will be saved individually. When you finish the calibration, the target color gamut of the lower layer will receive recommendation based on that of the higher layer.

4) Brightness calibration

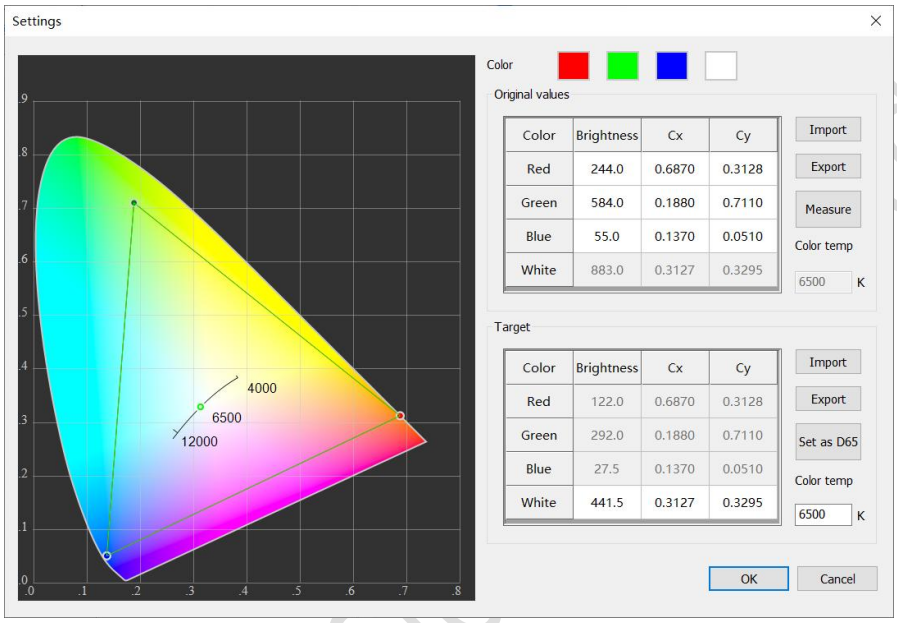


Fig.3-115 Target settings for brightness calibration

- **Color:** Click on a colored box to let the screen display the corresponding color.
- **Original values**: You can measure the original values by clicking **Measure** after connecting to the color meter. Besides, you can also import the existing brightness value and coordinates, or double-click the value to modify. *Calibration Pro* will calculate the white point's color temperature based on the original values. You can export the original values by clicking **Export**. If you don't need to adjust the target temperature, you can simply skip this step.
- **Target**: You can adjust the coordinates of the target white point in this sheet. Click **Import** to import the existing target values. Clicking **Export** allows for saving the new target values. You can also click **Set as D65** to

set the color temperature to the standard 6500K. In addition, you can double-click the brightness, x, and y of White in the sheet, and then enter the new values.

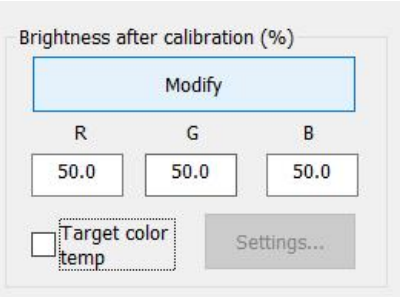


Fig.3-116 Brightness after calibration

- **The** brightness after calibration is 85% by default. You can click the input boxes below **R**, **G** and **B** respectively to modify the brightness. You should do the settings once for the first calibrated cabinet. The settings will then be applied to the subsequent cabinets.

3.3.5.2 Cabinet Capture Procedure

1) Click **Shoot** to start capturing cabinets from the selected cabinet list.

Chip low brightness calibration: Click **Shoot** first. The software will then send the initial coefficients and finish calibrating the captured gray levels in turn.

2) After the end of analyzing image and generating coefficients, the calibration coefficients will automatically be saved to receivers, module, and chip. The **Auto save calibration coefs** is enabled by default. You can unselect the function.

3) You will be prompted once the coefficients have been successfully saved. Clicking **OK** can continue calibrating the next cabinet. You can also click the color on top of the interface to check the calibration effect.

Fig.3-117 Display control area

4) Repeat the step 1-3 to calibrate the rest cabinets.

3.3.6 Calibration Log

The calibration log records the abnormal event and the progress information of the calibration. When a cabinet finished calibration, or was added, deleted, or renamed, the event will be recorded into **Progress** sheet of the log. The operations such as switching calibration mode and modifying post-calibration brightness that will affect the calibration progress and effects will be recorded into the **Exception** sheet.

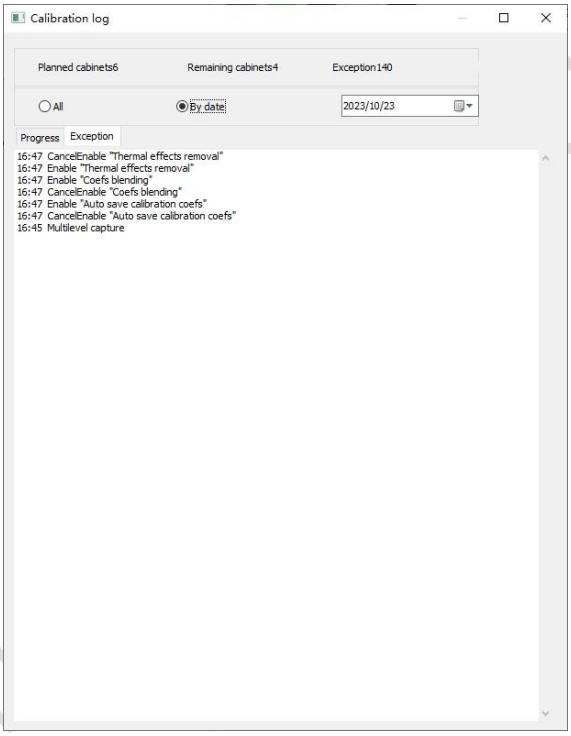


Fig.3-118 Calibration log

- **Planned cabinet count**: This number conforms to the cabinet count in the cabinet list.
- **Remaining cabinet count** = **Planned cabinet count** — calibrated cabinet count
- **Exception**: This field shows the number of abnormal cabinets during calibration.

- **All**: This field shows the progress and exception records of the project.
- **By date**: Click the downward arrow to select a date from the drop-down calendar so as to check the calibration record generated on the selected date.

3.3.7 Coefs Assembly

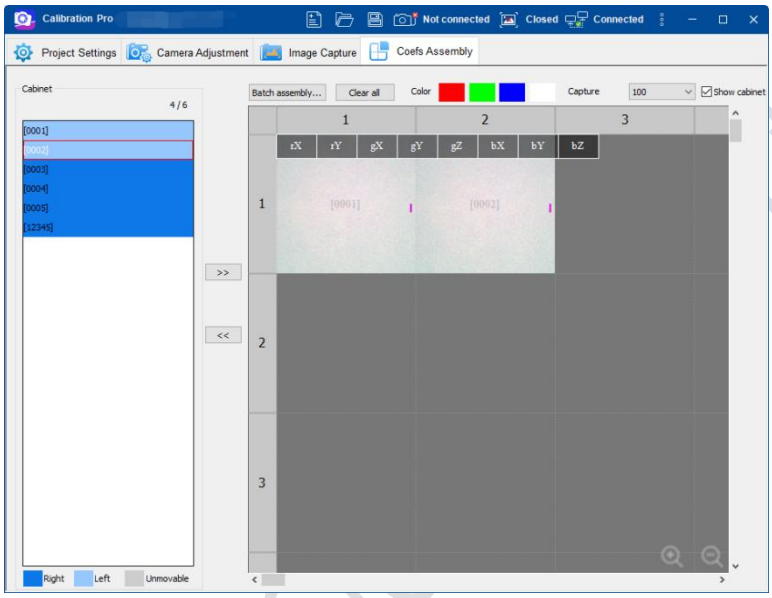


Fig.3-119 Coefficient assembly

You can access the **Coefs Assembly** tab after the end of cabinet calibration. In cabinet list on the left side of the tab, the cabinets that have finished calibration will be colored dark blue. You can assemble the luminance map on the right side of the tab.

Select a cabinet with dark blue background and then click the rightward double arrows button in the middle of the interface to add the luminance map of the selected cabinet to the assembly area on the right side. The added map can move freely on the assembly area. If you want to remove a map from the area, you can simply select the map and then click the leftward double arrows button in the middle of the interface. A cabinet with gray background indicates it has not finished calibration and its luminance map cannot be added to the assembly area.

When there are multiple capture gray levels for the cabinet (performing high and low brightness calibration, and multi-layer calibration), you can switch the current gray level to view corresponding luminance map in the assembly area.

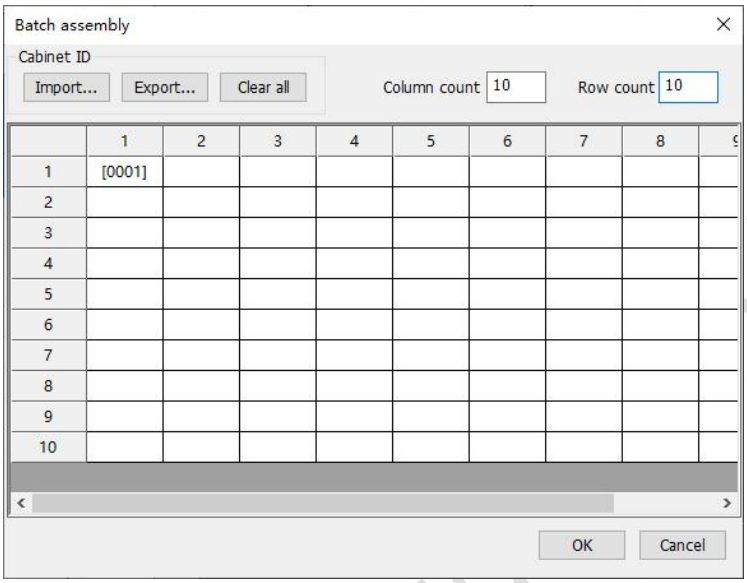


Fig.3-120 Batch assembly

Batch assembly: Enter target cabinets' names into an Excel table first. Then, in the **Batch assembly** window, import the Excel table. The cabinets' luminance maps will then automatically be assembled according to the naming method of the cabinets. Next, click **Export coefs** to export the assembled cabinet coefficients based on the cabinets' layout in the assembly area. The coefficients will be exported either as full-screen coefficients or by partitions or by modules.

For the luminance maps of the assembled cabinets, you can right-click on the map to add an **Image dust off** mark frame. Then, you can set the mark frame to apply it to the current cabinets, the subsequent cabinets, or all cabinets. Next, click **Apply** to make the settings take effect.

Chapter4 Calibration with Canon Camera

4.1 Canon Camera Assembly

4.1.1 Tripod Setup

Unfold the tripod and adjust its height, making it face the screen center, or at a height close to the user's eye level.

Fig.4-1 Open the tripod

4.1.2 Mount Tripod Head

Align the screw hole at the bottom of the tripod head with the mounting screw of the tripod, and then screw the tripod head clockwise.

Fig.4-2 Mount the tripod head

4.1.3 Attach Lens

1) Rotate the lens cap and the body cap to remove them.

2) Align the red mount index on the lens with the red mount index on the camera and turn the lens as shown by the arrow until it clicks in place. See Figure 4-3.

Fig.4-3 Attach lens

3) Switch the focus mode to <MF> and then switch off the stabilizer of the lens (marked as OS on Sigma lens and IS on Canon lens). See Figure 4-4.

Fig.4-4 Adjust the focus mode

4.1.4 Mount Camera

1) Flip the quick-release lever of the tripod head to the direction as depicted in Figure 4-5.

2) Adjust the lens direction to make it align with that of the tripod head.

3) Mount the camera onto the plate of the tripod, and the lever will be automatically released to fix the camera. See Figure 4-6.

Fig.4-5 Mount Camera

Fig.4-6 Mounting complete

Fig.4-7Mounting complete

4.2 Full-Screen Calibration

4.2.1 New Full-Screen Calibration

Step 1: Full-screen project wizard-1

In the start screen, click **New full-screen calibration** to access the **Full-screen project wizard-1**. See Figure 4-8.

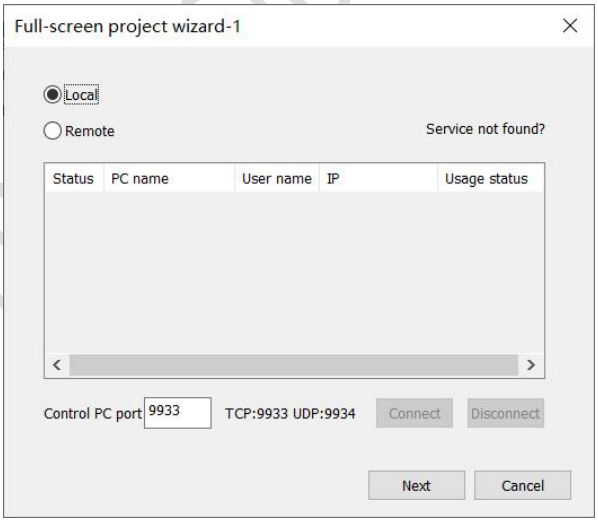


Fig.4-8 Select **Local**

1) For calibration with a single control PC, select **Local** to connect to the control PC.

2) For calibration with 2 PCs, select **Remote** and then select a PC as the control PC from the sheet below (available PCs in the currently used LAN

will be automatically shown in the sheet). Once you have selected the target PC, click **Connect**.

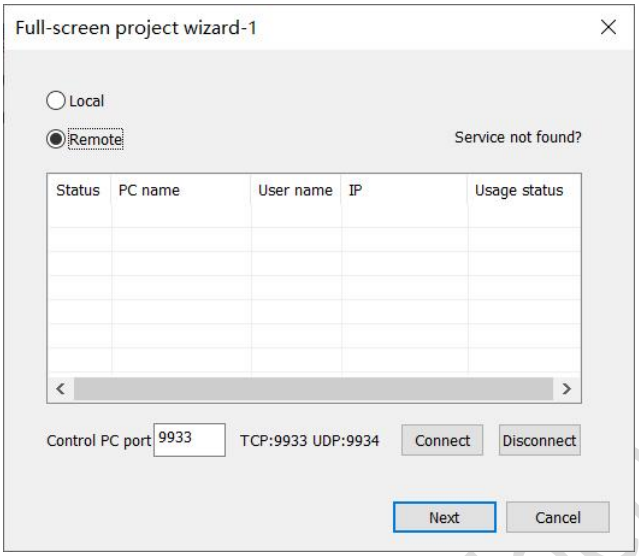


Fig.4-9 Select **Remote**

Notes:

① It is recommended that you select **Remote** when the sender is placed far from the LED screen and the control PC cannot physically connect to the sender via a cable.

② For calibration with 2 PCs, the PCs should share the same LAN (connected via WIFI or network cable), and the firewalls of them should be turned off. Both PCs should also install *Calibration Pro* of the same version.

③ The PC for display capture will automatically launch CaliPro Server and should be connected to the control PC.

④ The **Control PC port** is 9933 by default. If the default port has been occupied by other devices, you will need to set a port number for both the control PC and the PC for display capture. To modify the port number, right-click the software interface or minimize the interface in the control PC, and then access the network setup window to enter a new port number. See Figure 4-10.

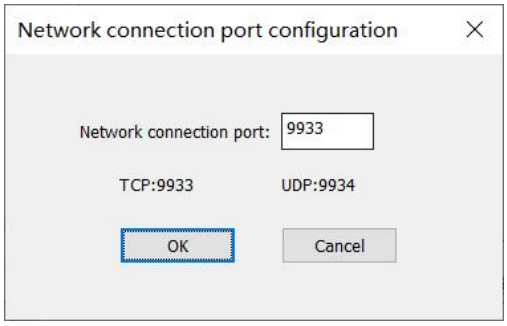


Fig.4-10 Network connection port configuration

After the control PC finished network connection, click **Next** to bring up the **Full-screen project wizard-2**.

Step 2: Full-screen project wizard-2

In the **Full-screen project wizard-2**, you will be able to view information about the amount of connected sender and receiver, their model, and their program version. See Figure 4-11.

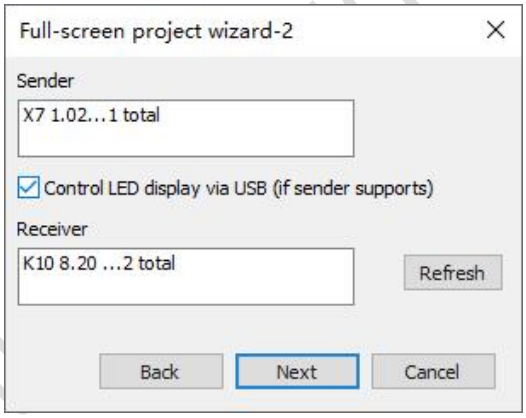


Fig.4-11 Full-screen project wizard-2

- If the sender supports display control via USB, you can select the **Control LED display via USB (if sender supports)** checkbox. This will allows for pixel-to-pixel calibration image display without video signal.
- If the sender does not support USB control, you can perform calibration using video signal. Note that you should perform calibration with an extended screen in this case (see **Project settings-Canvas settings** in the following descriptions for reference).

- If the sender supports controlling screen group, you will be able to select the desired group for control in this window. After your selection, the selected screen group will display red at 255 grayscale, and other groups will display black.

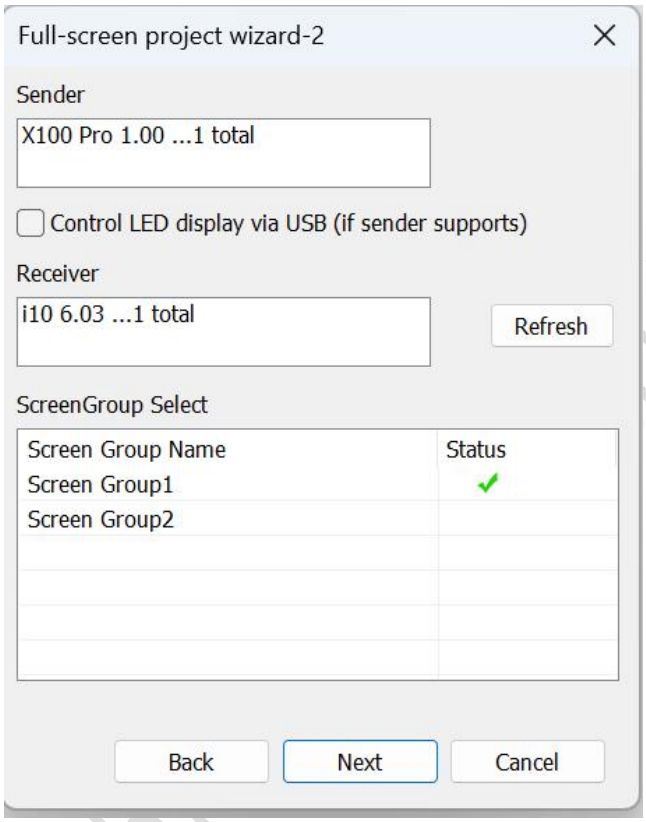


Fig.4-12 Full-screen project wizard-2-multiple screen groups

Then, you can click **Next** to move on to the **Full-screen project wizard-3**.

Step 3: Full-screen project wizard-3

Select **Canon** to finish camera settings in this step. See Figure 4-12.

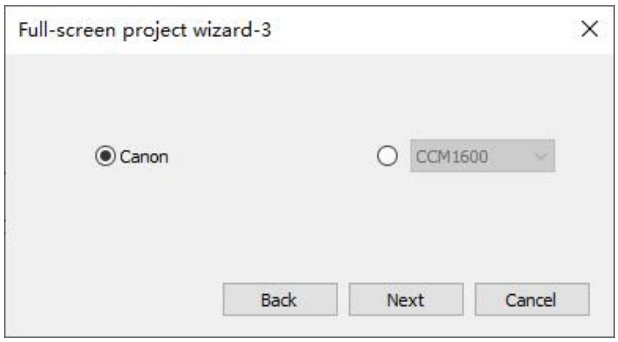


Fig.4-13 Full-screen project wizard-3

Step 4: Full-screen project wizard-4

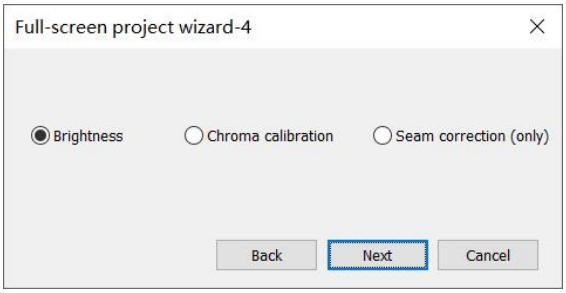


Fig.4-14 Full-screen project wizard-4

You can select the calibration mode in this step. See Figure 4-13. Available modes include: **Brightness**, **Chroma**, **Seam correction (only)**, and **Chip low brightness** (if supported by receiver).

After the selection, you can click **Next** to move on to the **Full-screen project wizard-5**.

Step 5: Full-screen project wizard-5

You can finish the setup of the module, cabinet, and screen in this step. See Figure 4-15.

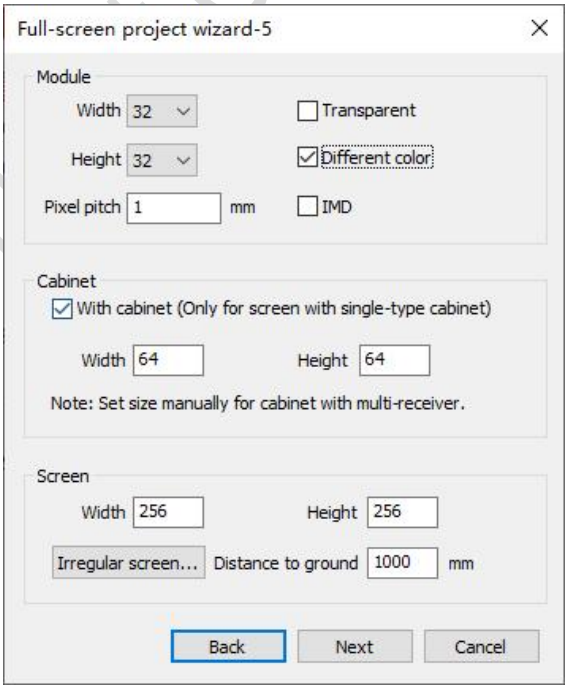


Fig.4-15 Full-screen project wizard-5

- **With Cabinet (Only for screen with single-type cabinet):** This checkbox is selected by default. Select this checkbox when the screen is composed of cabinets of only one type.
- **Transparent:** This checkbox should be selected when the horizontal pixel pitch is different from the vertical one.
- **Different color**: Select this checkbox when the calibrated screen has modules with color difference.
- **IMD:** Select this checkbox when IMD module is used for the currently calibrated screen.
- **Pixel Pitch:** *Calibration Pro* will recommend a proper pixel pitch once the receiver is detected. Normally it is 0 by default, and you can enter a new pitch according to the real situation.
- **Irregular screen settings**
  - **Curved screen:** Select this checkbox when the screen is a curved one assembled by modules with the same LEDs in row and in column. You should also enter a value in the **One-fold Width** input box for a curved screen according to the real situation. See Figure 4-15.
  - **Polygonal screen:** Select this checkbox when the screen is an irregular one assembled by rectangular modules with the same LEDs in row and in column.

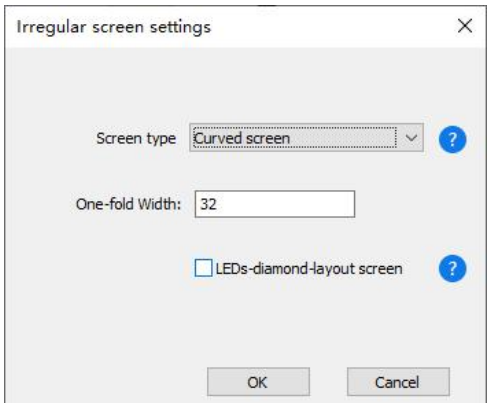


Fig.4-16 Irregular screen settings

- **Distance to ground:** This field indicates the real distance between the bottom of the screen and the ground (unit: mm).

Click **Next** when you finish this step.

Step 6: Full-screen project wizard-6

You can set the margins of the screen in this step. See Figure 4-17.

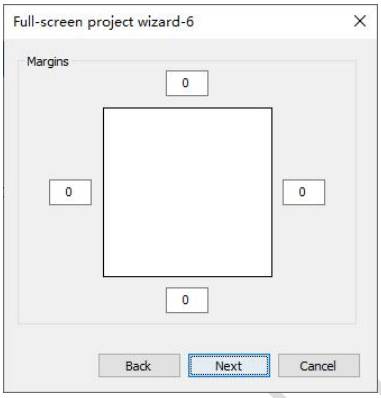


Fig.4-17 Full-screen project wizard-6

In this step, the screen will display a white frame. In this window, you can enter the number of LEDs that will not be lit during calibration respectively in the four input boxes around the frame, according to situation at site.

- When *Calibration Pro* has detected more than 1 sender, you will need to set the sender layout before continuing the wizard-6. See Figure 4-18.

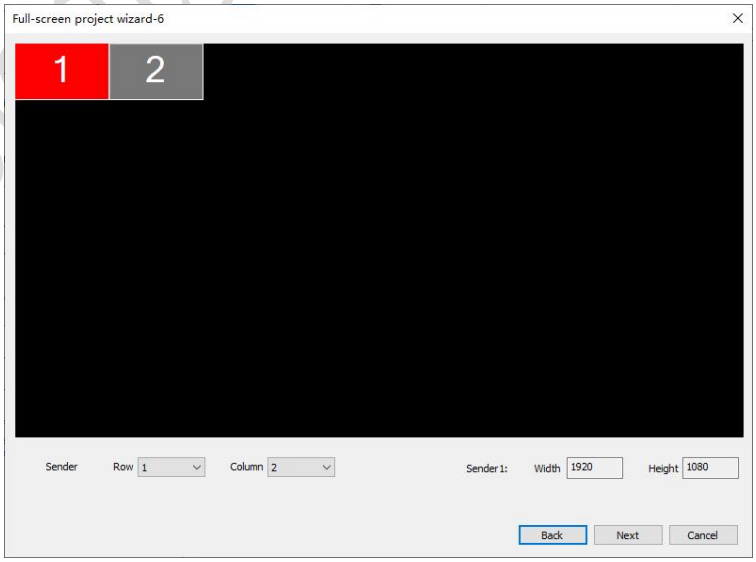


Fig.4-18 Sender layout settings

In this step, you should enter the rows and columns of the senders according to their real layout. Click a sender to set its size and position in the load area. You can also exchange the control area and position of two senders by dragging them in this interface. Once you have finished the sender settings, you can click **Next** to move on to the setup of **Margins** and do as described above.

Once you have finished setting the margins, click **Next** to continue.

Step 7: Full-screen project wizard-7

You can name the calibration project and select a path for saving it in this step. See Figure 4-19.

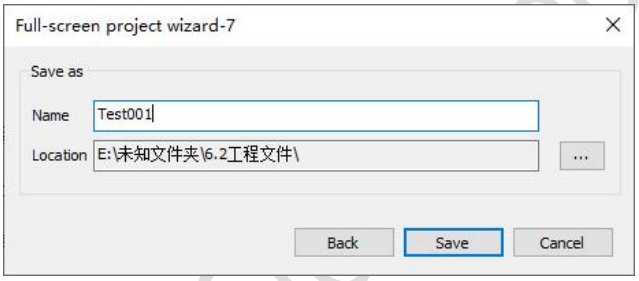


Fig.4-19 Full-screen project wizard-7

Name: Enter the name of the calibration project in this field.

Location: Select a path for saving the project file and data in this field.

Once you have finished this step, you can click **Save** to apply all the settings finished in the above 7 steps, and you will be prompted the recommended shooting distance (see Figure 4-20). Next, click **OK** to finish the full-screen calibration project setup and access the main interface for this project.

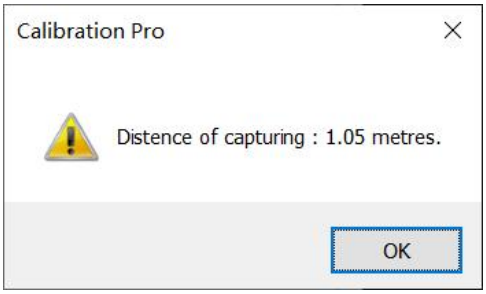


Fig.4-20 The reminding message for the recommended shooting distance

4.2.2 Project Settings

The main interface of the full-screen project is as shown in Figure 4-21. You should first set the basic parameters for the project in the **Project Settings** tab.

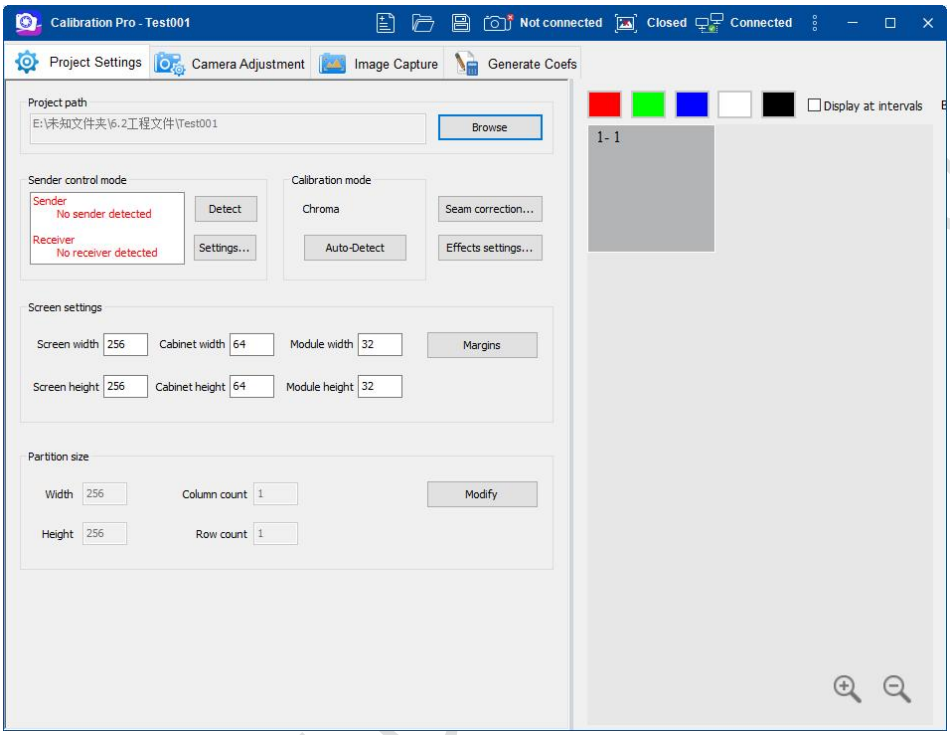


Fig.4-21 Main interface of full-screen project

4.2.2.1 Sender Mode

In the **Project Settings** tab, *Calibration Pro* will automatically detect senders and receivers once the control PC has been connected, and the senders and receivers that have been detected will be shown in the tab. See Figure 4-22.

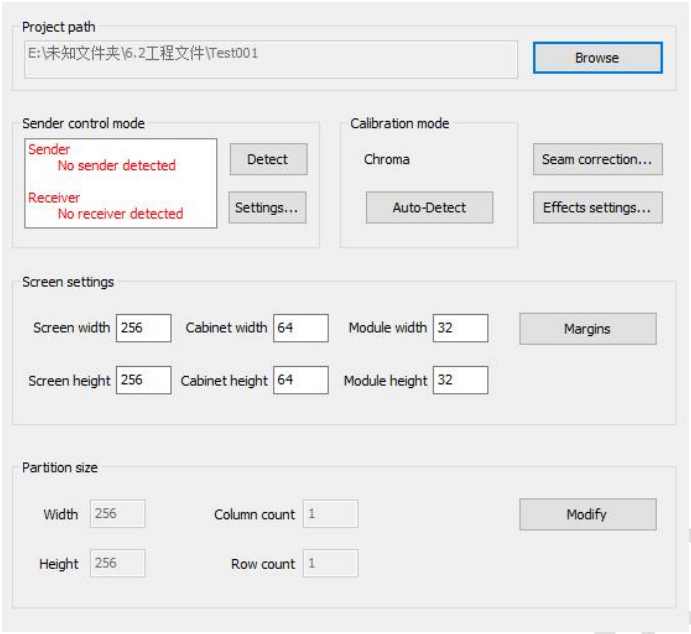


Fig.4-22 Basic information in sender mode

- **Detect**: Click **Detect** to detect the currently connected senders and receivers, and then you will be able to view the model and version number of the senders and receivers detected, as well as the amount of the receivers.

- **Settings...**

1) Click **Settings...** to bring up a pop-up window for setting the sender control mode. When the amount of the senders that have been detected is no more than 1, you can only enable or disable the option **Control LED display via USB (if sender supports)**. See Figure 4-23.

Fig.4-23 Control LED display via USB (if sender supports)

2) When the amount of the senders that have been detected exceeds 1 (i.e., there are multiple senders for cascading calibration), you will be able to set the layout of the senders in the pop-up window.

➢ **Sender setup wizard-1**

In **Sender setup wizard-1**, you can divide the screen into several partitions according to the load capacity of the sender. There are 2 ways available, as shown in Figure 4-24.

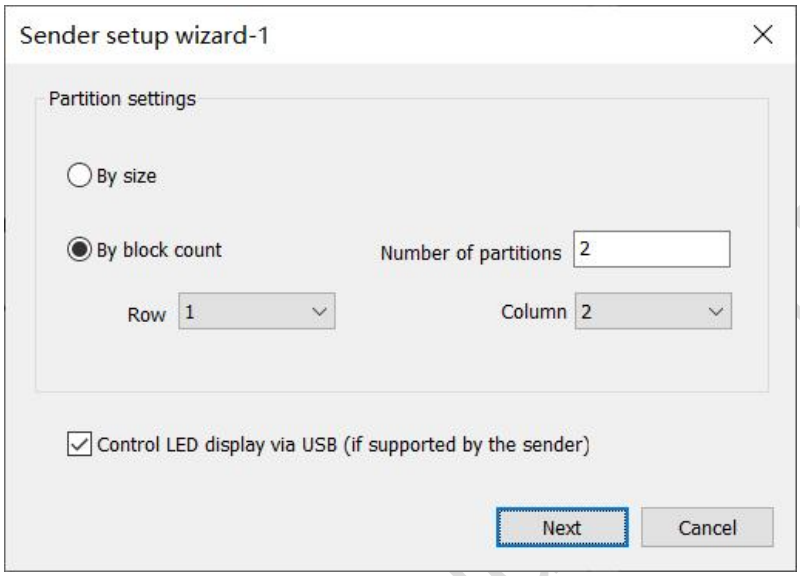


Fig.4-24 Sender setup wizard-1

① **By size**: Divide the screen based on the size of each partition.

② **By block count**: Divide the screen according to the rows, columns, and number of partitions you set.

Once you have set up the screen partitions based on the real control area of the senders, you can click **Next** to continue.

➢ **Sender setup wizard-2**

In this step, you can set up the partitions. See Figure 4-25.

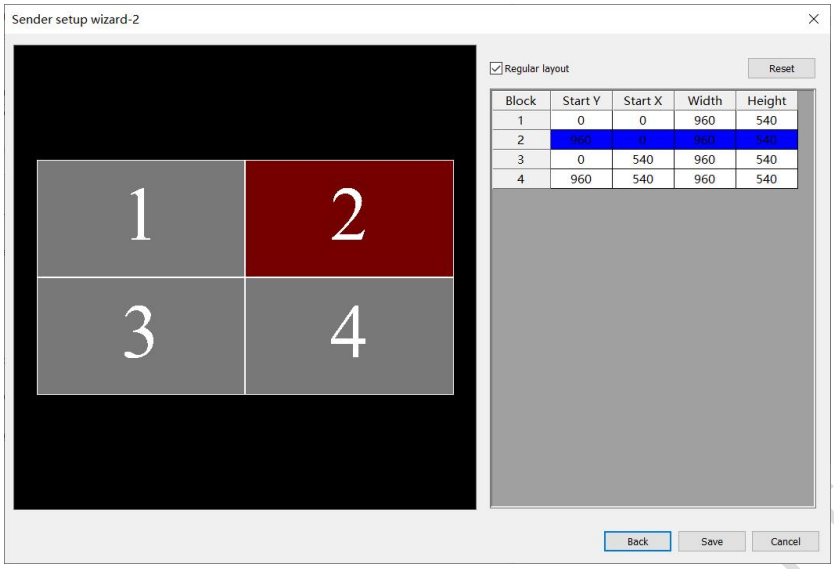


Fig.4-25 Sender setup wizard-2

- **Regular layout**: If you select this option, you can only set the size of the sender-control area in a way that can make the partitions align in rows and columns. You can modify the size of each sender-control area individually when the **Regular layout** checkbox has not been selected.
- **Reset**: Click to reset the position and size of the sender-control area.

Click **Save** once you have finished the setting process.

4.2.2.2 Calibration Mode

Click **Switch** to choose a calibration mode. Available options include: **Brightness**, **Chroma**, and **Seam correction (only)**. See Figure 4-26.

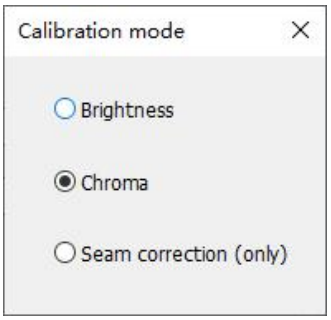


Fig.4-26 Available calibration modes

4.2.2.3 Seam Correction

A dark line will appear when the seam between modules or cabinets is too wide. Similarly, a bright line will appear when the width of the seam is less than the pixel pitch. Such dark or bright line can be fixed by adjusting the brightness of the LEDs on the border of the target seam.

- **Seam correction:** Click **Seam correction** in the **Project Settings** tab, and then select the **Enable** checkbox in the pop-up window to enable the seam correction function. See Figure 4-27.

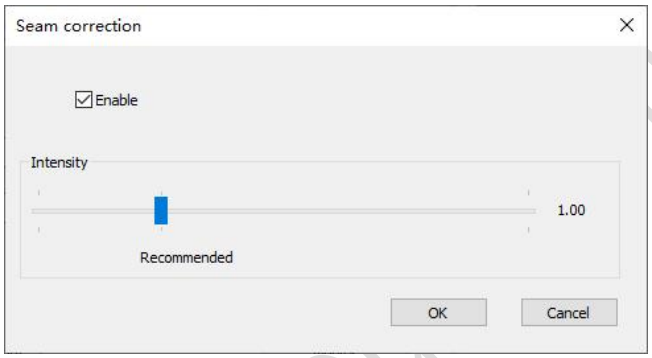


Fig.4-27 Seam correction settings

- **Intensity:** You can move the slider below to change the adjusting intensity for seam correction, if you find the correction effect is not as is expected. The default intensity is 1. If the original dark (or bright) line turns to be too bright (or too dark) after seam correction, you can lower the intensity appropriately. However, if you find the line still relatively dark (or bright) after correction, you can then increase the intensity appropriately.

Note: If you have selected **Seam correction (only)** before, you cannot perform the brightness/chroma calibration, and the seam correction function will be enabled by default. See Figure 4-28.

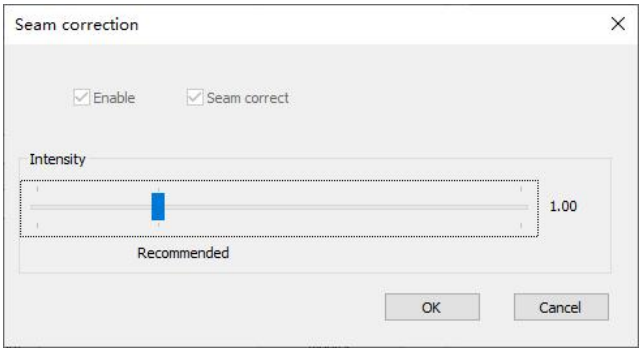


Fig.4-28 Seam correction (only) settings

4.2.2.4 Effects Settings

You can click **Effects settings** to access corresponding interface. See Figure 4-29.

- **Interchangeable after calibration**: This option is selected by default to enable eliminating differences between the partitions after calibration.
- **De-vignetting**: This option is selected by default to enable eliminating dark clusters caused by lens halo.
- **Image dust off**: This option is selected by default to enable eliminating the post-calibration bright spots caused by dust from camera/lens.
- **Color moiré removal**: This option can be selected to eliminate the moiré generated during the calibration.
- **Ambient light intensity**: The Canon camera can work for calibration when ambient light exists, and the camera can adjust itself automatically to match the light. You can also select **Strong**, **Weak**, or **None** according to the real situation of the ambient light at site.
- **Dead pixel rate**: This field shows the ratio of dead pixels to the entire screen. You can adjust the ratio based on the actual situation (3-50‰). Note that if the actual dead pixel rate exceeds the rate you have set, a failure will occur.

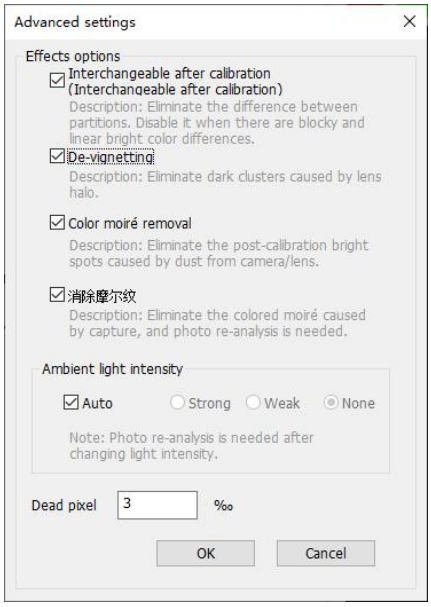


Fig.4-29Effects settings for the Canon camera

- **COB:** If you have selected **COB** before, the available option in **Effects settings** will only include **Image dust off**. See Figure 4-30.

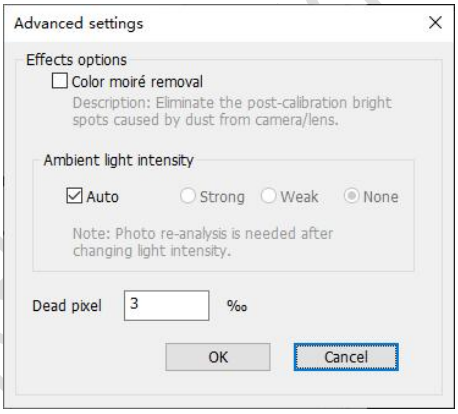


Fig.4-30 Effects settings for Canon camera (COB module)

4.2.2.5 Screen Settings

Fig.4-31 Screen settings

Screen width and **Screen height**: Set the size of the full-screen.

Cabinet width / **height**: Set the width and height of a single cabinet.

Module width / **height**: Set the width and height of a single module.

- **Margins:** Please refer to relevant description in **Step 6: Full-screen project wizard-6** above.

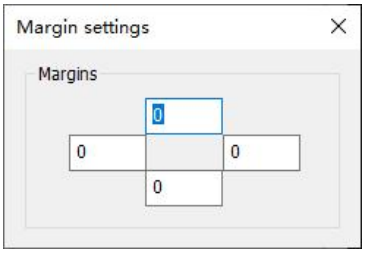


Fig.4-32 Margin settings

- **Canvas settings:** If you have not selected **Control LED display via USB (if sender supports)**, you will find the **Canvas settings** option in **Screen settings**. Click this option to access the pop-up window where you can set the start coordinates of the canvas.

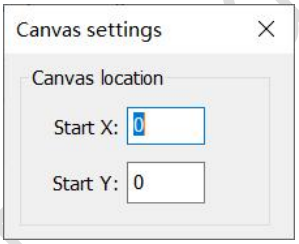


Fig.4-33 Canvas settings

4.2.2.6 Partition Size

Calibration Pro will recommend a proper partition size according to the size of the screen. You can click **Modify** to change the partition size if necessary.

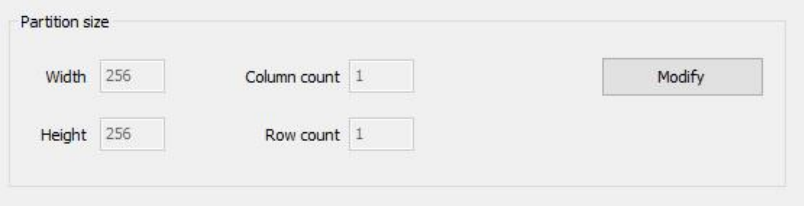


Fig.4-34 Partition size settings

Note: For a regular screen by default, 16 LEDs will overlap between partitions, and for a COB screen, 256 LEDs will overlap between partitions by

default. Once you have finished modifying the partition size, the number of intervals will automatically be calculated.

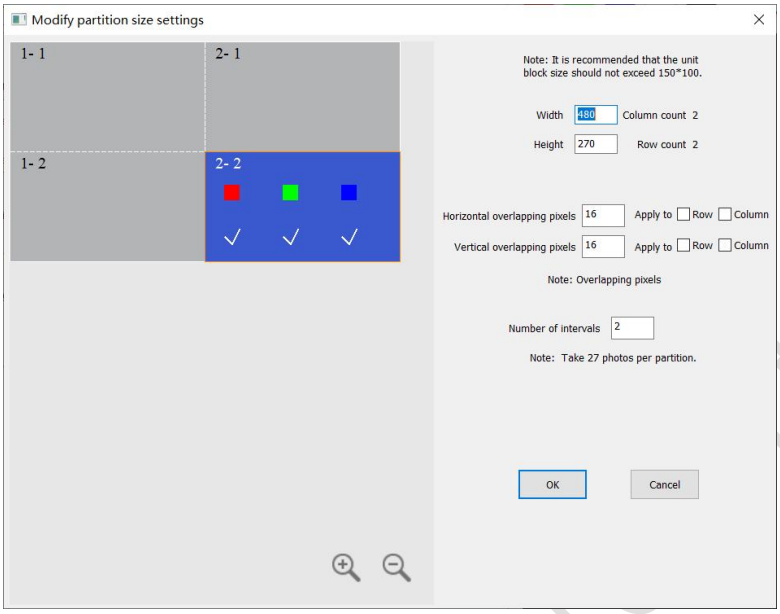


Fig.4-35 Modify the partition size

You can select a partition from the **Partition preview** window or from the right side of the **Project Settings** tab. The selected partition will then be displayed with a white frame on the LED screen.

4.2.3 Camera Adjustment

1) Adjust the position of the camera and the tripod head to make the selected area of the LED screen be captured on the white frame of the preview area for framing.

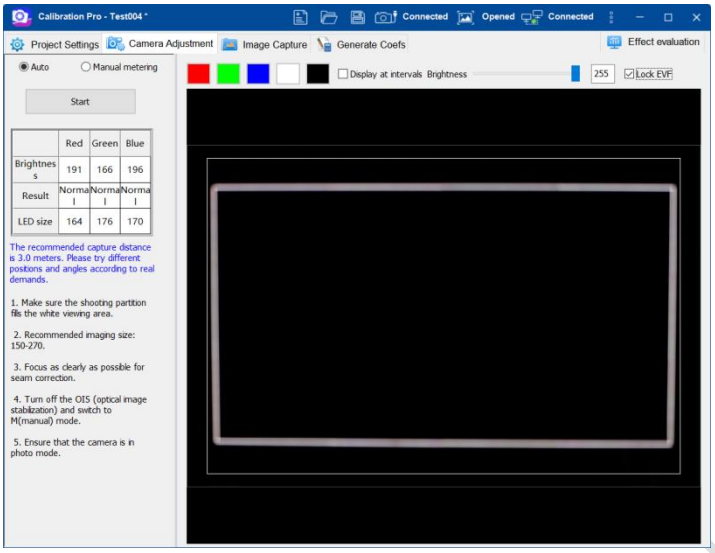


Fig.4-36 Camera framing

Note: The selected area should generally align with the frame; The selected area should generally fill with the frame (exceeding the frame a little bit is acceptable); The selected area should not exceed the preview area; Adjust the lens to get a clear focus first, and then fine tune the lens to make the framing a little bit fuzzy.

2) Auto metering: Select **Auto** and then click **Start**. *Calibration Pro* will automatically adjust the shutter time for normal metering, and you can check the size of the LEDs when metering can be performed normally.

① If the captured size of LEDs is less than 150, you should adjust the lens focus to make the image a little bit fuzzy, and then click **Start** again.

② If the captured size of LEDs is over 270, you should adjust the lens focus to make the image look sharper, and then click **Start** agian.

③ The normal metering result for the captured size of LEDs should be within the range of 150-270. Once you have obtained this result, you can finish the metering.

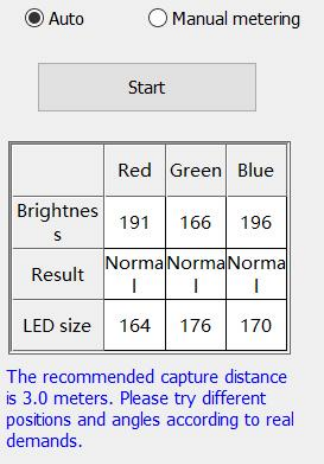


Fig.4-37 Auto metering complete

3) Manual metering: Select **Manual metering** and then click **Measure**.

① If the captured size of LEDs is less than 150, you should adjust the lens focus to make the image a little bit fuzzy.

② If the captured size of LEDs is over 270, you should adjust the lens focus to make the image look sharper.

③ If the measurement result is too dark, you should increase the shutter time or the brightness.

④ If the measurement result is too bright, you should decrease the shutter time or the brightness.

⑤ You should click **Measure** every time when you have adjusted the shutter time, brightness, or lens focus until the measurement result is normal and the captured size of the LEDs is between 150-270.

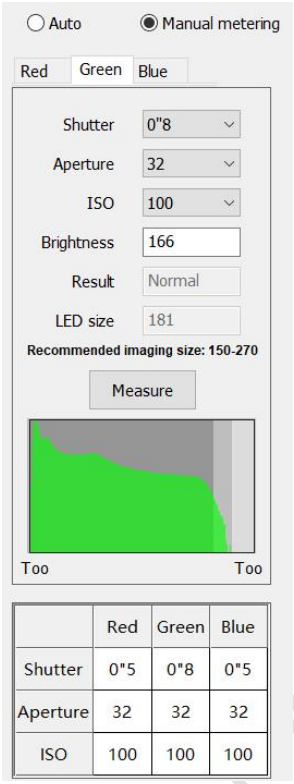


Fig.4-38 Manual metering

Note: When the captured size of the LEDs is far from the range (150-270), you will be prompted "WARNING: Too few pixels marked." or "WARNING: Too many pixels marked." In this case, you should check whether there are too many dead pixels or whether the screen have been blocked.

4.2.4 Image Capture

Click **Image Capture** to access corresponding tab. In the tab, select a partition and then adjust the position of the tripod head to make the camera face the selected partition. Then, click **Shoot**. *Calibration Pro* will automatically control the camera to capture image of the selected partition and conduct analysis. Once the procedure for the partition has finished, the software will automatically repeat the same process to the next partition until all partitions are captured and analyzed. During this period, you can put the mouse on the partition that is undergoing the procedure to view the progress of the task. See Figure 4-39.

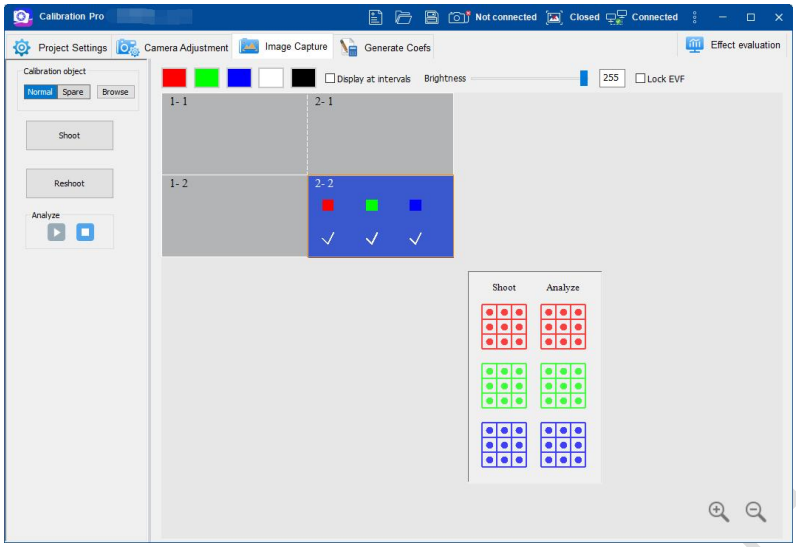


Fig.4-39 Image capture

- Once a color (Red, Green, or Blue) of a partition has been captured, it will be shown on the corresponding partition and the background color of that partition will change to light blue (see Figure 4-39).

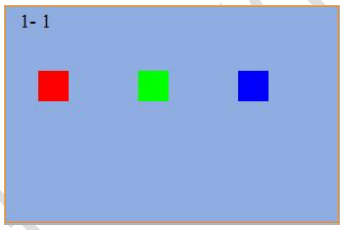


Fig.4-40 Shooting complete

- Once the analysis of the components is completed, a white check mark will appear below the corresponding color. When a partition has been captured and analyzed, its background color will change to dark blue (see Figure 4-41).

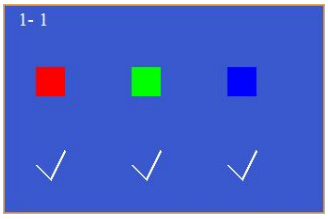


Fig.4-41 Shooting and analysis complete

4.2.5 Generate Coefs

4.2.5.1 Brightness After Calibration

Once the shooting and analyzing have been completed, you can access the interface for generating coefficients. Next, you can click **Generate luminance map** to view the brightness loss automatically calculated. You can also modify the post-calibration brightness to change the brightness loss.

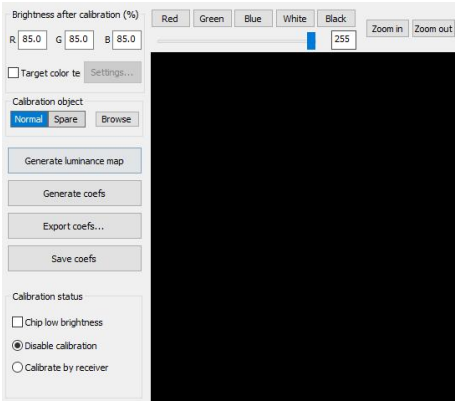


Fig.4-42 Brightness calibration mode

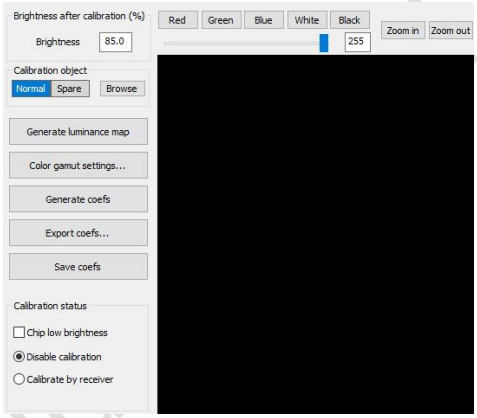


Fig.4-43 Chroma calibration mode

4.2.5.2 Settings

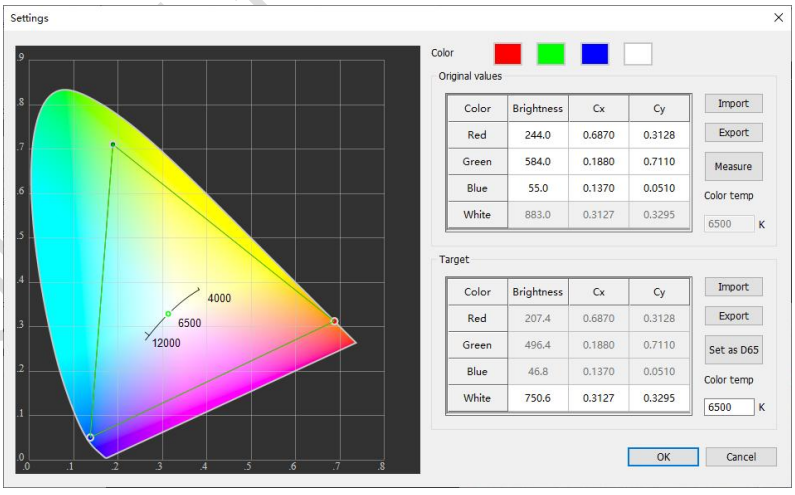


Fig.4-44 Target color temperature settings in brightness calibration mode

- **Color**: Click on a colored box to let the screen display the corresponding color.
- **Original values**: You can measure the original values by clicking **Measure**

after connecting to the color meter. Besides, you can also import the existing brightness value and coordinates, or double-click the value to modify. *Calibration Pro* will calculate the white point's color temperature based on the original values. You can export the original values by clicking **Export**. If you don't need to adjust the target temperature, you can simply skip this step.

- **Target**: You can adjust the coordinates of the target white point in this sheet. Click **Import** to import the existing target values. Clicking **Export** allows for saving the new target values. You can also click **Set as D65** to set the color temperature to the standard 6500K. In addition, you can double-click the brightness, x, and y of White in the sheet, and then enter the new values.

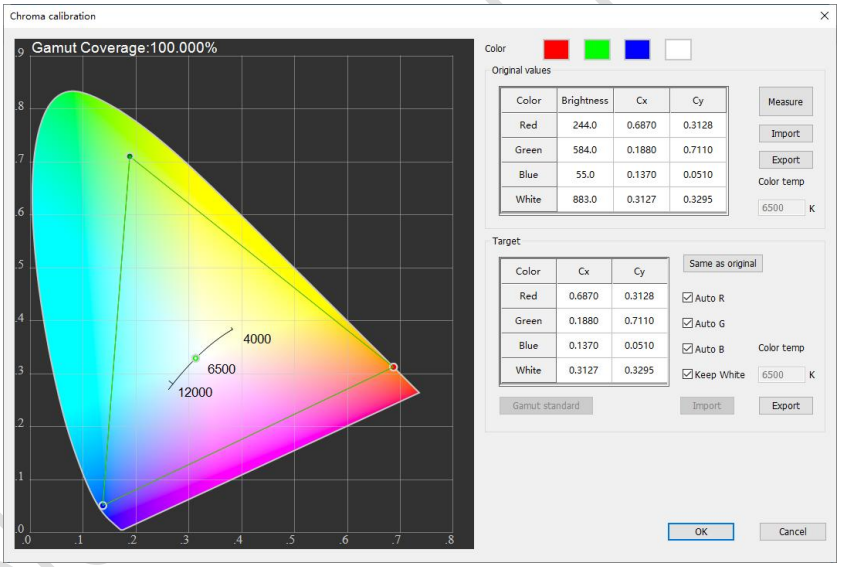


Fig.4-45 Color gamut settings interface

- **Color**: Click on a colored box to let the screen display the corresponding color.

- **Original values**: You can measure the original values by clicking **Measure** after connecting to the color meter. Besides, you can also import the original screen brightness and color gamut, or double-click the input boxes to modify the value. Clicking **Export** allows for exporting and

saving the original values. If you don’ t need to modify the values, you can simply skip this step.

- **Target**: You can adjust the target color gamut and the color temperature coordinates in this sheet. By default, the values in this sheet are calculated automatically. You can unselect **Auto** and double-click the input boxes to enter the new values if necessary. Besides, you can also apply the standard color gamut settings (*Calibration Pro* provides parameters of sRGB, AdobeRGB, PAL, NTSC, Rec.601, Rec.709, Rec.2020, and DCI-P3). If you select **Same as original**, there will not be color gamut loss.

- **Color spot reduction**: This option is available during chroma calibration for regular screen. You can select this option to optimize the color spot issue after the calibration.

4.2.5.3 Sending and Exporting Coefficients

- You can click **Generate luminance map** and then control the screen color and brightness on the control bar. In addition, you can also select **Zoom in**, **Zoom out**, or **1:1** to control the display of the luminance map. If you want to view the distribution of the shooting area on the screen, you can select the **Show partition line** checkbox.

Fig.4-46 Display control bar

- You can obtain coefficients by clicking on **Generate coefs**.

- Once the coefficients have been successfully generated, you can click **Save coefs** to save the coefficients to all areas or a specified area.

- You can then switch on/off the calibration.

- You can click **Export coefs** and then select **Export all**, **Export coefs by**

sender, or **Export by partition** based on your need to save the calibration coefficients.

- Spare calibration: Select **Calibration object** > **Switch** > **Spare**, and then click **OK**. You will then access the interface for spare calibration. Next, you can select the partition that you want to replace with a spare. And then you can click **Shoot** to start the spare calibration.

4.2.6 Effect Evaluation

Once a partition has finished calibration, the calibration parameters can be saved to receivers. With the calibration function enabled, you can then capture the calibrated partition again to evaluate the calibration effect. You can access the evaluation window by clicking on the icon at the right end of the toolbar.

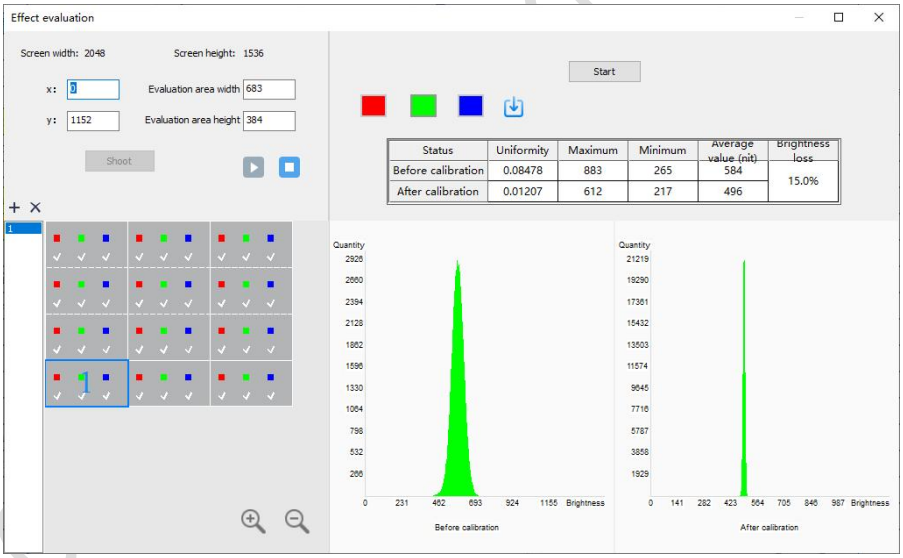


Fig.4-47 Effect evaluation

1) The **Screen width** / **Screen height** represents the width/height of the full-screen of the current project.

2) The **x** and **y** indicate the initial coordinates of the selected partition. Modifying the coordinates can change the evaluated partition. Also, you can add partitions for evaluation by clicking on the + icon above the

evaluated partition list. Each partition is seen as an individual evaluation area, which is marked by a number that corresponds to its number in the evaluation list.

3) Select one evaluated partition from the list, and then adjust the tripod head to make the camera face the lit part of the screen. Then, with the calibration function enabled, click **Shoot** to let *Calibration Pro* capture and analyze images of the evaluated partition. Next, click **Start** to begin the evaluation. The right side of the interface will display a statistical table that contains data before and after the calibration respectively. Below the table are 2 histograms representing the situation before and after the calibration.

4) The statistical table shows information about the evaluated partition before and after calibration, including **Uniformity**, **Maximum** (brightness), **Minimum** (brightness), **Average value (nit)**, and **Brightness loss**.

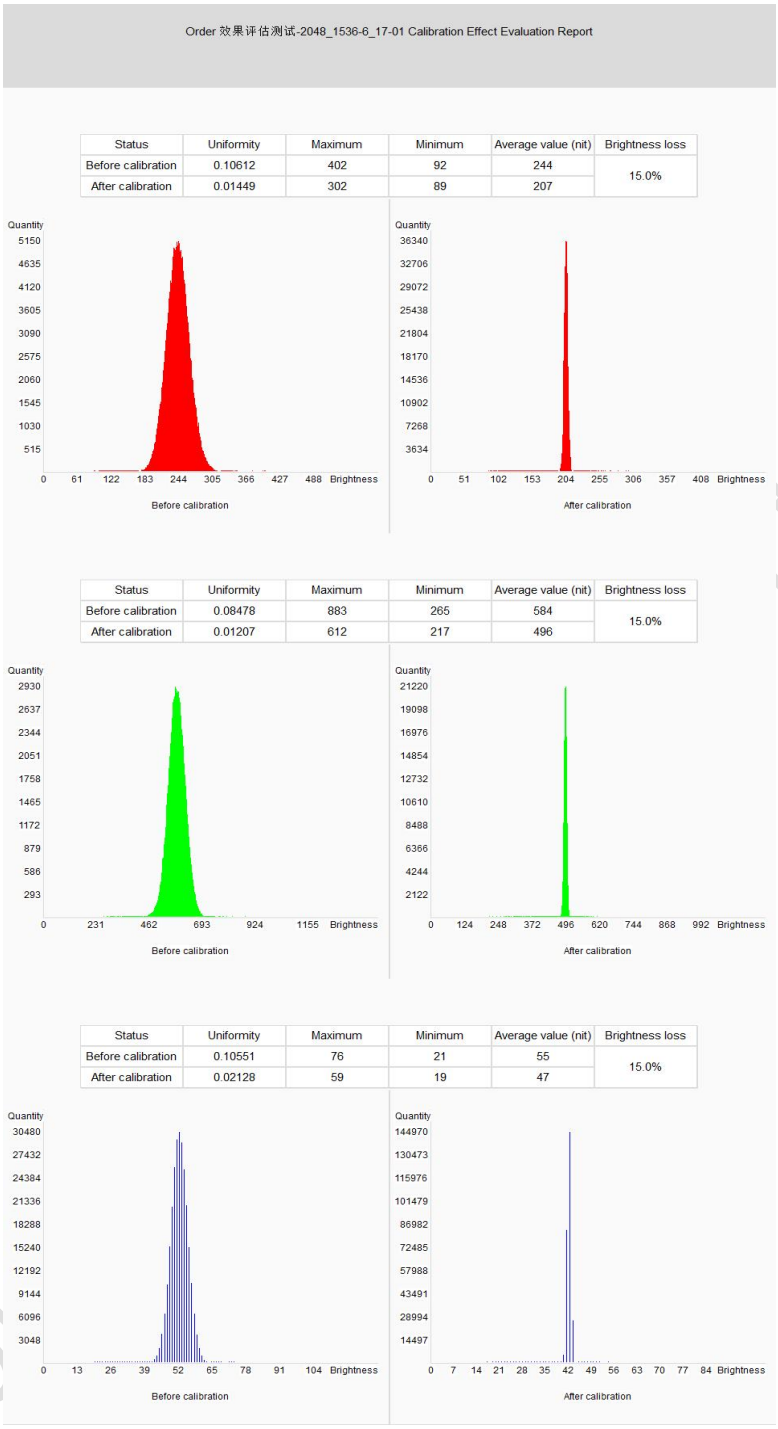


Fig.4-48 Effect evaluation report

5) You can view the statistical information and the layout of the LEDs (Red, Green, and Blue) by clicking on the icons , , and respectively. Then, you can click the icon to save the evaluation report to your PC.

4.3 Cabinet Calibration

4.3.1 New Cabinet Project

Step 1: Cabinet project wizard-1

In the start screen of *Calibration Pro*, click **New cabinet project** to access the **Cabinet project wizard-1** (see Figure 4-49). Then, select a way for control PC connection.

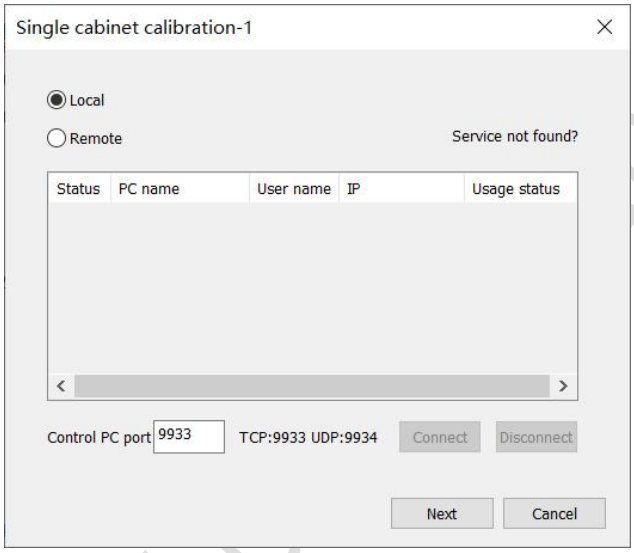


Fig.4-49 Cabinet project wizard-1

Step 2: Cabinet project wizard-2

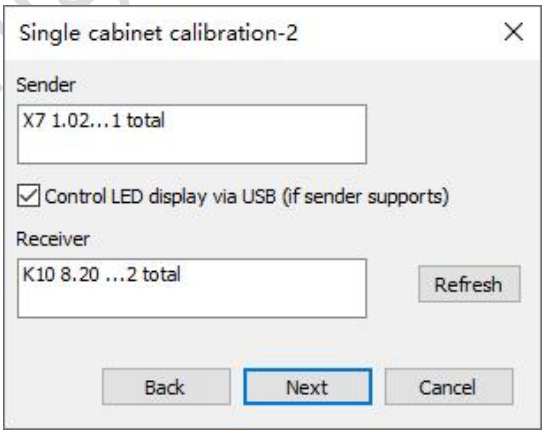


Fig.4-50 Cabinet project wizard-2

Note: You can refer to **Full-screen project wizard-2** for reference.

Step 3: Cabinet project wizard-3

Select **Cannon** in this step. See Figure 4-51.

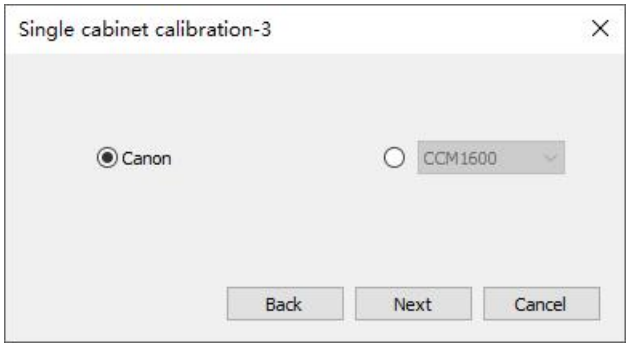


Fig.4-51 Cabinet project wizard-3

Step 4: Cabinet project wizard-4

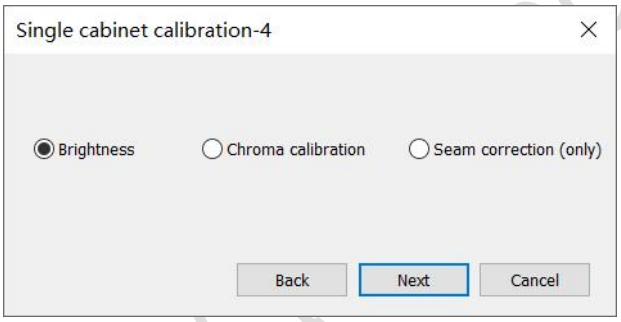


Fig.4-52 Cabinet project wizard-4

Note: You can refer to **Full-screen project wizard-4** for reference.

Step 5: Cabinet project wizard-5

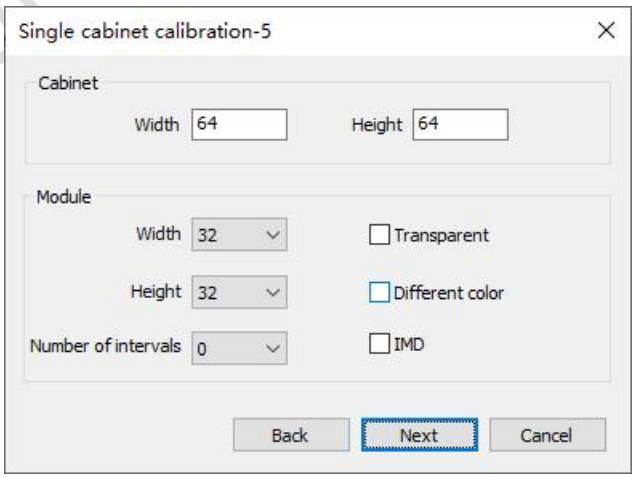


Fig.4-53 Cabinet project wizard-5

- **(Cabinet) Width/Height:** The resolution of the currently calibrated cabinet.
- **(Module) Width/Height:** The resolution of the currently calibrated module.
- **Number of intervals:** *Calibration Pro* will recommend a number after the cabinet width and height have been adjusted. You can also modify it manually.
- **Transparent:** This checkbox should be selected when the horizontal pixel pitch is different from the vertical one.
- **Different color:** Select this checkbox when the calibrated screen has modules with color difference.
- **IMD:** Select this checkbox when IMD module is used for the currently calibrated screen.

Step 6: Cabinet project wizard-6

- **Prefix:** Enter the prefix for the name of the new cabinets.
- **Count:** The number of cabinets that have been added to the cabinet list automatically.
- **Naming method:** Available options include: **Cabinet number**, **Row-Column**, **Column (ABC)-Row**, and **Row (ABC)-Column**.
- **Cabinet per row:** Enter the number of cabinets on each row. The number you enter in this field will automatically change the cabinet name.
- **Example**: This field shows the example of a cabinet name automatically based on the **Prefix**, **Naming method**, and **Cabinet per row** you set before.

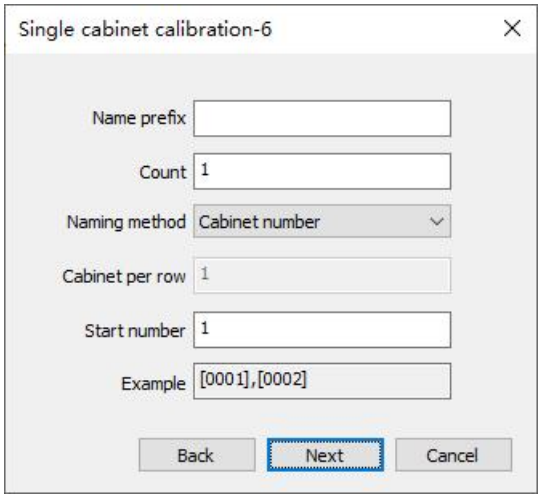


Fig.4-54 Cabinet project wizard-6

Step 7: Cabinet project wizard-7

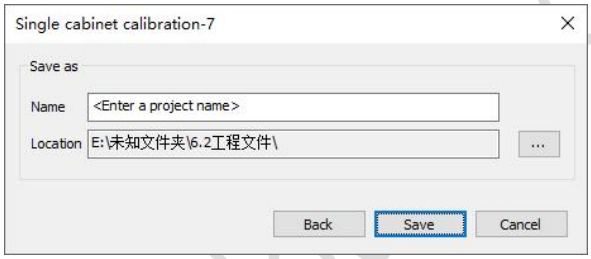


Fig.4-55 Cabinet project wizard-7

- **Name:** Enter the name of the calibration project in this field.
- **Location:** Select a path for saving the project file and data in this field.

Note: You can refer to **Full-screen project wizard-7** for reference.

4.3.2 Project Settings

4.3.2.1 Sender Mode

In the **Project Settings** tab, *Calibration Pro* will automatically detect senders and receivers once the control PC has been connected, and the senders and receivers that have been detected will be shown in the tab. See Figure 4-56.

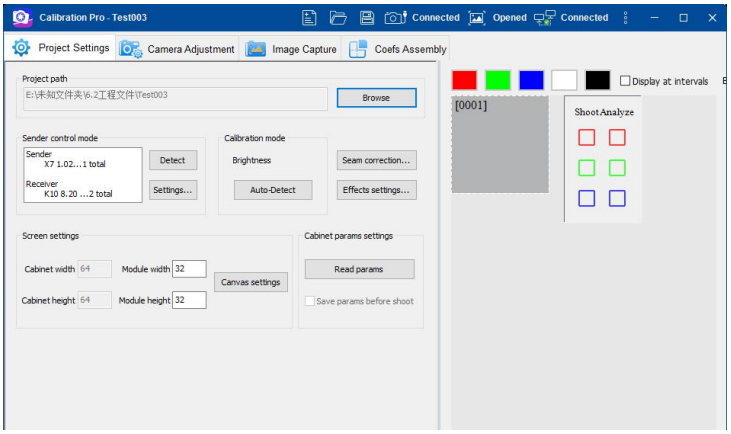


Fig.4-56 Main interface of cabinet project

- **Detect**: Click **Detect** to detect the currently connected senders and receivers, and then you will be able to view the model, version number, and amount of the senders and receivers detected.
- **Settings...:** Click **Settings...** to bring up a pop-up window where you can enable or disable the option **Display control via USB (if sender supports)**. See Figure 4-57.

Fig.4-57 Control LED display via USB (if sender supports)

4.3.2.2 Calibration Mode

Click **Switch** to choose a calibration mode. Available options include: **Brightness** and **Chroma**. See Figure 4-58.

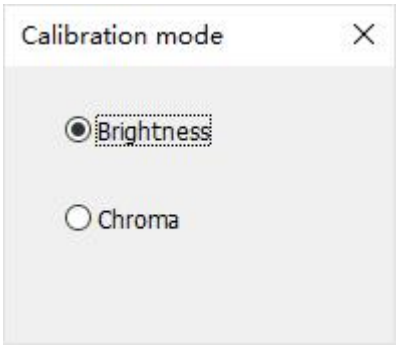


Fig.4-58 Available calibration modes

4.3.2.3 Seam Correction

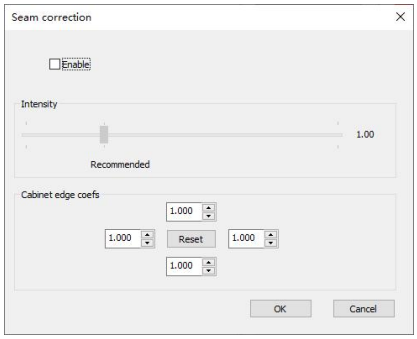


Fig.4-59 Seam Correction

- **Seam correction**: This function is enabled by default. You can disable it according to your need. See Figure 4-59.
- **Intensity**: This field indicates the intensity of brightness adjustment for LEDs at the edges of the cabinet. The default intensity is 1. If the dark (or bright) line turns to be too bright (or too dark) after seam correction, you can lower the intensity appropriately. However, if you find the line still relatively dark (or bright) after correction, you can then increase the intensity appropriately.

If you have selected **Seam correction (only)** before, you cannot perform the brightness/chroma calibration, and the seam correction function will be enabled by default. See Figure 4-60.

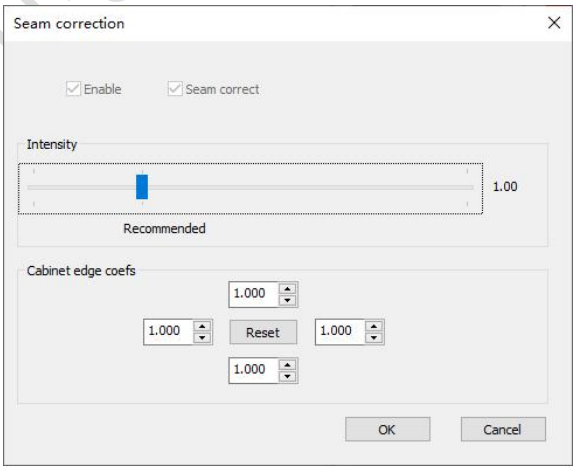


Fig.4-60 Seam correction (only) settings

- **Cabinet edge coefs**: You can fine tune the coefficients of the cabinet edge based on the existing calibration coefficients in this field. This operation can fix the dark and bright lines between cabinets.

4.3.2.4 Effect Settings

You can refer to **Section 4.2.2.4 Effect Settings** for reference.

4.3.2.5 Screen Settings

In this field, you can set the width and height of the current cabinets and modules.

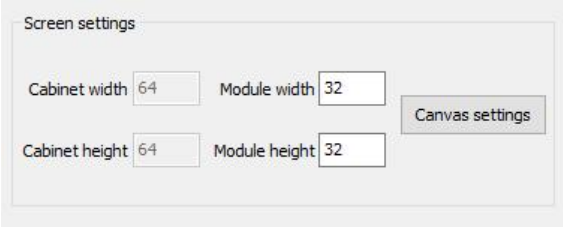


Fig.4-61 Screen settings

Canvas settings: If you have not selected **Display control via USB (if sender supports)**, you will find the **Canvas settings** option in **Screen settings**. Click this option to access the pop-up window where you can set the start coordinates of the canvas.

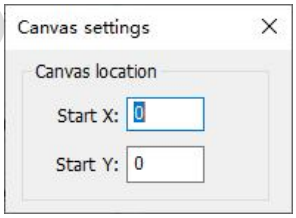


Fig.4-62 Canvas settings

4.3.2.6 Cabinet Parameters Settings

Connect to the sample cabinet that has saved receiver parameters and topology. Then, click **Read reference cabinet params** to save the parameters and topology from the sample cabinet. Once the parameters have been successfully read, you can select **Save params before shoot** so that the

real-time parameters and topology will be automatically sent to the receivers before shooting photo for cabinet calibration. See Figure 4-63.

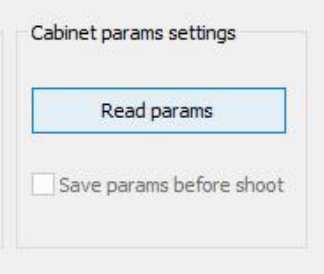


Fig.4-63 Cabinet parameters settings

4.3.3 Camera Adjustment

Note: You can refer to **Section 4.2.3 Camera Adjustment** for reference.

4.3.4 Image Capture

4.3.4.1 Capture Settings

The interface of image capture for single cabinet calibration is as shown in Figure 4-64.

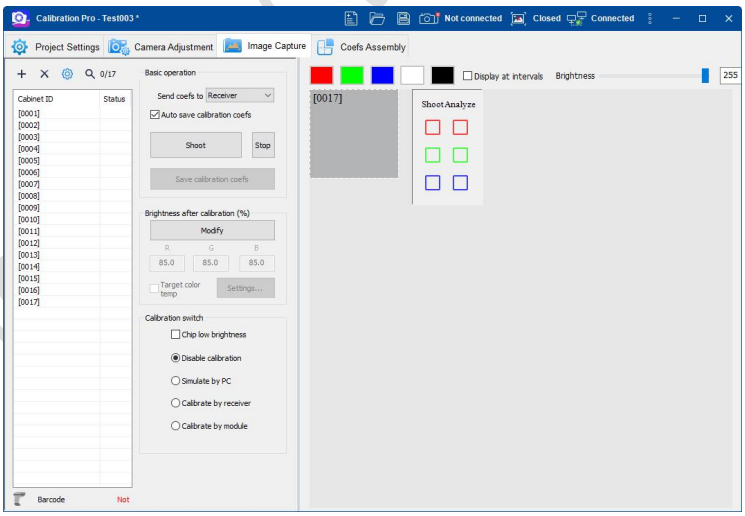


Fig.4-64 Single cabinet image capture

1) Settings

In **Image Capture** tab, available options above the cabinet list include: ＋ (Add cabinet), ✕ (Delete the selected cabinet), ⚙ (Settings), and

(Search in cabinet list). Click Settings icon to bring up the corresponding window. See Figure 4-65.

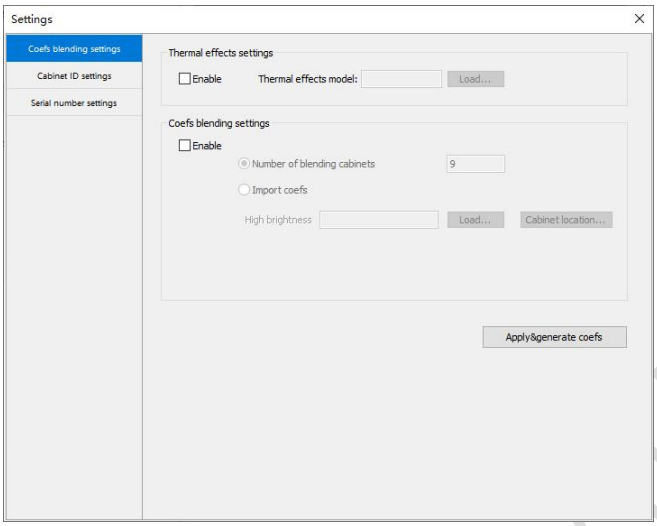


Fig.4-65 Single cabinet calibration settings

- **Thermal effects settings**: This option is for importing the thermal effects removal model to eliminate the negative effects caused by warm screen. You can select this checkbox to enable **Thermal effects removal** for the subsequent cabinets.
- **Coefs blending settings**: Use the data applied to the **Number of blending cabinets** so as to automatically eliminate the vignetting of the camera and the lens. By default, this number for modules with different colors is 9. With this function enabled, a de-vignetting model will automatically be generated when the number of calibrated cabinets reaches the set number of blending cabinets. The model will automatically be applied to the subsequent cabinets. In this case, the coefficients should also be recent. If this function is not enabled, the model will not be applied to the subsequent cabinets.
- **Apply & generate coefs**: Click this button to let the software automatically generate cabinet coefficients of all the calibrated cabinets based on the reference model and the coefficients blending settings.

- **Cabinet ID settings**: You can refer to **Cabinet project wizard-6**.
- Double-click the target cabinet ID in the cabinet list to bring up the window where you can modify the ID. Once you have changed the cabinet ID, the calibration data will also change accordingly. After the end of shooting and analyzing, the background color of the cabinet list will change to light blue, and when the coefficients have been successfully sent, a green check mark will appear on the status column.

2) Coefficient saving

- The coefficients will be sent to receivers by default; when smart module is adopted, you can select a target to send the coefficients. Available options include: **Receiver**, **Receiver&module**, and **Module**.

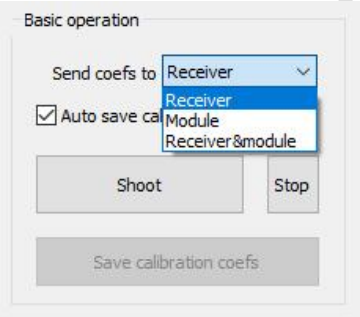


Fig.4-66 High brightness capture

Auto save calibration coefs is selected by default. When the coefficients are generated after image analyzing, the coefficients will automatically be sent to the receivers, modules, and chips.

3) Chroma calibration mode

The brightness after calibration is 85% by default. You can click the input box in the **Brightness after calibration** field to modify the brightness. Click **Chroma settings** to bring up the window where you can change the original color gamut and the target gamut. You should do the settings once for the first calibrated cabinet. The settings will then be applied to the subsequent cabinets.

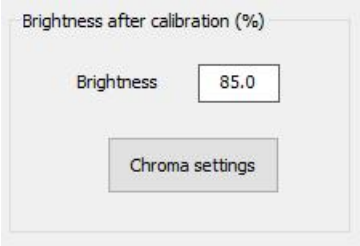


Fig.4-67 Brightness after calibration

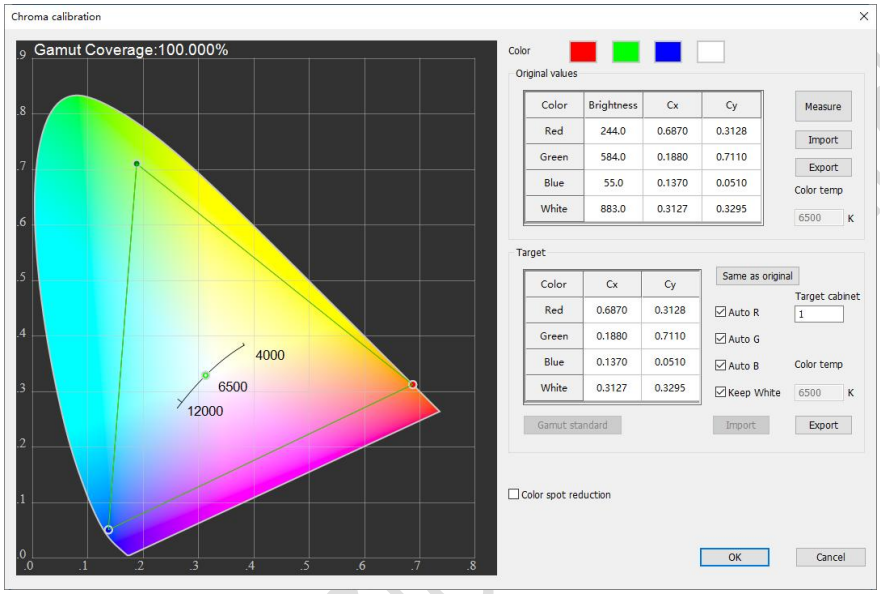


Fig.4-68 Chroma settings

- **Original values**: You can measure the original values by clicking **Measure** after connecting to the color meter. Besides, you can also import the existing brightness value and coordinates, or click the value to modify. Clicking **Export** allows for exporting and saving the original values.
- **Target**: *Calibration Pro* will give a target gamut based on the data captured by the camera. If you want to modify the target gamut, you can deselect **Auto R/G/B**. If you want to apply standard gamut, you can select the standard (available standards include sRGB, AdobeRGB, PAL, NTSC, Rec.601, Rec.709, Rec.2020, and DCI-P3), and then click **Import** to import the target gamut. Besides, you can also double-click the input boxes to enter the desired values. If you select **Same as original**, the target gamut will not be adjusted after calibration.

4) Brightness calibration

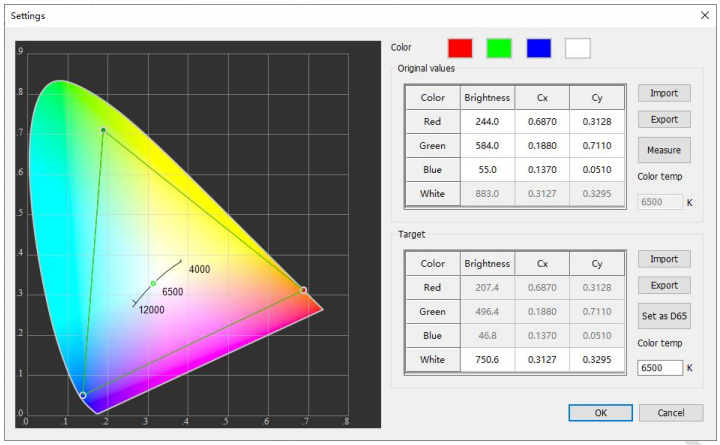


Fig.4-69 Target settings for brightness calibration

- **Color:** Click a colored box to let the screen display the selected color.
- **Original values**: You can measure the original values by clicking **Measure** after connecting to the color meter. Besides, you can also import the existing brightness value and coordinates, or double-click the value to modify. *Calibration Pro* will calculate the white point's color temperature based on the original values. You can export the original values by clicking **Export**. If you don't need to adjust the target temperature, you can simply skip this step.
- **Target**: You can adjust the coordinates of the target white point in this sheet. Click **Import** to import the existing target values. Clicking **Export** allows for saving the new target values. You can also click **Set as D65** to set the color temperature to the standard 6500K. In addition, you can double-click the brightness, x, and y of White in the sheet, and then enter the new values.

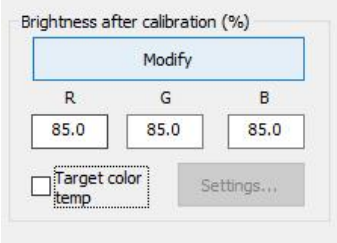


Fig.4-70 Brightness after calibration

- The brightness after calibration is 85% by default. You can click the input boxes below **R**, **G** and **B** respectively to modify the brightness. You should do the settings once for the first calibrated cabinet. The settings will then be applied to the subsequent cabinets.

4.3.5.2 Cabinet Capture Procedure

1) Click **Shoot** to start capturing cabinets from the selected cabinet list.

2) After the end of analyzing image and generating coefficients, the calibration coefficients will automatically be saved to receivers, module, and chip. The **Auto save calibration coefs** is enabled by default. You can unselect the function.

3) You will be prompted once the coefficients have been successfully saved. Clicking **OK** can continue calibrating the next cabinet. You can also click the color on top of the interface to check the calibration effect.

Fig.4-71 Display control area

4) Repeat step 1-3 to calibrate the rest cabinets.

4.3.5 Calibration Log

The calibration log records the abnormal event and the progress information of the calibration. When a cabinet finished calibration, or was added, deleted, or renamed, the event will be recorded into **Progress** sheet of the log. The operations such as switching calibration mode and modifying post-calibration brightness that will affect the calibration progress and effects will be recorded into the **Exception** sheet.

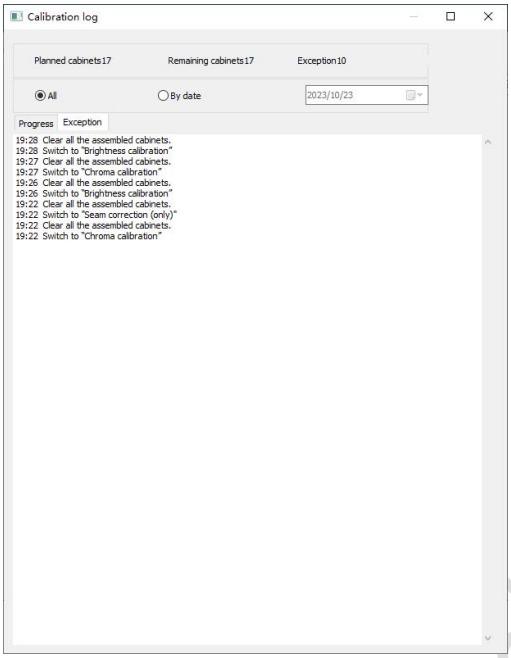


Fig.4-72 Calibration log

- **Planned cabinet count**: This number conforms to the cabinet count in the cabinet list.
- **Remaining cabinet count** = **Planned cabinet count** − calibrated cabinet count
- **Exception**: This field shows the number of abnormal cabinets during calibration.
- **All**: This field shows the progress and exception records of the project.
- **By date**: Click the downward arrow to select a date from the drop-down calendar so as to check the calibration record generated on the selected date.

4.3.6 Coefs Assembly

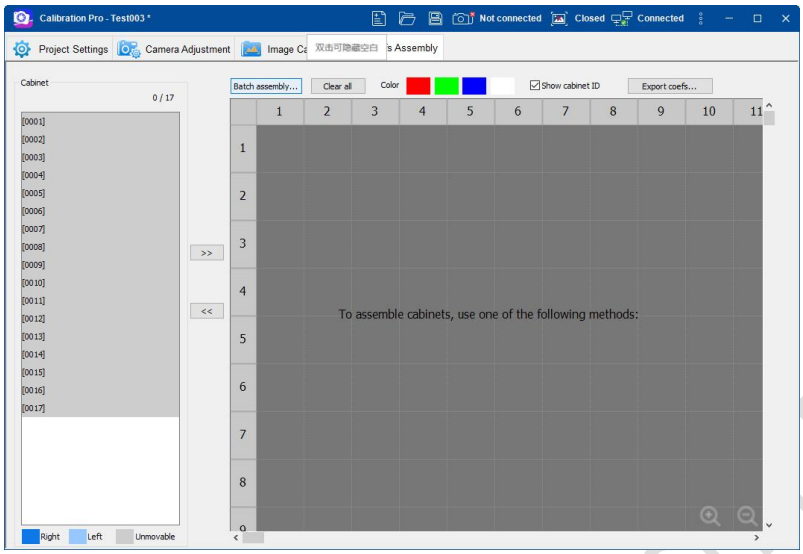


Fig.4-73 Coefficient assembly

You can access the **Coefs Assembly** tab after the end of cabinet calibration. In cabinet list on the left side of the tab, the cabinets that have finished calibration will be colored dark blue. You can assemble the luminance map on the right side of the tab.

Select a cabinet with dark blue background and then click the rightward double arrows button in the middle of the interface to add the luminance map of the selected cabinet to the assembly area on the right side. The added map can move freely on the assembly area. If you want to remove a map from the area, you can simply select the map and then click the leftward double arrows button in the middle of the interface. A cabinet with gray background indicates it has not finished calibration and its luminance map cannot be added to the assembly area.

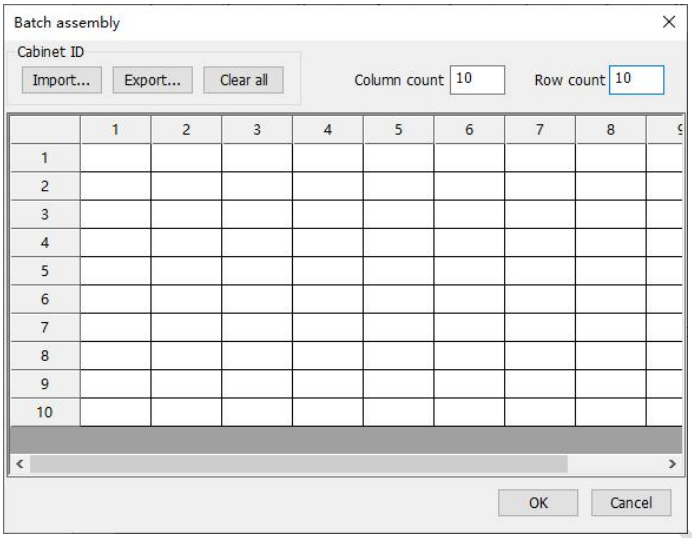


Fig.4-74 Batch assembly

Batch assembly: Enter target cabinets' names into an Excel table first. Then, in the **Batch assembly** window, import the Excel table. The cabinets' luminance maps will then automatically be assembled according to the naming method of the cabinets. Next, click **Export coefs** to export the assembled cabinet coefficients based on the cabinets' layout in the assembly area. The coefficients will be exported either as full-screen coefficients or by partitions or by modules.

Chapter5 Menu

5.1 Default Settings

Click the **Menu** button  and then select **Settings** > **Default settings** to bring up a pop-up window where you can perform photo deleting settings, set up brightness after single gray level calibration, and select default location for saving project. See Figure 5-1.

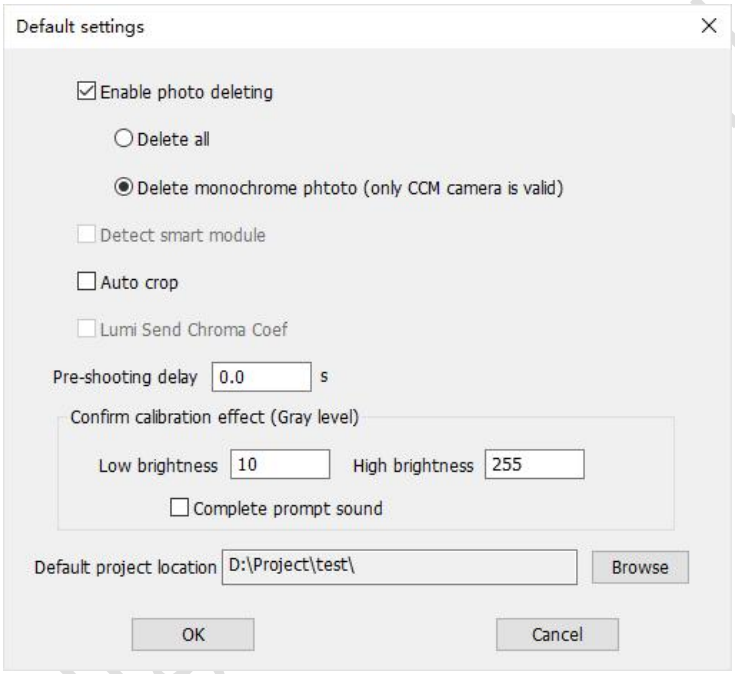


Fig.5-1 Default settings

- **Enable photo deleting**: If you select this checkbox, the software will automatically delete the photos that have been fully analyzed during the camera capturing process. The monochrome photo is only available in an operating environment using industrial camera. After deleting the monochrome photo, you can still gain the analysis result.
- **Detect smart module**: If you select this checkbox, the smart modules will be detected, if any. If there is a smart module detected, you can send coefficients to the module.

- **Auto crop**: When this option is selected, the image captured will automatically be cropped for an effective area, reducing the negative impact of oversize image and non-related area on the analysis.
- **Brightness calibration sends chroma coefs**: This option is only available for high brightness calibration project.
- **Pre-shooting delay:** The default delay is 0. You can set a countdown for shooting, activating the capture after the designated time from the moment you click **Shoot**.
- **Confirm calibration effect (Gray level):** The default gray level in low brightness is 10. After the end of low brightness calibration, the software will automatically enable this calibration and display color white at gray level 10 on the screen for you to check the calibration effect. The default gray level in high brightness is 255. After the end of high calibration, the software will automatically enable this calibration and display color white at gray level 255 on the screen for you to check the calibration effect.
- **Completion sound**: When selected, the software will play a reminding sound once the calibration is completed.

5.2 Hardware Device

Click the three-dot button  for menu, then select Hardware device for a pop-up management window. The hardware devices include **Camera**, **PLC**, **Scanner**, and **Color meter**. The tabs for **PLC** and **Scanner** management are only available with an open project.

- **Camera**

In this tab, you can control the connection and EVF of the camera. After the connection, you can view information of the camera. If it is an industrial camera, you can view its model, CCD temperature, resolution, and driver

version. If it is a Canon camera, you can view its resolution, exposure mode, current shutter, current aperture, focus ring value, and the quality of the photos captured by it.

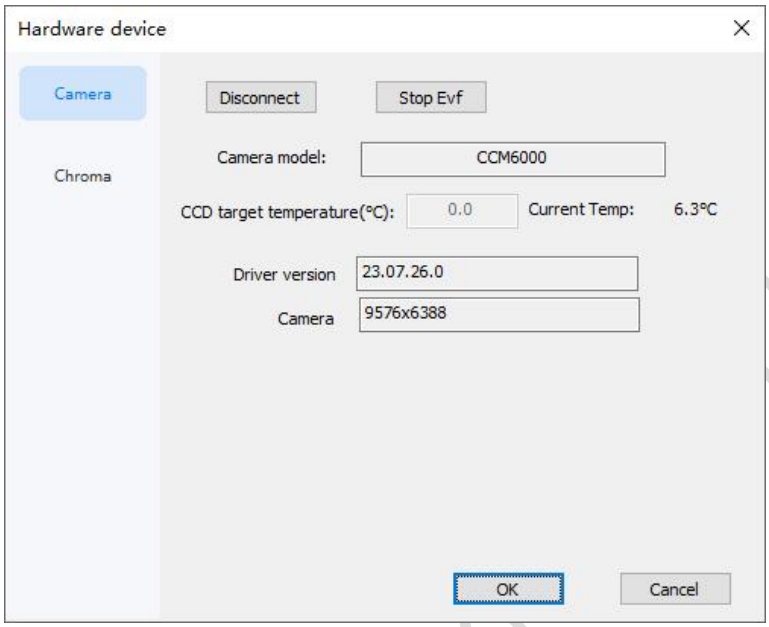


Fig.5-2 Camera

- PLC

You can configure the PLC connection in this tab.

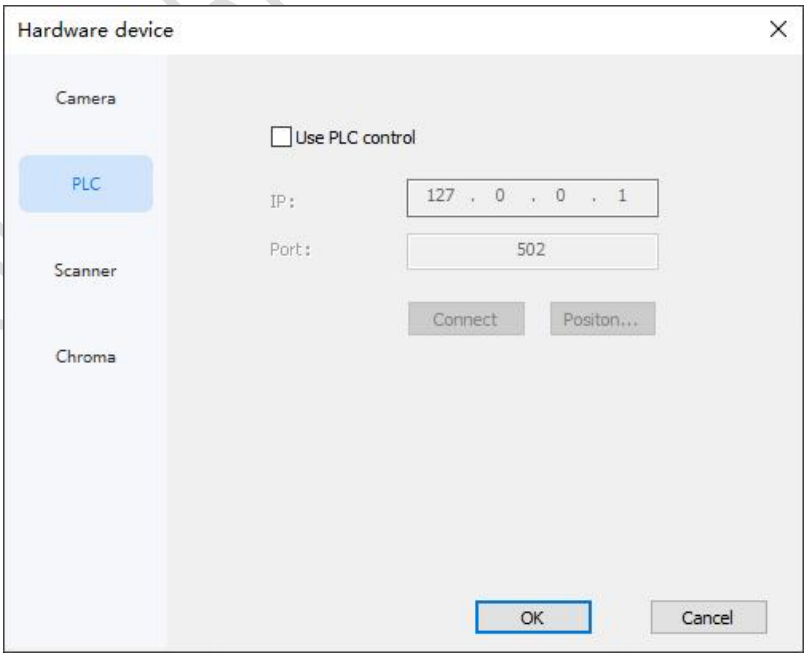


Fig.5-3 PLC

- **Scanner**

You can manage the scanner connection and enable **Calibration with scanner** in this tab.

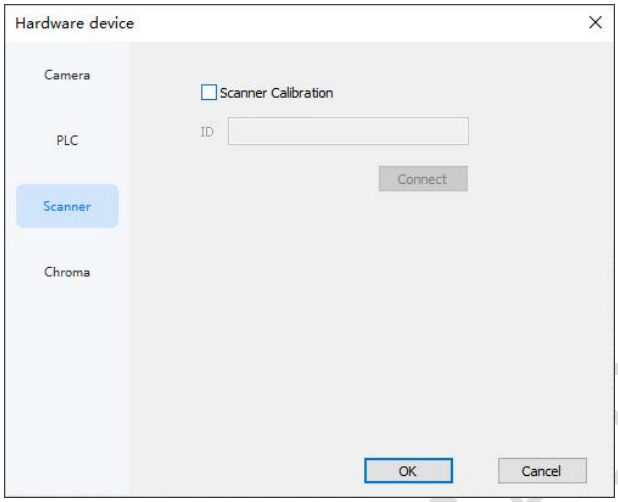


Fig.5-4 Scanner

- Color meter

In the tab, you can connect to the color meter CS2000. Click **Measure** upon connecting to the color meter. Then, the spectral data of the 3 colors (Red, Green, and Blue) of the screen will be measured and shown in the tab. You can then click **Export spectral data** to export the RGB spectral data in .csv (Excel) format.

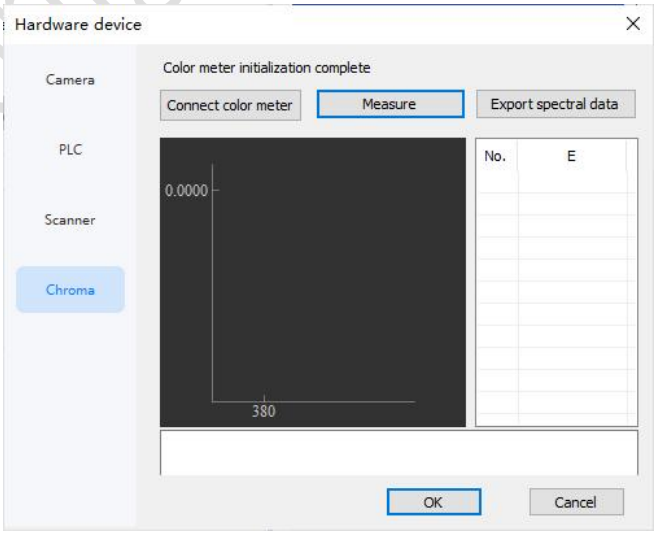


Fig.5-5 Color meter measurement - Green

5.3 Image Viewing

Click the **Menu** button  and then select **Tools** > **Image viewing** to view the captured images. See Figure 5-6.

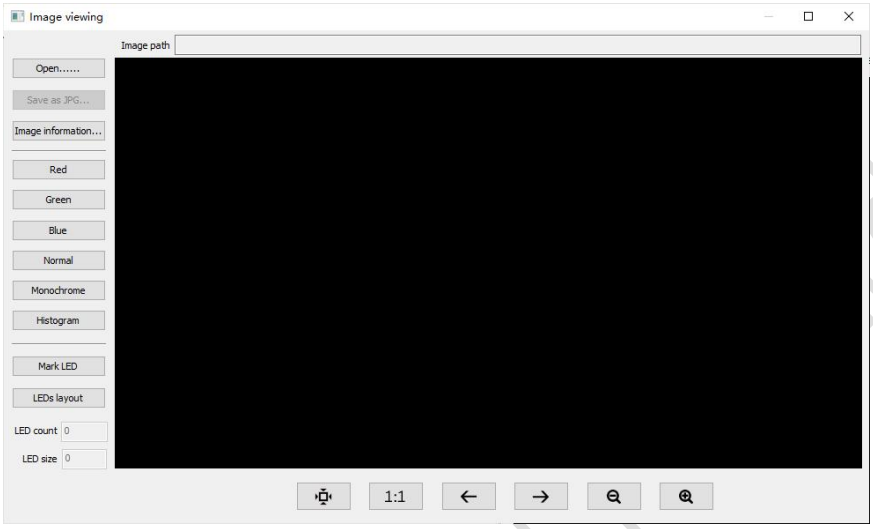


Fig.5-6 View image

- **Open...**: Click **Open...** to select a photo to view.
- **Save as JPG**: Click **Save as JPG** to save the currently opened photo in .JPG format.
- **Image information**: Click **Image information** to check information about the currently opened photo, including: **Width**, **Height**, **Time**, **Shooting mode**, **Shutter**, **Aperture value**, **ISO**, **Focal length**, **Color temp**, **Temp**, **Manufacturer**, **camera model**, and **Lens model**.

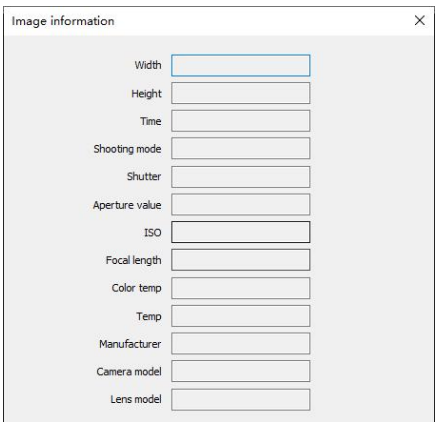


Fig.5-7 Image viewing - Image information

- **Red/Green/Blue/Normal**: Respectively shows the RGB information and the comprehensive information of the current photo.
- **Monochrome**: Shows the gray level layout information of the current photo.
- **Histogram**: Shows the brightness layout information of the current photo.
- **Mark LED**: Shows the LEDs identified and marked by the software.
- **LEDs layout**: Shows the LEDs layout of the current photo.
- **LED count**: Shows the LED count of the current photo.
- **LED size**: Shows the LED size of the current photo.
- You can click the icon to view the complete image, or select **1:1** to view the current photo pixel to pixel. Clicking ← can return to the previous photo and clicking → can access the next photo. You can also zoom in / zoom out on the photo by clicking / .

5.4 Tools

5.4.1 CoefRotateTools

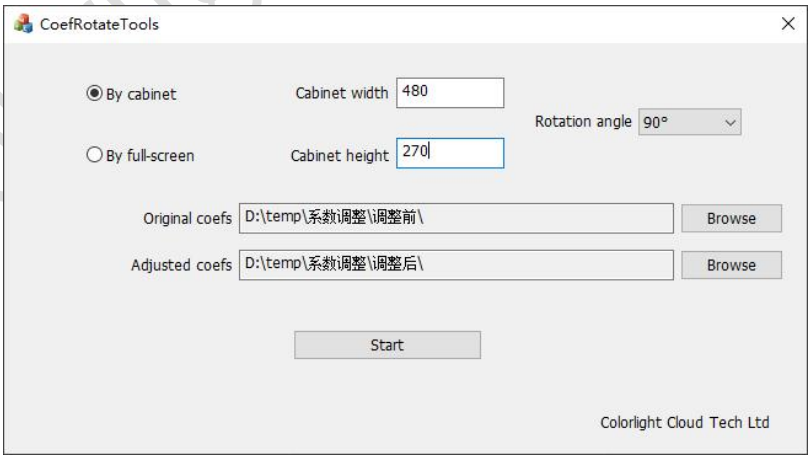


Fig.5-8 Coefficient rotation settings

You can rotate the cabinet or screen coefficients (clockwise by default).

- **By cabinet**: Set the width and height of the cabinet.
- **By full-screen**: Set the width and height of the screen.
- **Rotation angle**: Set the rotation angle for the coefficients. By default, the coefficients will be rotated in a clockwise direction. Available angles include: 90, 180, and 270.
- **Original coefs**: Select the location for saving the original coefficients.
- **Adjusted coefs**: Select the location for saving the adjusted coefficients.

You can click **Start** once you have finished the above settings. The original coefficients will then be rotated and saved according to the settings.

5.4.2 CrossTools

Based on the difference between the cold and warm screen coefficients, the **CrossTools** can be used to fix the problem caused by the thermal effect of the screen. The corrected coefficients can be saved locally.

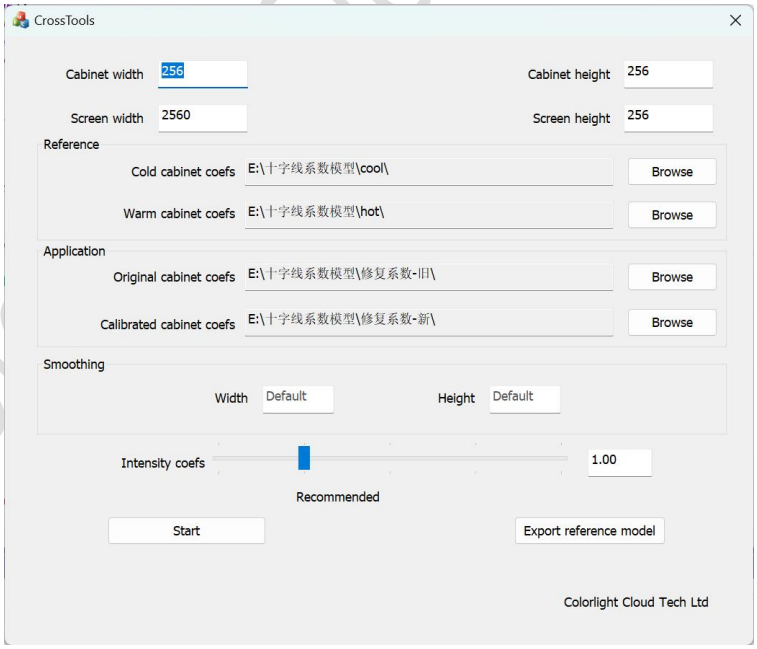


Fig.5-9 CrossTools for thermal effect removal

- Cabinet width and height: Set the cabinet size.
- Screen width and height: Set the screen size.

- **Cold cabinet coefs**: Select a location for saving the cold cabinet coefficients.
- **Warm cabinet coefs**: Select a location for saving the warm cabinet coefficients. The name of the cold cabinet coefficient should be the same as that of the warm cabinet coefficient.
- **Original cabinet coefs**: Select a location for saving the original coefficients.
- **Calibrated cabinet coefs**: Select a location for saving the coefficients after thermal removal.
- **Intensity coefs**: The default intensity is 1. You can change the intensity if necessary.

You can click **Start** once you have finished the above settings. The cabinet calibration coefficients after thermal removal will be generated automatically. You can then click **Export reference model** to export the coefficients.

5.4.3 Gamma Test

You can use color meter (model CA-VP427 or CS2000) to test the Gamma linearity of the screen.

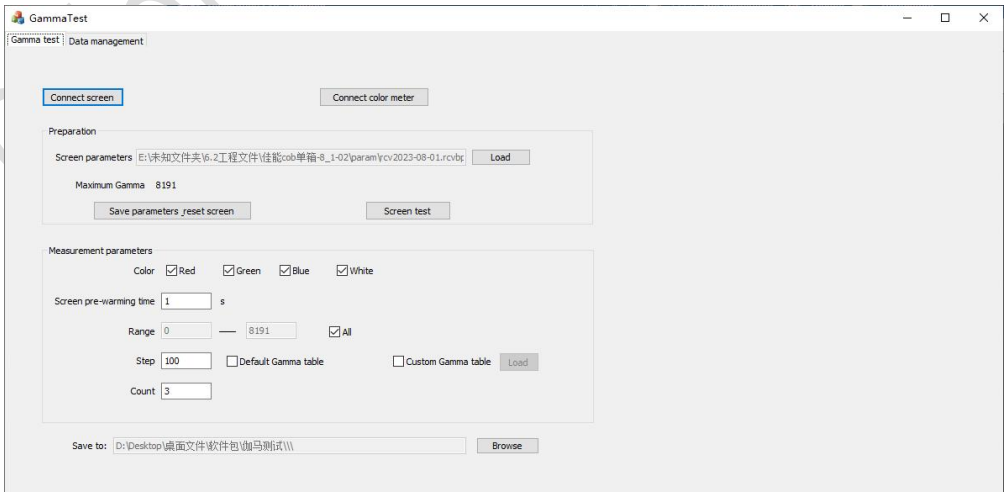


Fig.5-10 Gamma test settings

- **Connect screen**: Click this button to detect sender and control the screen.
- **Connect color meter**: Connect to the currently adopted color meter.
- **Screen test**: Click this button to test the screen color.
- **Color**: Select colors to be tested.
- **Screen pre-warming time**: Set a duration for screen pre-warming.
- **Range**: Shows the range of Gamma value (0-Max. Value) by default. The range can be modified manually.
- **Step**: Set the increment of the Gamma test. If you select **Default Gamma table**, the Gamma table of the current screen will be tested. You can also click **Load** to load a customized Gamma table. A green check mark will appear on the right side if the loading is successful.
- **Count**: Set the times for testing a same Gamma value.
- **Save to**: Select a location for saving the data generated during the test.

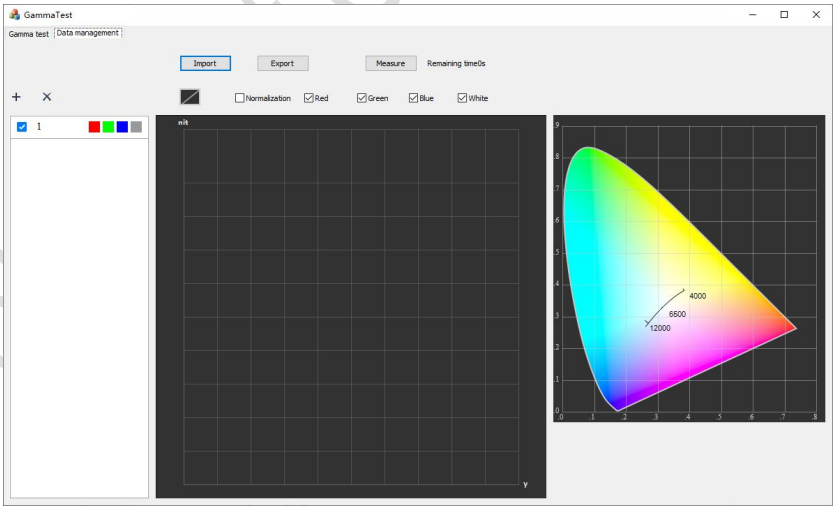


Fig.5-11 Gamma test - Date management

- **Import**: Import the previous Gamma test data.
- **Export**: Export the current Gamma test data.

- **Measure**: Measure the Gamma based on the current Gamma test settings.
- **Draw line segments**  : Select 2 points on the area below by clicking to draw a line segment connecting the 2 points.

5.4.4 Adjust Coefs

You can fix the problem of obvious color difference when the spare modules are changed to other position.

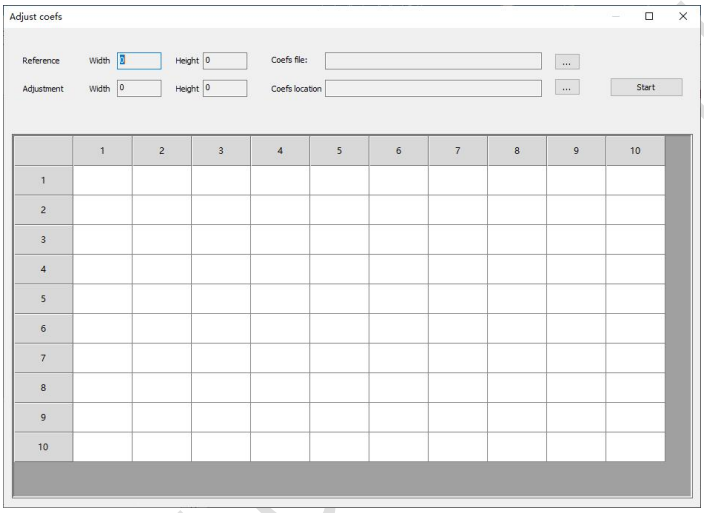


Fig.5-12 Coefficient adjustment tool

- **Coefs file** (next to **Reference**): Select a location for saving the full-screen calibration coefficients before changing spares.
- **Coefs location** (next to **Adjustment**): Select a location for saving coefficients of the spares that need to be adjusted.

Select the destination that you want to change the spare to, and enter the spare coefficient name. Then, you can click **Start**. A new full-screen coefficient after changing spares will be exported to the location you set (**Coefs file**), and a new coefficient after the adjustment will be exported to the **Coefs location** that you have selected before.

5.4.5 Calibration coefs mapping

In this window, you can re-map the LEDs coefficients based on the pixel drawing table.

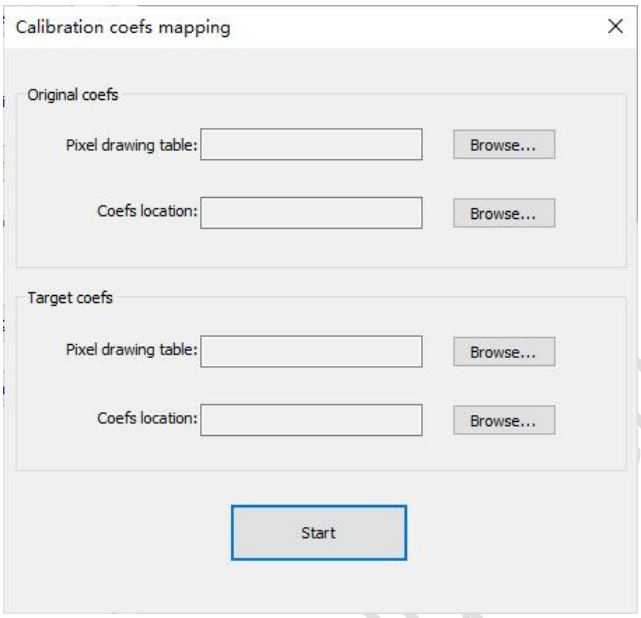


Fig.5-13 Coefficient remapping tool

5.4.6 Thermometer

You can view the real-time temperature of the screen in this window once a thermometer is connected.

Fig.5-14 Thermometer

Chapter6 FAQs

- Q: Failed to detect receiver?

  A: 1. Make sure you have connected the power supply.

  2. Ensure a stable connection.

- Q: Failed to launch *Calibration Pro* after installation?

  A: 1. Make sure all components have been installed.

  2. Do not launch the software EOS Utility.

- Q: Failed to connect to the control PC?

  A: 1. Ensure a stable firmware connection.

  2. Ensure a correct IP (if you have selected the local PC as the control PC, the IP should be 127.X.X.X), and then check if the ping is successful.

  3. Make sure the control PC and the client end share the same port, and try to establish ping with the target port (if the IP ping is successful but the port ping is not, it is usually caused by the firewall or router logic issue).

- Q: Abnormal screen display after launching *Calibration Pro* (such as screen flashing and screen artifact)?

  A: Use the software LEDVISION to adjust the display and then save the new parameters to the receivers.

- Q: Failed to connect to the camera?

  A: 1. Make sure the camera is supported by *Calibration Pro* (supported models include: CCM6000, Canon 70D, 80D, 90D, 7D, and 7D MarkII).

2. Ensure a stable firmware connections.

3. Make sure the camera is open and is not in the standby mode.

4. Make sure the camera is in manual mode (M mode).

5. Make sure the dongle has been inserted to your PC when you are using CCM6000 for calibration.

- Q: Failed to capture?

A: 1. Make sure you are using supported camera for calibration.

2. Make sure the camera is in manual mode (M mode).

3. Make sure the MF of the lens has been enabled.

- Q: The shutter speed is 1/30 and cannot be increased?

A: 1. Make sure the camera is in manual mode (M mode).

2. Make sure the camera is in picture mode (for taking photos) instead of in shooting mode (for taking videos).

- Q: Failed to analyze photos?

A: 1. Make sure you are using supported camera for calibration.

2. Reinstall *Calibration Pro* to ensure complete components.

3. Check the quality of capturing via **Image viewing**. In the **Image viewing** tab, you can first open a photo and then click **Measure brightness**, or view the monochrome and histogram to check whether the photo has the problem of focus error, overexposure, underexposure, or camera shake.

4. This problem might be caused by over-dense LEDs as the partition is too big. In this case, you can add intervals among pixels to decrease the LED density.

5. This problem might be caused by too many dead pixels or pixel displacement.

6. This problem might be caused by the lack of memory.

- Q: Photo quality unable to be improved even after repeated capturing?

A: Possible causes include: Focus error, overexposure or underexposure, or camera shake.

If it is caused by focus error, you can:

1. If you are using SLR camera, you should enable the viewfinder of the camera or switch to LIVE mode for focusing.

2. Try the MF mode to enhance focus accuracy.

If it is caused by overexposure/Underexposure, you can:

Set new camera parameters in **Camera Adjustment** tab.

If it is caused by camera shake, you can:

1. Ensure stable camera placing.

2. Disable the lens' stabilizer (if any) and the camera's stabilizer (if any).

- Q: Screen brightness/saturation decreased after calibration?

A: *Calibration Pro* will decrease the brightness of the relatively brighter point of the screen to ensure uniform brightness when performing brightness calibration, hence the decreased full-screen brightness after the calibration. When performing chroma calibration, the software will decrease saturation to ensure a uniform screen display and the brightness will also be calibrated during this process, hence the decreased full-screen brightness and saturation.

- Q: Screen artifact (with color spot) after calibration?

  A: 1.Check the quality of capturing via **Image viewing**. In the **Image viewing** tab, you can first open a photo and then click **Measure brightness**, or view the monochrome and histogram to check whether the photo has the problem of focus error, overexposure, underexposure, or camera shake.

  2. This problem might be caused by over-sized partition, which leads to too small imaging size and increase sampling error.

  3. This problem might be caused by inconsistency between the simulated calibration Gamma table and the target. Try to send parameters to receivers in this case.

  4. Deselect **Image dust off**.

- Q: Scan lines appeared after calibration?

  A: 1. This problem might be caused by too fast shutter speed. In this case, try to increase shutter and decrease the brightness at the same time.

  2. This problem might be caused by too low refresh rate. Try to increase the refresh rate in this case.

- Q: Color moiré (rippling effect) appeared after calibration?

  A: When you are capturing a high-resolution screen, the LED refresh rate might interfere with the pixel resolution, which leads to system error. The error include position error and brightness error. To fix this problem, you can:

  1. Make sure the camera frame is filled with image.

  2. Decrease partitions and increase focal length (you should perform metering again after adjusting the focal length).

3. Reduce the focus a little bit (you should perform metering again after adjusting the focus), and then try to capture with a little focus error (the error should not be too big to ensure normal analysis). And add intervals among pixels if necessary.

4. Disable **Seam correction** to eliminate the effect of position error.

Statement

This guide is for reference only and does not constitute any form of commitment. Please refer to the actual products (including but not limited to color, size, screen display, etc.)

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