



CC3 Screen Calibration

User Manual

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1 Software Introduction

The CC3 calibration platform is NovaStar's newest calibration software. This document mainly introduces screen calibration.

At the moment, screen calibration supports brightness calibration, high-precision brightness and chroma calibration, low-grayscale calibration, full-grayscale calibration 1.0, and full-grayscale calibration 2.0. With the advantages of fast calibration speed and high accuracy, screen calibration significantly reduces image capture time and enhances on-site calibration efficiency. It also effectively eliminates color discrepancies, ensuring highly uniform brightness and chromaticity across the entire screen. Additionally, it enables smooth and gradual grayscale transitions for MiniLED displays, significantly improving the overall image quality of MiniLED screens.

2 Software Installation

Prerequisites

- Obtain the installation package for CC3.
- A computer that meets the following requirements:
 - Operating system: Windows 10 (64-bit only), Windows 11
 - Screen: Recommended resolution 1920×1080
 - CPU: 3.0 GHz or greater
 - Network adapter: Intel(R) Ethernet Connection network adapter
 - RAM: Refer to the following table.

Number of Pixels (100 Million)	Calibration Plan	RAM Required	Disk Space Required
0.5~1	High-precision brightness and chroma calibration	16 GB	500 GB
	Full-grayscale calibration 1.0, full-grayscale calibration 2.0, brightness calibration, low-grayscale calibration		
2	High-precision brightness and chroma calibration	32 GB	
	Full-grayscale calibration 1.0, full-grayscale calibration 2.0, brightness calibration, low-grayscale calibration		
3	High-precision brightness and chroma calibration	64 GB	
	Full-grayscale calibration 1.0, full-grayscale calibration 2.0, brightness calibration, low-grayscale calibration		

Number of Pixels (100 Million)	Calibration Plan	RAM Required	Disk Space Required	
4	High-precision brightness and chroma calibration			
	Full-grayscale calibration 1.0, full-grayscale calibration 2.0, brightness calibration, low-grayscale calibration			
5	High-precision brightness and chroma calibration	128 GB	1 TB	
	Full-grayscale calibration 1.0, full-grayscale calibration 2.0, brightness calibration, low-grayscale calibration			
6~7	High-precision brightness and chroma calibration			
	Full-grayscale calibration 1.0, full-grayscale calibration 2.0, brightness calibration, low-grayscale calibration			
8~10	High-precision brightness and chroma calibration	256 GB		
	Full-grayscale calibration 1.0, full-grayscale calibration 2.0, brightness calibration, low-grayscale calibration			

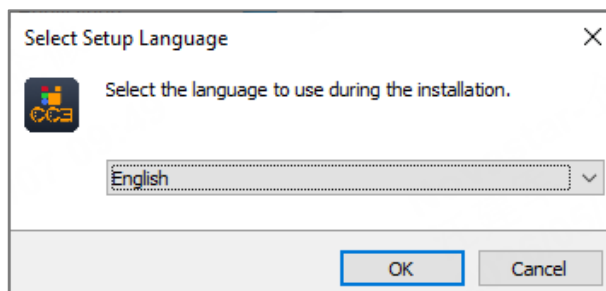
- If there is an older version of the software already installed, it needs to be uninstalled before installing the new version. Overwriting the existing installation is not supported.

The software UI screenshots in this document are provided using Windows 10 as an example.

Procedure

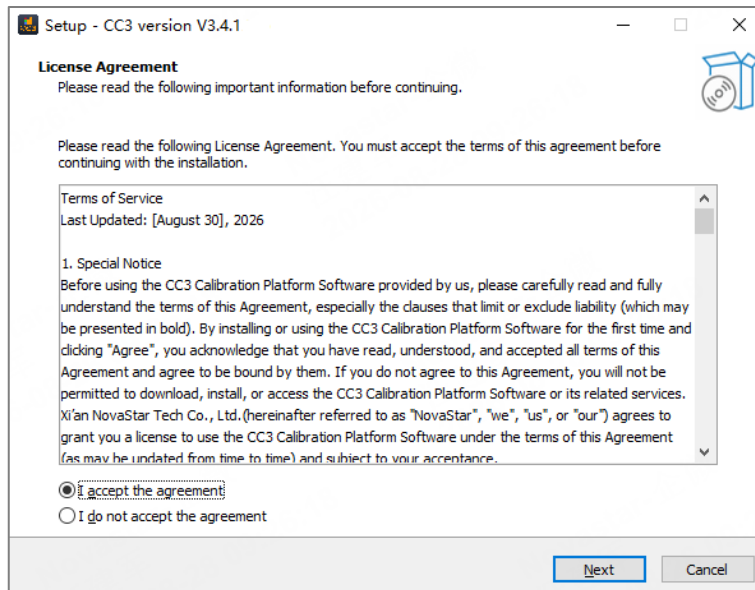
- Step 1 Double-click the installation package, select the language to use during installation (Simplified Chinese, English) in the pop-up window, and click **OK**.

Figure 2-1 Installation language



Step 2 Review the CC3 license agreement, select **I accept the agreement**, and click **Next**.

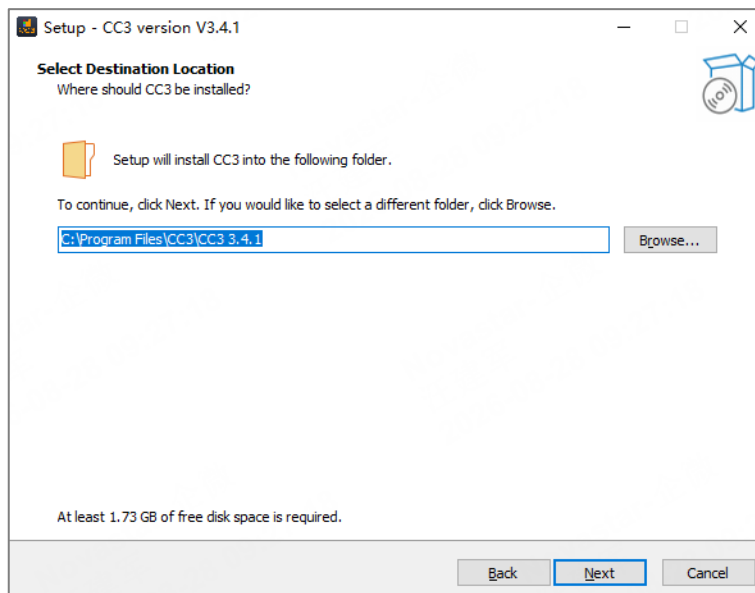
Figure 2-2 License agreement



Step 3 Choose the installation directory and click **Next**.

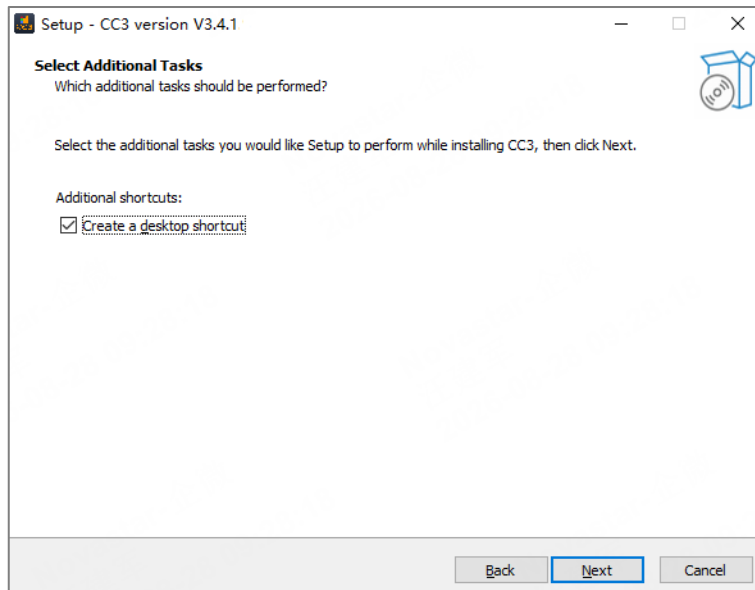
The default directory is "C:\Program Files\CC3\CC3 3.4.1". You can click **Browse** to select another directory. It is recommended to install it on a disk with large free storage space.

Figure 2-3 Installation location



Step 4 On the Select Additional Tasks screen, check Create a desktop shortcut, and click **Next**.

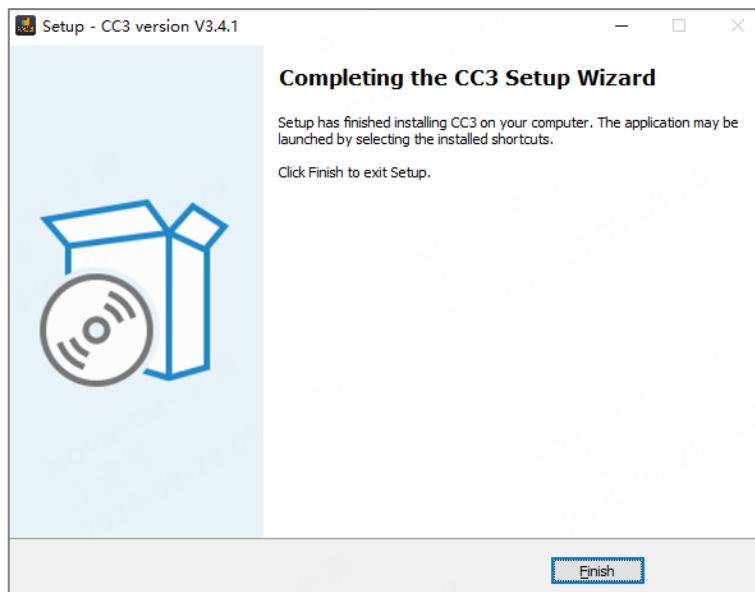
Figure 2-4 Creating desktop shortcut



Step 5 Confirm that the destination location and additional task settings meet the requirements, and click **Install**.

Step 6 Once the installation is completed, click **Finish** and the system will automatically exit the installation screen.

Figure 2-5 Installation complete



Installation Result



If the installation is successful, a shortcut **CC3** for CC3 will appear on your desktop.



If you encounter any security alerts from your anti-virus software or firewall during installation, make sure to select the option to allow the installation.

3 UI Introduction

3.1 Startup Screen

Once the CC3 software is opened, the startup screen appears, as shown in [Figure 3-1](#). Here, users can create calibration projects, manage them, and configure software settings. For a detailed introduction to the startup screen, see [Table 3-1](#).

Figure 3-1 CC3 startup screen

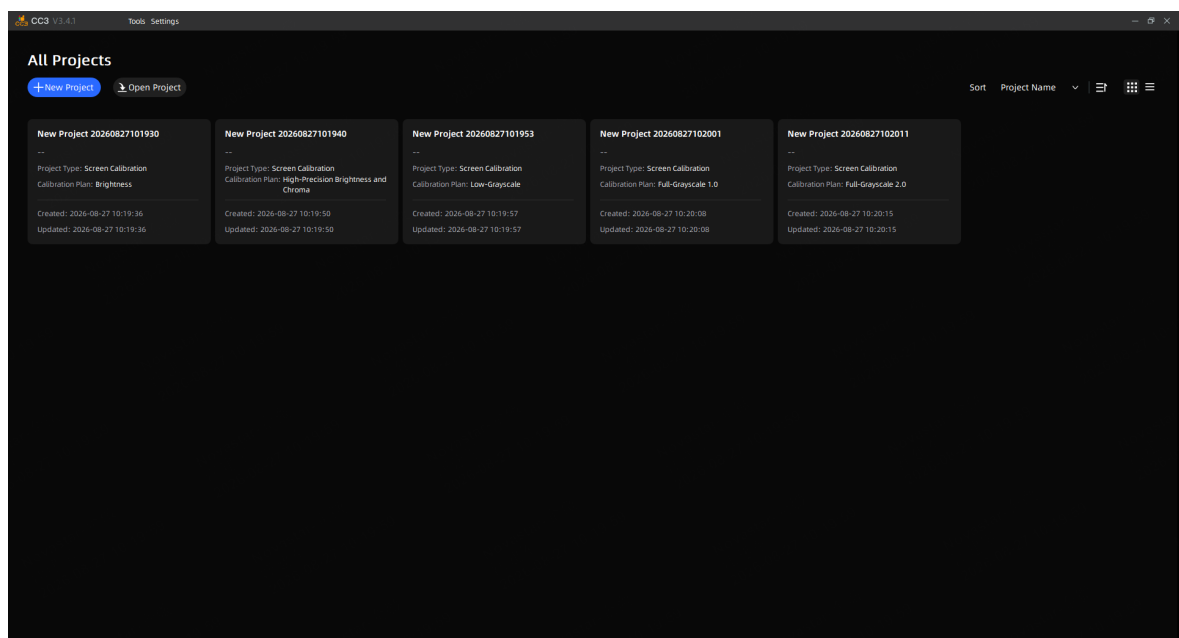


Table 3-1 Startup screen introduction

Item	Description
New project	Click New Project , then fill in and set the relevant information to create a calibration project. For the specific screen and operation of creating a project, please refer to the chapter 6 Create a Calibration Project .
Open Project	Click the project name to open a saved calibration project and access the project screen. Click Open Project to open a locally saved calibration project.
Sort	You can select Project Name , Date Created , or Last Used from the drop-down menu. Click  or  to sort in ascending or descending order according to the selected

Item	Description
	sorting method.
	Calibration projects are displayed in the form of cards.
	Calibration projects are displayed in a list.
Calibration project	When existing calibration projects are displayed in a list view, the system shows the calibration project list and project details, including the project name, description, type, calibration plan, project path, date created, last used time, and available operations. The following operations can be performed on a project: • Edit project description: Click  to access the project editing screen, where you can change the project description. • Export coefficients: Click  to export the calibration coefficients of the current project. • Delete project: Click  to delete the current project.
Calibration tools	• Coefficient Splitting Tool: Splits the calibration database of calibrated cabinets according to the specified settings. • Coefficient Simulation Tool: Simulates and previews the calibration results stored in the cabinet calibration database.
Settings	Authorization/Correction Files: Import and manage camera authorization/correction files.
	Update Log: Displays the details of software updates compared to the previous version.
	Manual: Scan the QR code, click the obtain the latest documentation link, or click Offline Manual to access the CC3 software user manual.
	Language: Set the interface display language of the software. Currently, Simplified Chinese and English are supported. (Language change requires a restart.)
	About: Displays the current software version information, NovaStar official website link, and copyright information.
	Check for Updates at Startup: Automatically checks whether CC3 is up to date each time it starts.  : Enables automatic update checks at startup. Each time CC3 starts, it automatically checks for updates.  : Disables automatic update checks at startup. CC3 does not automatically check for updates when it starts.

3.2 Project Homepage

Open a calibration project to access the project home screen, as shown in [Figure 3-2](#).

Figure 3-2 Project home screen

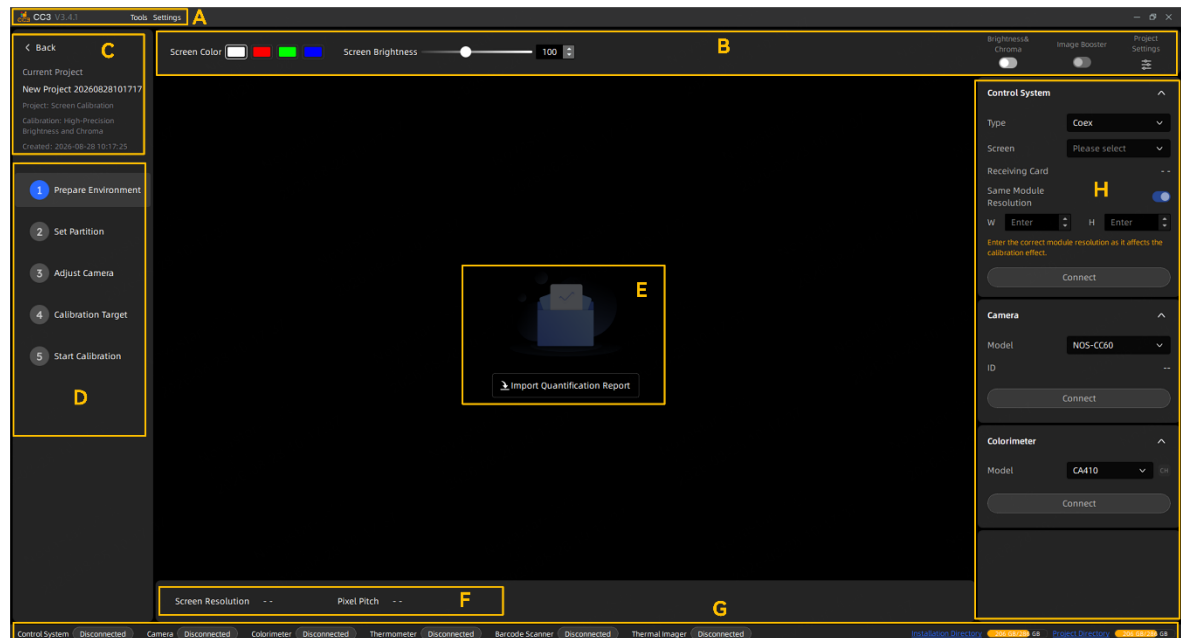


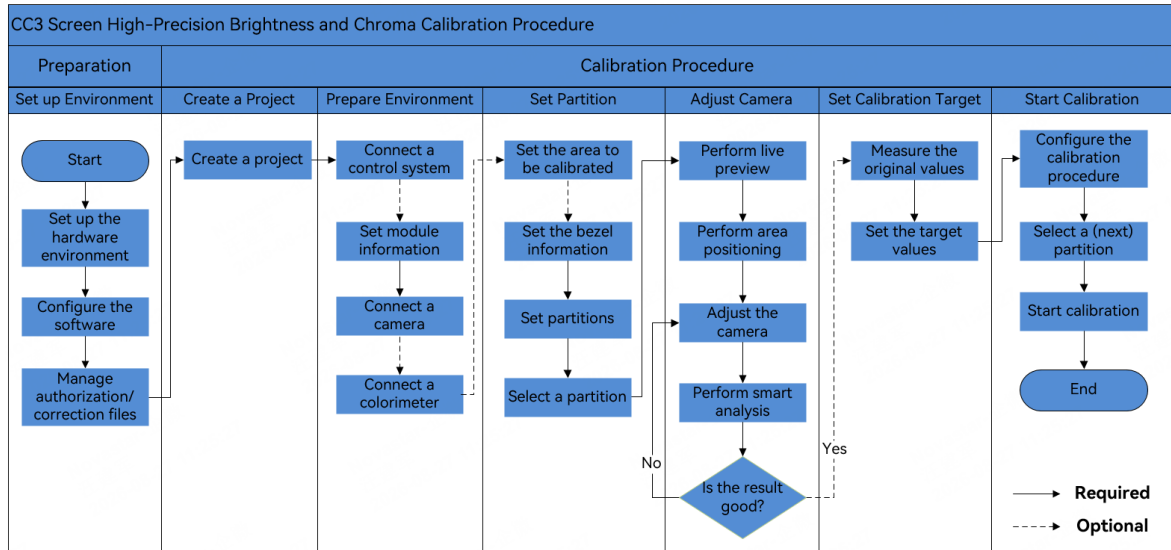
Table 3-2 Project home screen introduction

Area	Item	Description
A	CC3	Software logo and name.
	Tools	Coefficient splitting and simulation tools.
	Settings	Perform software-related settings.
B	Screen Color	Select the color displayed on the screen to be calibrated.
	Screen Brightness	Set the grayscale brightness displayed on the screen to be calibrated.
	Calibration Switches	Turn on or off calibration effect switches. The calibration switches supported depend on the type of the project created. Note The Image Booster switch here is only used to view the display effect before and after it is turned on, and will not change the project settings.
	Project Settings	Capture Interval (ms): When there is a significant delay for the controller in displaying the image, the capture interval can be appropriately increased. Image Save Path: Displays the path where images are stored. Click View to access the save path and see the captured images, and click Browse to change the save path.

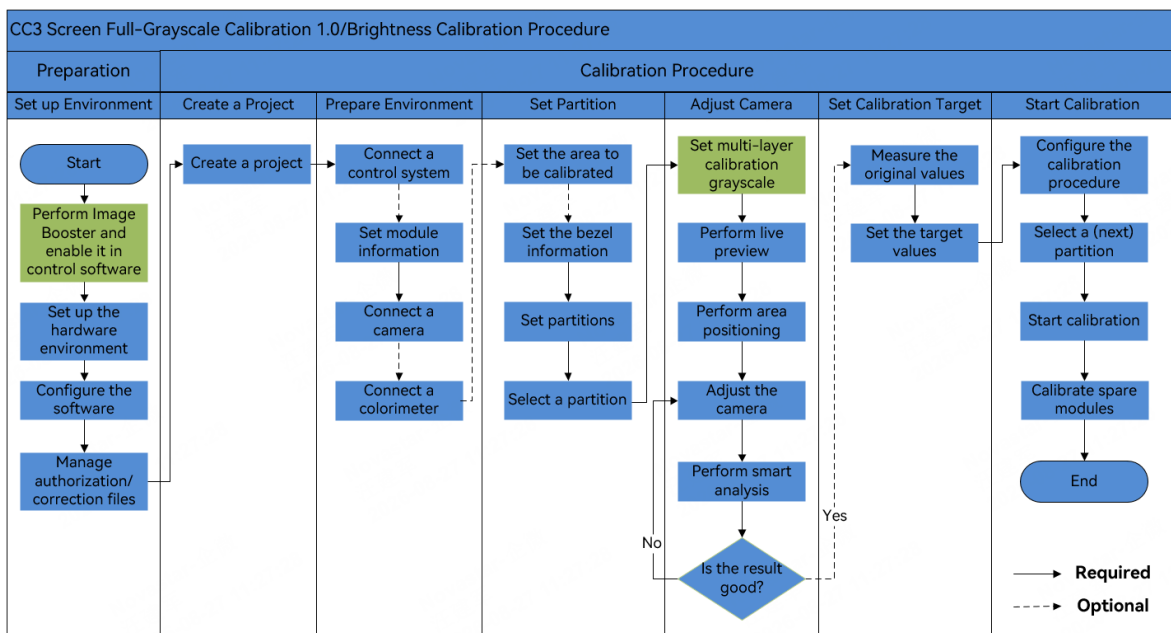
Area	Item	Description
		Image Save Type: Set whether to "Save all process data" and "Save all raw images" as needed. They are unchecked by default. When checked, all images and data during the calibration process can be saved, which consumes a large amount of memory. If you need to troubleshoot issues, you can save them and send all data back to NovaStar engineers.
C	Project Information	View current project information, including project name, project type, and project creation time. Click Back in the top-left corner to exit the current project management screen and return to the startup screen.
D	Navigation Menu	Calibration navigation menu. • Prepare Environment: Connect a control system, camera, and colorimeter. • Set Partition: Set the calibration area, bezel information, and perform partition configurations. • Adjust Camera: Preview the images captured by the camera, set the calibration grayscale, camera parameters, and area positioning, and analyze the camera parameters to ensure the parameter analysis results meet the calibration requirements. • Calibration Target: Obtain the original brightness and chroma values of the screen, and set the target values to complete the calibration target configuration. • Start Calibration: Start calibration, view calibration results, and export calibration coefficients.
E	Import Quantification Report	Supports importing quantification reports to view the basic display parameter of the screen before calibration.
F	Screen Details	Check the screen resolution and pixel pitch, and configure the same module resolution setting.
G	Device Status	• View the connection status of devices such as the control system, camera, and colorimeter. • Check the total and free space of the disk where the CC3 software is installed. • Check the total and free space of the disk where the current CC3 project is saved.
H	Parameter Settings Area	Set calibration parameters for each stage of calibration.

4 Basic Calibration Procedure

4.1 High-Precision Brightness and Chroma Calibration



4.2 Full-Grayscale Calibration 1.0/Brightness Calibration

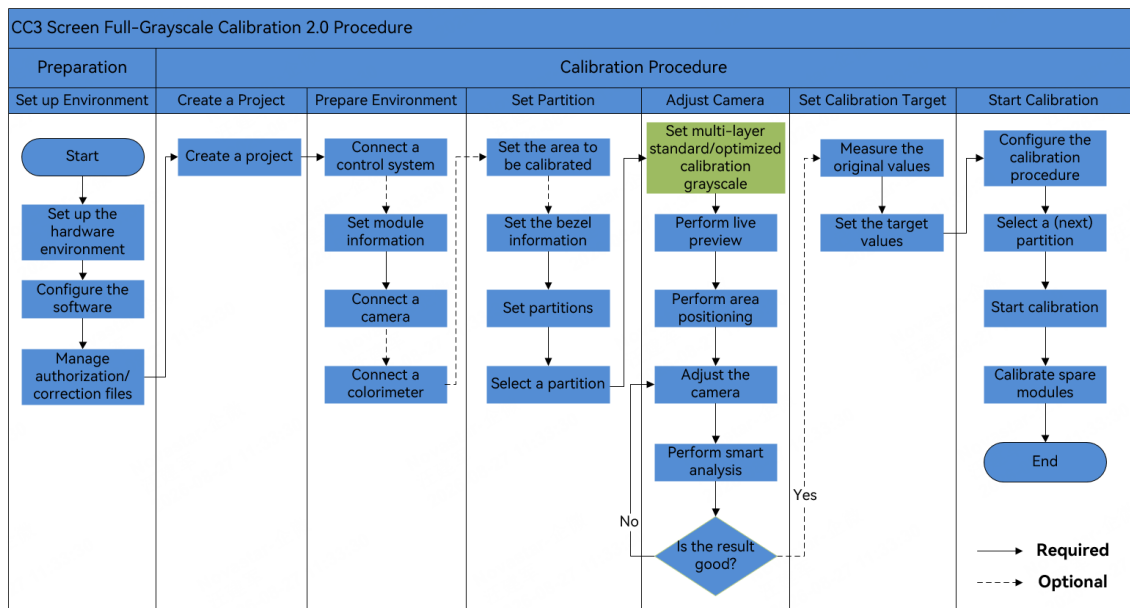


Note

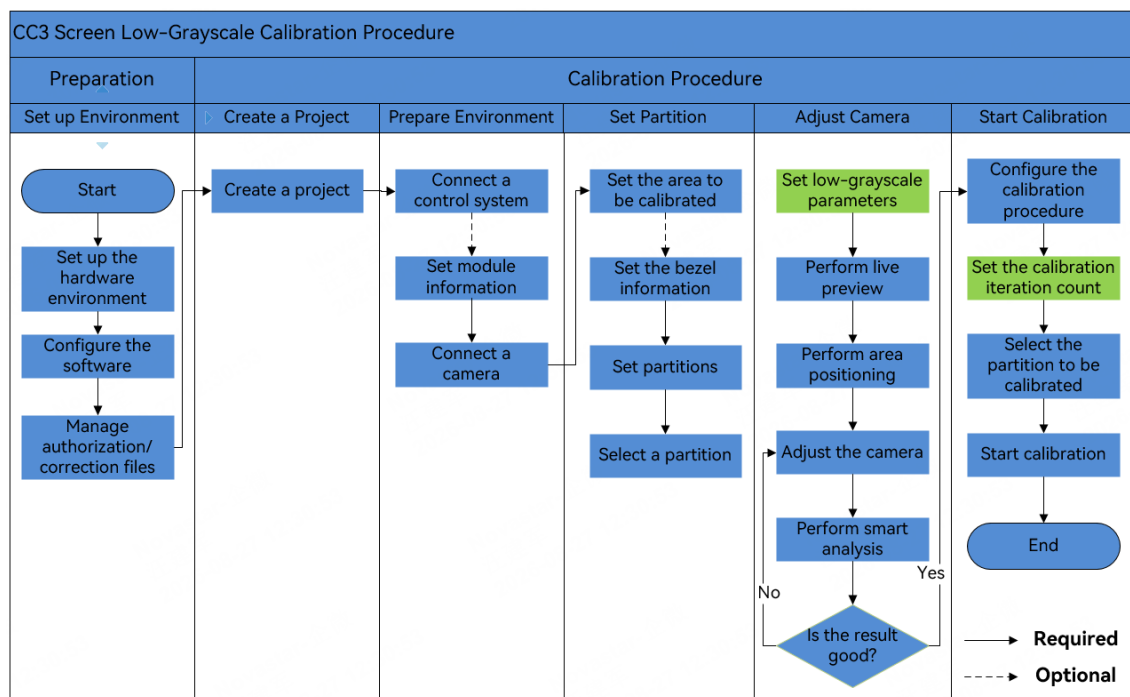
- When using the full-grayscale calibration 1.0 plan, it is necessary to first confirm that Image Booster has been performed and enabled when creating the project on the screen to be calibrated through the control software.

- When using the brightness calibration plan, support for single-layer or multi-layer calibration grayscale depends on the receiving card model. If multi-layer calibration grayscale is selected, the system will prompt you to enable Image Booster. In this case, you need to configure Image Booster for the screen in the control software in advance and enable this function when creating the project. If single-layer calibration grayscale is selected, you can proceed directly with the calibration.

4.3 Full-Grayscale Calibration 2.0



4.4 Low-Grayscale Calibration



5 Calibration Preparation

If you are performing calibration for the first time, there are some pre-calibration preparations that need to be completed. These include setting up calibration environment, configuring the software, and managing the authorization/correction files.

If you are familiar with the calibration process, you can skip this chapter and start the calibration directly.

5.1 Environment Requirements

Light Requirements

It is necessary to maintain a stable environment during calibration, ensuring no external light interference, no noticeable light leakage around the screen, and no infrared-emitting devices (such as infrared cameras) positioned where the camera is aligned.

Calibration Distance

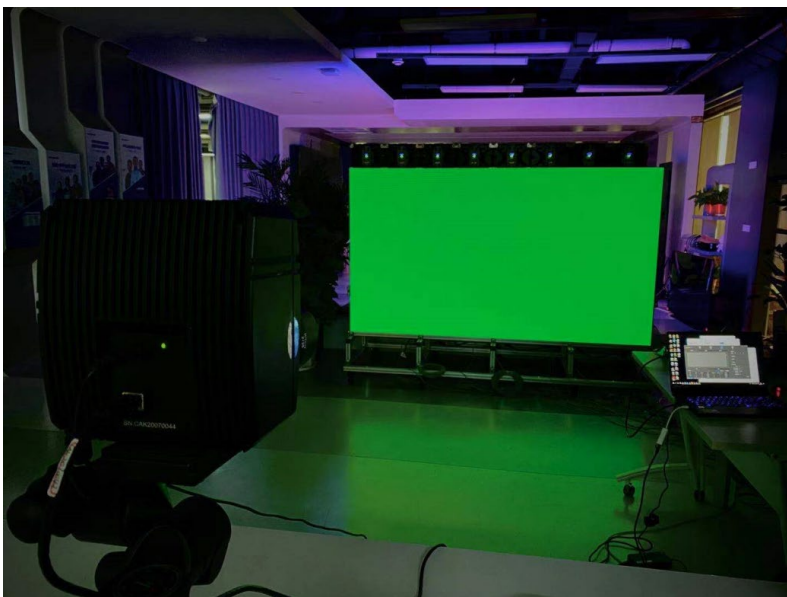
Make sure the screen image is located in the center of the camera preview box and also falls between the maximum and minimum boxes.

For example, when calibrating a P0.9 COB screen, the optimal distance for a 4K screen is 7 to 8 meters, while the optimal distance for a 2K screen is 3 to 4 meters.

Caution

The camera lens needs to be perpendicular to the center of the screen (both horizontally and vertically) to avoid large angles; otherwise, abnormal results such as Moiré are likely to occur.

Figure 5-1 Example of calibration environment



5.2 Hardware Setup

Set up all the required calibration devices according to the system architecture and complete the on-site arrangement based on the calibration environment requirements.

5.2.1 System Architecture

When using different control systems and different cameras, the system architectures and cables used are different. Please see [Table 5-1](#) for detailed device information and connection instructions.

Mars Control System

When using the Mars control system, one or two computers are needed.

Figure 5-2 System architecture — one computer

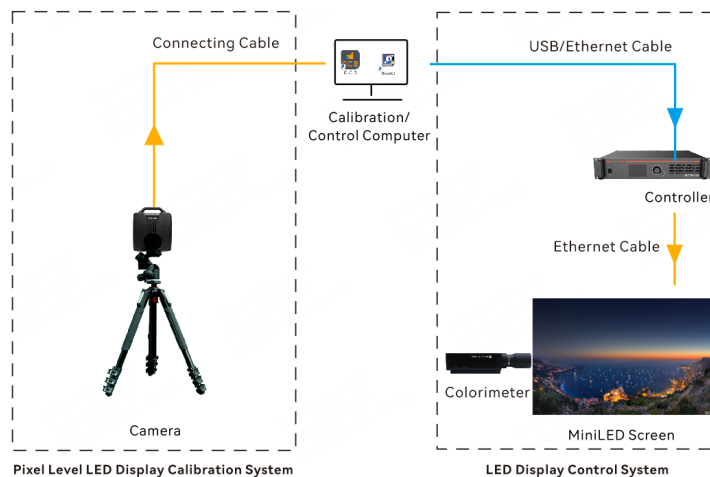
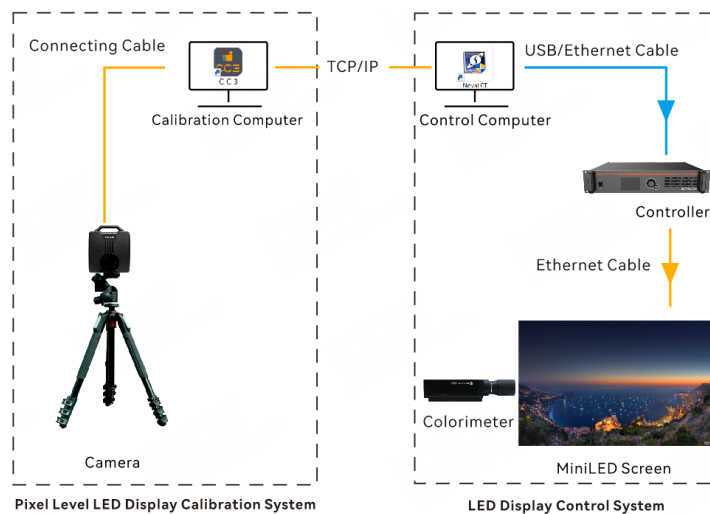


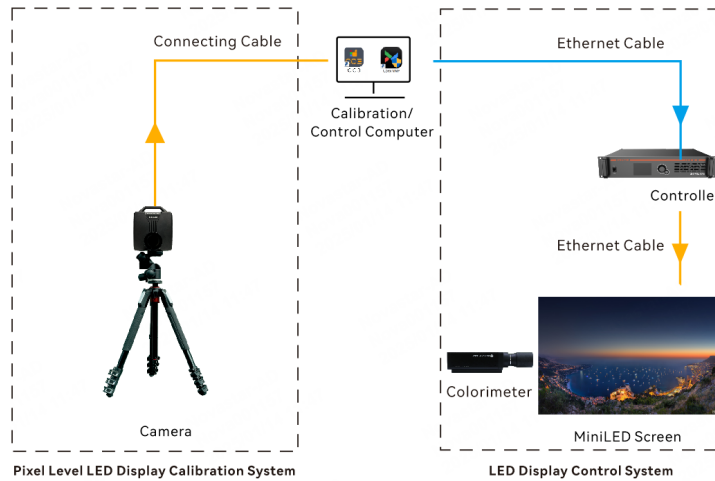
Figure 5-3 System architecture — two computers



Coex Control System

When using the Coex control system, only one computer is required.

Figure 5-4 System architecture — COEX



5.2.2 Configuration List

Table 5-1 Device information and connection instructions

Calibration Device	Description
Computer	Either a desktop or a laptop would suffice. - When using the Mars control system, one or two computers are needed. - One computer: Install NovaLCT (V5.4.8 and later) for screen control and the calibration software for calibration. - Two computers: Install NovaLCT (V5.4.8 and later) on the control computer and the calibration software on the calibration computer. - When using the Coex control system, only one computer is needed. Install VMP for screen status adjustment and the calibration software for calibration. - Before calibration, make sure that the calibration computer and graphics card have the same resolution and the scaling is set to 100%. In addition, the dynamic range of the graphics card must be set to Full.
Controller	It converts audio and video signals from the computer and sends them to the LED screen. - Before calibration, turn off the scaling function of the controller. - If you need to enable the Super Resolution Imaging function (enabled by default in the full-grayscale calibration 2.0 plan), please select a controller that supports checkerboard test pattern.

Calibration Device	Description
Receiving card	It is installed inside the cabinet to receive audio and video signals and light up the screen. - If you need to use the full-grayscale calibration 1.0 plan, please choose the A8s Pro or higher level receiving card. When using the brightness calibration solution, if you need to add multi-layer calibration grayscale, the supported receiving card models are the same as those for full-grayscale calibration 1.0. - To use the full-grayscale calibration 2.0 plan, please select the A8s Pro or A10s Pro receiving card.
Screen	The screen to be calibrated. Use an Ethernet cable to connect the screen to the controller.
Imaging colorimeter/ camera	It is used to capture LED screen images. The NOS-CC60 imaging colorimeter and C3200 industrial camera are supported.  Note The tripods for the CC60 and C3200 are not interchangeable. Please use the matched tripod for calibration.
Colorimeter (Optional)	It is used to measure the screen brightness and chroma. The measured values serve as the original values for the calibration. The CA410 and CS2000 colorimeters are supported.
Router	If the control computer and calibration computer are two separate computers, you can use a router and connect the two computers to the LAN ports of the router with Ethernet cables. The router Ethernet ports need to be Gigabit Ethernet ports.

5.3 Configure the Control Software

5.3.1 Network Connection

The calibration software requires different network configurations for different control systems.

- Mars control system

When using the Mars control system, one or two computers are needed.

- If the control computer and the calibration computer are the same, and if you use an Ethernet cable to connect the computer and controller, ensure that the computer and the controller are on the same network segment.
- If the control computer and calibration computer are two separate computers, you can use Ethernet cable to connect them directly. You can also use a router and connect the two computers to the

router's LAN ports with Ethernet cables. The IP addresses of the two computers and the router's default IP address must be on the same network segment. Refer to [9.1 How to configure network connection?](#) for specific settings.

- Coex control system

Only one computer is required to complete the entire calibration procedure. It is necessary to ensure that the computer and controller are on the same network segment.

Note

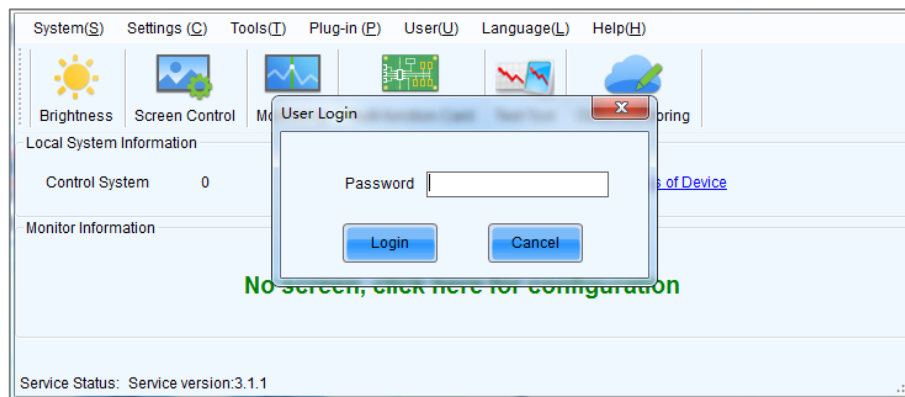
If the computer does not have enough Ethernet ports available, you can use a USB to Ethernet adapter.

5.3.2 NovaLCT Settings

When using the Mars control system, the NovaLCT should be used during calibration. In NovaLCT, you will need to complete the screen connection and listening settings.

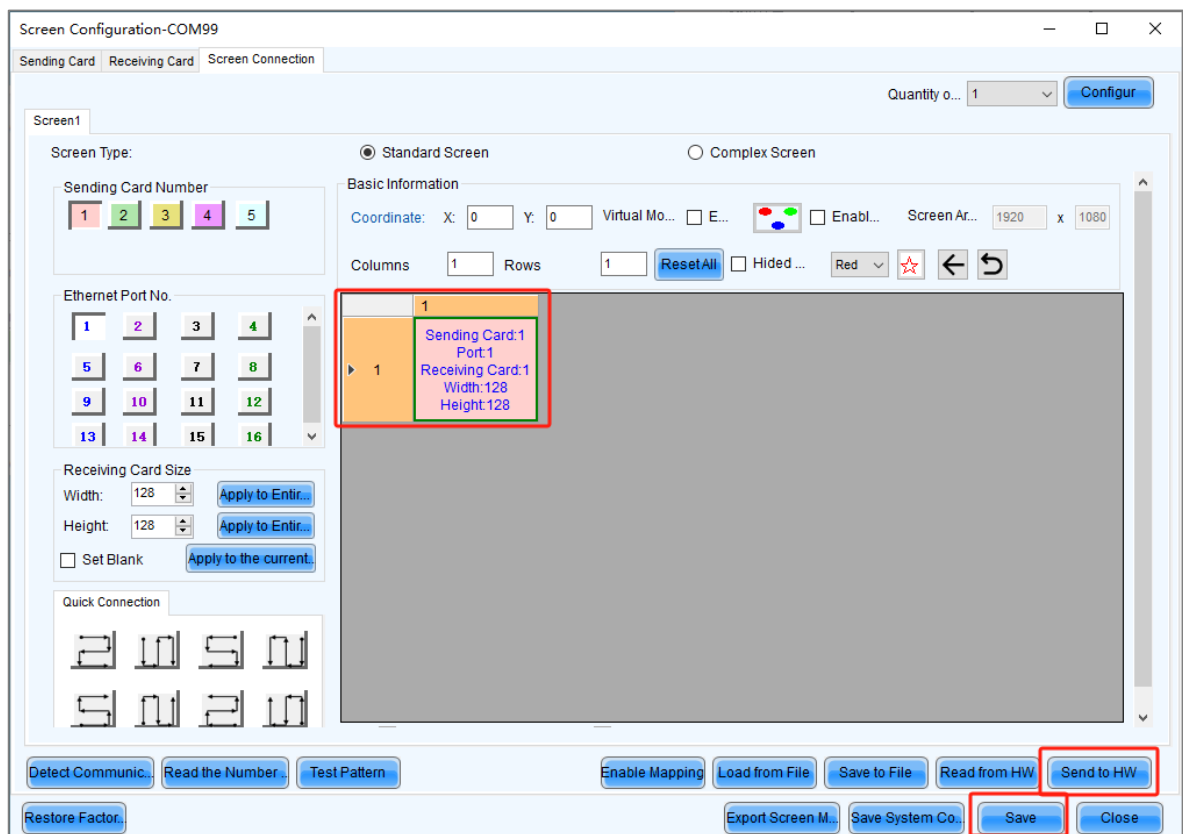
- Step 1 Open NovaLCT and verify that there is a stable communication connection between the calibration computer and the control computer.
- Step 2 Choose **User > Advanced Synchronous System User Login**, enter the password (initial password: admin), and click **Login**.

Figure 5-5 Login



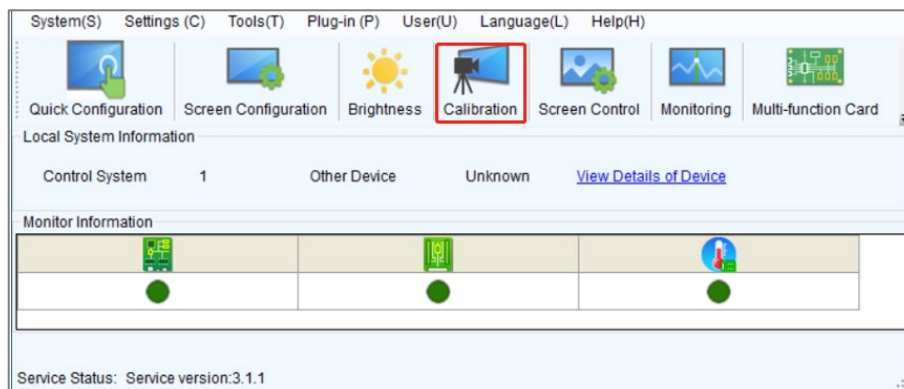
- Step 3 Complete screen connection.
1. On the main window, click **Screen Configuration** and select the current communication port to enter the **Screen Configuration** screen.
 2. Select the **Screen Connection** tab and complete screen connection.
 3. Click **Send to HW** and then click **Save**.

Figure 5-6 Screen connection



Step 4 On the main window, click **Calibration** to open the calibration page.

Figure 5-7 Calibration button

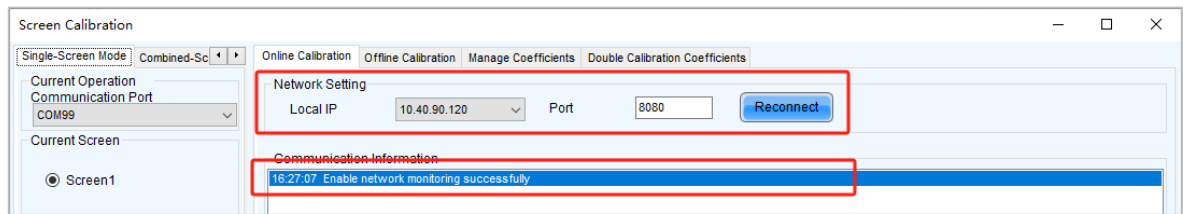


Step 5 On the Screen Calibration screen, set Local IP and Port under Network Setting.

- Local IP: Indicates the IP address of the control computer.
- Port: The default value is 8080.

If a message saying **Enable network monitoring successfully** is displayed, it means that NovaLCT is ready to listen. However, if a message indicating that the listening process failed appears, please check if there is a port conflict. In case there is a conflict, please change the port number and try again.

Figure 5-8 Ready for calibration



If there are multiple screens in NovaLCT, you must first select the screen to be calibrated.

5.3.3 VMP Settings

When using the Coex control system, the VMP should be used and screen configuration needs to be completed in VMP. For details, please refer to the VMP user manual. During screen configuration, make sure the screen connection starts from the upper left corner.

Figure 5-9 Correct screen connection

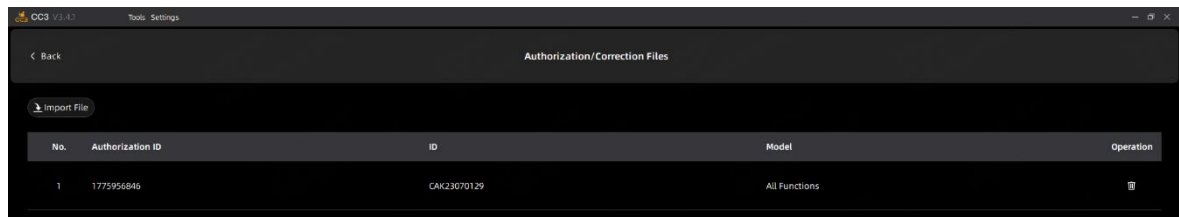


5.4 Import Authorization/Correction Files

In the calibration preparation stage, you need to import the authorization/correction file. Each device corresponds to one authorization/correction file.

- Step 1 Open CC3 calibration software, click **Settings** in the top-left corner and then click **Authorization/Correction Files**.
- Step 2 Check the serial number (SN) on the rear panel of the connected imaging colorimeter/industrial camera and record the SN.
- Step 3 On the **Authorization/Correction Files** screen, click **Import File** and select the corresponding authorization/correction file.
 - For the CC60 imaging colorimeter, select a correction file (.calib).
 - For the C3200 industrial camera, select an authorization file (.auth).

Figure 5-10 Importing file



Step 4 Click **Open** to import the authorization/correction file.



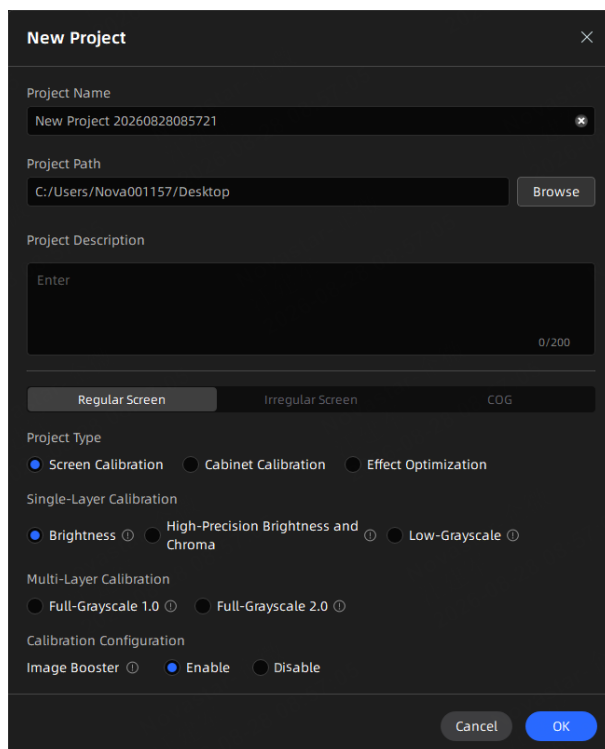
The CC60 comes with a USB drive containing the correction file named after the serial number.

To delete the imported authorization/correction file, click .

6 Create a Calibration Project

Step 1 Open CC3 and click **New Project** to access the **New Project** page.

Figure 6-1 New project



Step 2 Set the project name, save path, and description to help you quickly find the project later.

The project name defaults to **New Project YearMonthDayHourMinuteSecond** and you can change to a different name you like.

Step 3 Select the screen type. Currently, only Regular Screen is supported.

Step 4 Under Project Type, select Screen Calibration.

Step 5 Select a calibration plan.

You can hover the mouse over  next to the calibration plan to view the differences between each calibration plan, and select the corresponding plan based on the current phenomenon of the screen to be calibrated.

- **Brightness Calibration:** This feature is for SMD screens with uniform bin mixing and excellent chroma consistency between modules in order to maintain the screen's color gamut and improve post-calibration brightness uniformity.
- **High-Precision Brightness and Chroma Calibration:** This feature is for COB modules with mura differences or SMD screens with mixed bins from different batches in order to ensure a high level of uniformity in both brightness and chroma.
- **Low-Grayscale Calibration:** This feature is for screens that use special driver ICs and have poor performance at low grayscale levels in order to achieve a smooth linear transition for low grayscale.
- **Full-Grayscale Calibration 1.0:** This feature is for screens where the mura pattern changes non-linearly across different grayscales in order to ensure a smooth gradual transition through all grayscale levels.
- **Full-Grayscale Calibration 2.0:** This feature is for screens where the mura pattern changes non-linearly across different colors and grayscales in order to enhance uniformity of all grayscales and colors.

Step 6 Configure the Image Booster switch. Before enabling it, ensure the Image Booster file has been sent, as failing to do so can result in a black screen during calibration.

- When creating a full-grayscale calibration 1.0 or 2.0 plan, make sure to enable Image Booster. (Image Booster must be performed in the control software in advance.)
- When creating a brightness calibration plan, if you need to add multiple layers of calibration grayscale, Image Booster must be turned on. (Image Booster must be performed in the control software in advance.)
- For other calibration plans, please enable Image Booster as needed. If Image Booster has been performed, it is recommended to turn it on.

Step 7 Click **OK** to complete creating the project. The software automatically opens the project and enters the **Prepare Environment** screen.

7 Calibration Operation Instructions

The CC3 calibration software supports five screen calibration plans: brightness calibration, high-precision brightness and chroma calibration, full-grayscale calibration 1.0, full-grayscale calibration 2.0, and low-grayscale calibration. After the calibration preparation is completed, you can click the links below to jump to view the corresponding operation steps as needed.

- [7.1 Brightness Calibration](#)
- [7.2 High-Precision Brightness and Chroma Calibration](#)
- [7.3 Low-Grayscale Calibration](#)
- [7.4 Full-Grayscale Calibration 1.0](#)

- [7.5 Full-Grayscale Calibration 2.0](#)

7.1 Brightness Calibration

7.1.1 Prepare Environment

7.1.1.1 Connect a Control System

The CC3 calibration software is compatible with both the Mars and Coex control systems from NovaStar. The default system is "Coex". Please make sure to select the correct control system type for your needs.

Notes

- Ensure the computer firewall is disabled before connecting to the control system.
- A static IP address is required for the sending card.

Connect Coex Control System

Step 1 Open CC3, create or open a calibration project and enter the project home screen.

Step 2 On the **Prepare Environment** screen, set **Type** to **Coex** in the **Control System** area on the right.

Figure 7-1 Connecting Coex control system

Control System

Type: Coex

Screen: Please select

Receiving Card: --

Rv Card Config File: Import

Same Module Resolution

W: Enter H: Enter

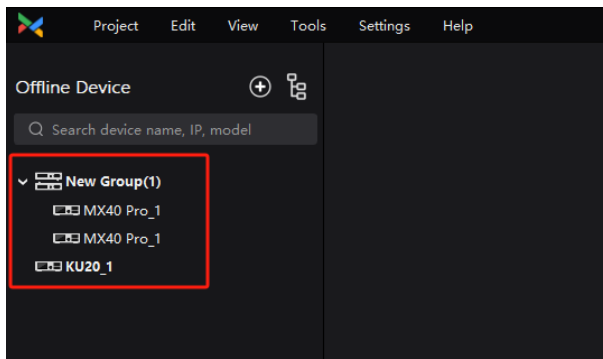
Enter the correct module resolution as it affects the calibration effect.

Connect

Step 3 Click the drop-down box next to **Screen**, select the device that loads the screen to be calibrated.

When selecting the device, you can first confirm the name of the device loading the screen to be calibrated in the device list of the VMP, and then select the corresponding device name in the **Screen** drop-down box in the calibration software.

Figure 7-2 Device list in VMP



Only the unlocked devices can be selected. The locked devices cannot be selected.

Step 4 Click Connect to complete the connection between CC3 and the control system, and view the screen details.

After the control system is successfully connected, the resolution and pixel pitch information of the current screen will be displayed in the bottom area of the screen.

Step 5 Check whether the modules have the same resolution.

- Same: Check **Same Module Resolution** and set the module width and height. To ensure better calibration effects, please fill in the actual module resolution.
- Different: Uncheck Same Module Resolution.

Connect Mars Control System

To connect Mars system, complete relevant settings in NovaLCT first. See [5.3.2 NovaLCT Settings](#).

Step 1 Open CC3, create or open a calibration project and enter the project home screen.

Step 2 On the **Prepare Environment** screen, set **Type** to **Mars** in the **Control System** area on the right, enter the IP address and port number set in NovaLCT, and click **Connect**.

Figure 7-3 Connecting Mars control system

The screenshot shows a 'Control System' configuration window. It includes a 'Type' dropdown set to 'Mars', an 'IP Address' field with '127.0.0.1', a 'Port' field with '8080', a 'Screen' dropdown with 'Please select', a 'Receiving Card' field, an 'Rv Card Config File' field with an 'Import' button, a 'Same Module Resolution' checkbox which is checked, and 'W' and 'H' resolution input fields both set to 'Enter'. A note at the bottom states: 'Enter the correct module resolution as it affects the calibration effect.' A 'Connect' button is located at the bottom of the form.

Step 3 Check whether the modules have the same resolution.

- Same: Check **Same Module Resolution** and set the module width and height. To ensure better calibration effects, please fill in the actual module resolution.
- Different: Uncheck Same Module Resolution.

Step 4 View the screen details.

After the control system is successfully connected, the resolution and pixel pitch information of the current screen will be displayed in the bottom area of the screen.

Note

If the control system connection fails, please check to make sure:

- The firewall has been disabled.
- The software is running normally.
- The calibration computer and control computer are on the same network segment.
- NovaLCT is ready to listen for the Mars control system.

7.1.1.2 Connect Camera

The NOS-CC60 imaging colorimeter and C3200 industrial camera are supported.

Step 1 Plug in the camera and connect it to the calibration computer.

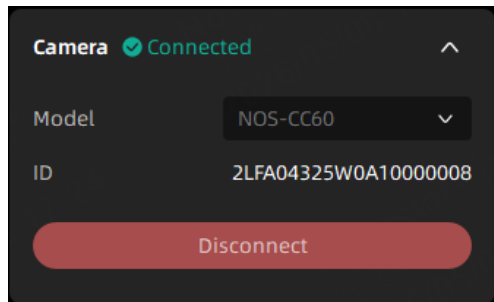
- CC60: Use a USB cable to connect it to the calibration computer.
- C3200: Use an Ethernet cable to connect it to the calibration computer.

Step 2 Go to the project home screen and select the **Prepare Environment** tab.

Step 3 In the **Camera** area on the right, select the model of the connected camera.

Step 4 Click **Connect** to connect the camera to the calibration software.

Figure 7-4 Connecting camera



Note

Due to compatibility issues between the C3200 camera and some computers, the camera connection may fail. In such cases, you can try disabling the network adapter connected to the C3200 and then enabling it again. The camera can be managed by using the tool that is installed together with the calibration software. See [9.2 How to use the auxiliary tool for C3200 camera?](#).

7.1.1.3 Connect a Colorimeter (Optional)

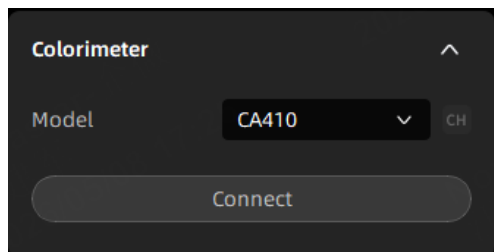
The CC3 calibration software supports the CA410 and CS2000 colorimeters.

Step 1 Plug in the colorimeter and connect it to the calibration computer using the USB cable.

Step 2 Go to the project home screen and select the **Prepare Environment** tab.

Step 3 In the **Colorimeter** area on the right, select the model of the connected colorimeter.

Figure 7-5 Connecting colorimeter



Step 4 Click **Connect** to connect the colorimeter to the calibration software.

After successful connection, the **Connect** button under **Colorimeter** changes to **Disconnect**.

7.1.1.4 Quantification Report (Optional)

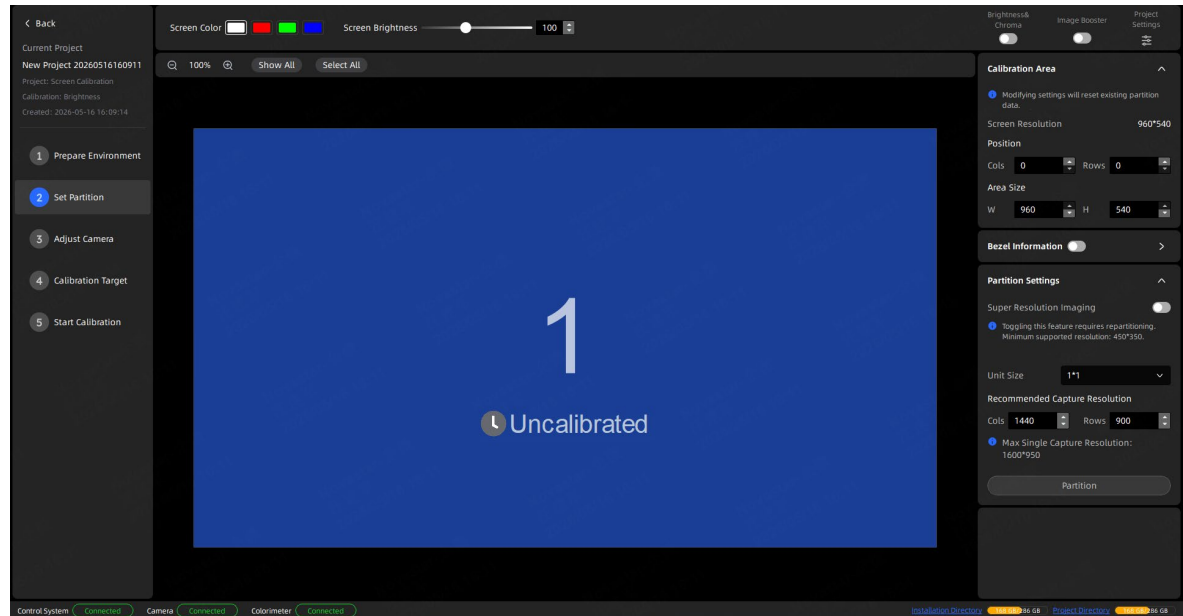
The CC3 calibration software supports direct import of quantification reports to view the display effect evaluation and performance parameters of the screen before calibration.

Click **Import Quantification Report** to directly import the generated display quantification report (.rep), and view the imported quantification report information.

7.1.2 Set Partition

Set the calibration area and bezel information, set the partition, and view the partitioning result.

Figure 7-6 Setting partition

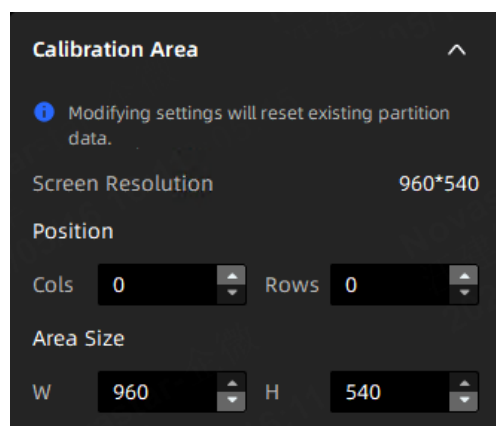


7.1.2.1 Set Calibration Area

When the calibration areas are not on the same surface or they have a certain angle, they need to be set in the software. If there are no such situations, skip this section.

For example, for the screens mounted on the four sides of a pillar, there is a 90° angle between each two adjacent screens. For adjacent screens that are separated by objects, they are not on the same surface.

Figure 7-7 Setting the calibration area



- Screen Resolution: The screen resolution automatically read by the software.
- Position
 - Cols: Set the vertical initial coordinate of the calibration area.
 - Rows: Set the horizontal initial coordinate of the calibration area.

- Area Size
 - W: Set the width of the calibration area.
 - H: Set the height of the calibration area.



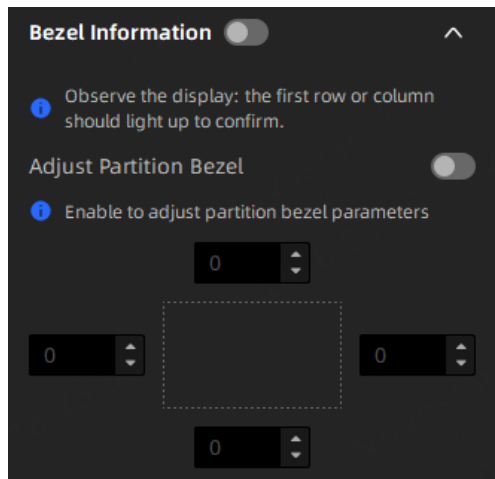
Modifying settings will reset existing partition data.

7.1.2.2 Set Bezel Information

When the screen to be calibrated has a bezel, the bezel information needs to be set in the software. If you do not set the information, positioning of the start LEDs during calibration and the calibration result will be affected. If there are no such situations, skip this section.

For example, the edges of the screen may be sealed to make it waterproof or to prevent the LEDs from being damaged. During the sealing process, some rows and columns of LEDs may be encased.

Figure 7-8 Bezel information



Step 2 Enable Bezel Information.

Step 3 In the text boxes of the top, bottom, left and right bezels, enter the number of rows or columns that are encased.

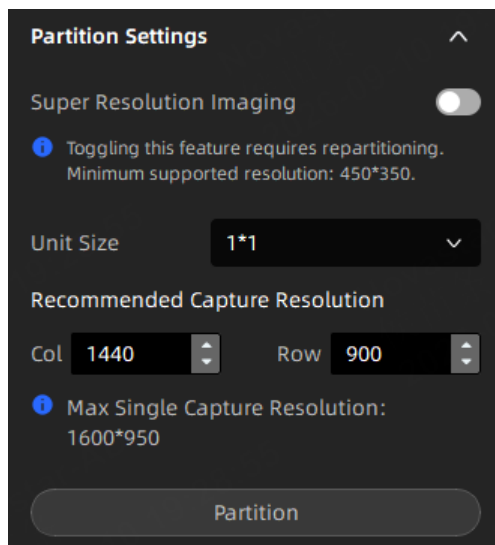
When setting the bezel, observe the changes on the display. If you see that the "N+1" row/column of pixels at the edge lights up according to the entered edge sealing information, and only the currently modified bezel is lit on the screen at that time, the setting is successful.

For example, if the top bezel is set to "5" and the other bezels are set to "0", then the top six rows will light up, while the other pixels remain off.

7.1.2.3 Set Partition

If the screen resolution is very high, the camera cannot capture the image of the entire screen in just one time. You must divide the screen into multiple partitions for calibration.

Figure 7-9 Setting partition



Step 1 Check whether the screen has blocked parts or a bezel.

- No: Go to [Step 2](#).
- Yes: Set the calibration area or the bezel information. For details, see [7.1.2.1 Set Calibration Area](#) and [7.1.2.2 Set Bezel Information](#).

Step 2 Enable or disable **Super Resolution Imaging** as needed. Enabling it can significantly enhance the calibration speed.

Note

When connecting to the control system, the software automatically detects whether the connected controller supports Super Resolution Imaging. If supported, it is enabled by default.

Step 3 When you disable **Super Resolution Imaging**, click the drop-down list next to **Unit Size** to select a display pattern for the camera to capture the image.

The default unit size is calculated based on the screen resolution and camera capture capability. If there are no specific requirements, use the default parameters.

Step 4 Set the camera's recommended capture resolution, and the software will generate the camera's single capture resolution based on the input value and the actual screen resolution.

- Rows: Indicates the number of vertical LEDs that can be captured each time.
- Cols: Indicates the number of horizontal LEDs that can be captured each time.

The values of rows and columns captured once cannot be greater than the maximum resolution of the image that can be captured by the camera.

- When Super Resolution Imaging is enabled

Maximum capture resolution for the NOS-CC60: 2800×1700; recommended capture resolution: 2560×1440.

Maximum capture resolution for the C3200: 2300×1600; recommended capture resolution: 1950×1350.

- When Super Resolution Imaging is disabled

Maximum capture resolution for the NOS-CC60: 1600×950; recommended capture resolution: 1440×900.

Maximum capture resolution for the C3200: 1050×650; recommended capture resolution: 800×450.

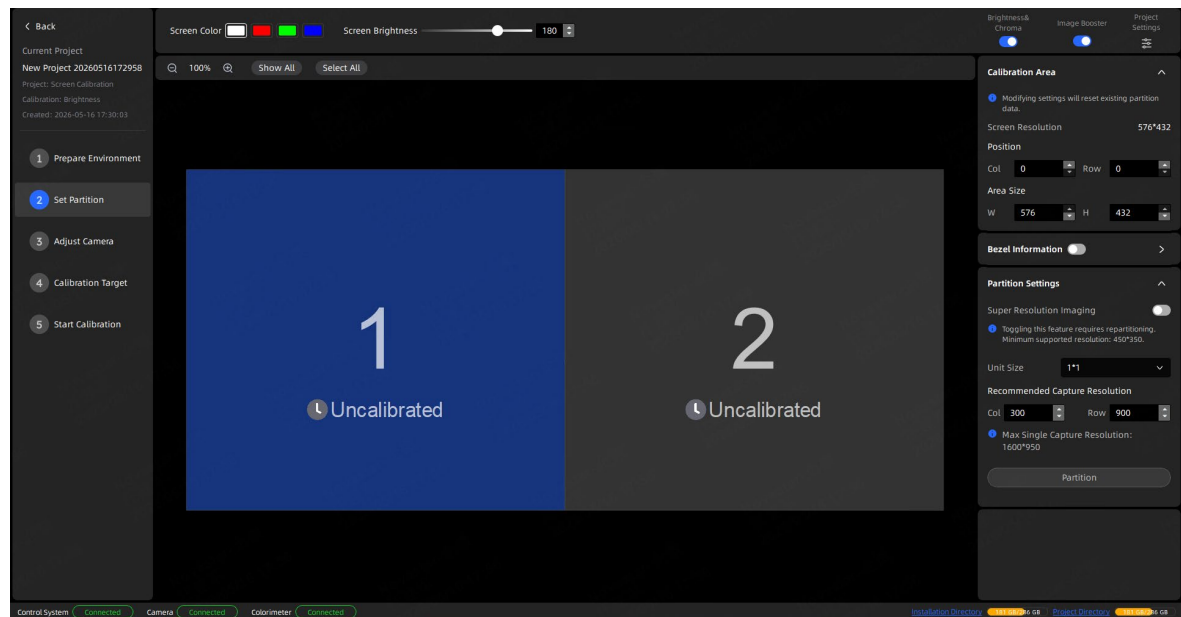
Step 5 Click the **Partition** button and the system will configure partitions based on the input parameters.



Modifying settings will reset existing partition data.

Step 6 Select a partition on the partition topology. The selected area becomes blue on the screen. When you move the mouse to the partition, the row, column, width and height values will be displayed.

Figure 7-10 Selecting a partition



- Rows: Indicates the vertical initial coordinate of the selected partition.
- Cols: Indicates the horizontal initial coordinate of the selected partition.
- W: Indicates the horizontal width of the selected partition.
- H: Indicates the vertical height of the selected partition.

7.1.3 Adjust Camera

7.1.3.1 Set Calibration Grayscale

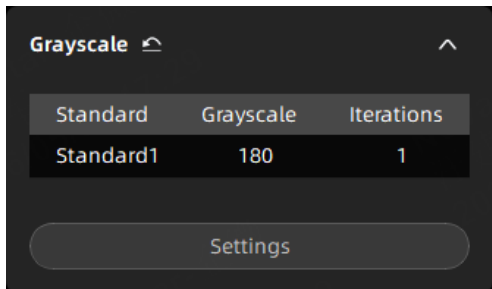
Set grayscale values for functions such as live preview, parameter analysis and calibration. For the brightness calibration plan, single-layer and multi-layer brightness calibration grayscale are supported depending on the receiving card model used.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

Step 2 In the **Grayscale** area on the right, view the calibration grayscale information.

Click  next to **Grayscale** to restore the grayscale values to the default values.

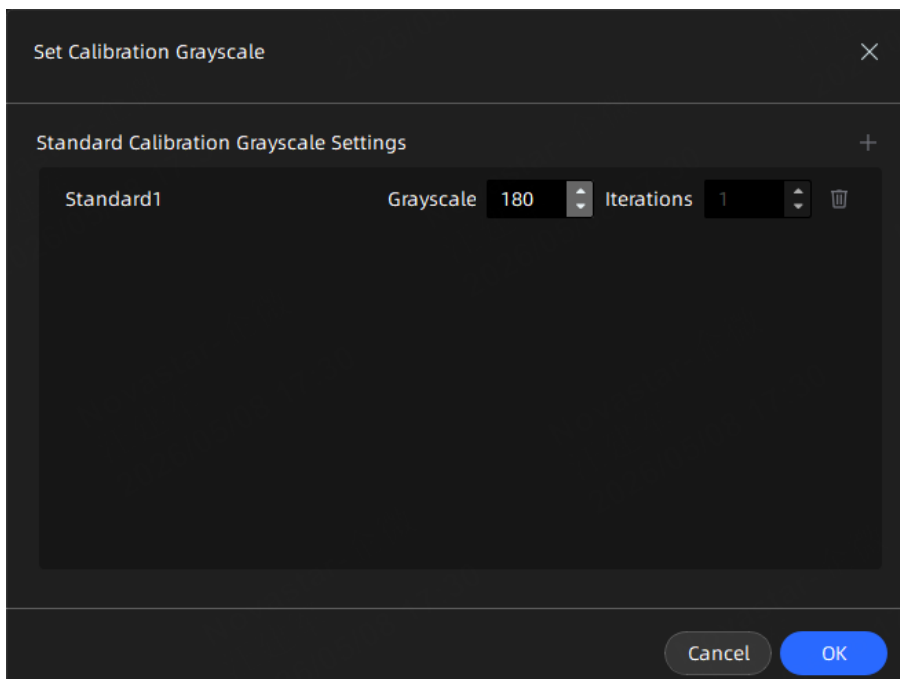
Figure 7-11 Calibration grayscale



Step 3 Click **Settings** in the **Grayscale** area to complete settings in the pop-up window.

- Calibration Grayscale: Single-layer and multi-layer brightness calibration grayscale are supported depending on the receiving card model used. For regular screens, the default capture grayscale can be used for calibration. At the same time, the calibration grayscale can be specifically set according to the screen characteristics.
- Iterations: Set the number of iterations for each layer of calibration grayscale. The default is 1.

Figure 7-12 Setting calibration grayscale



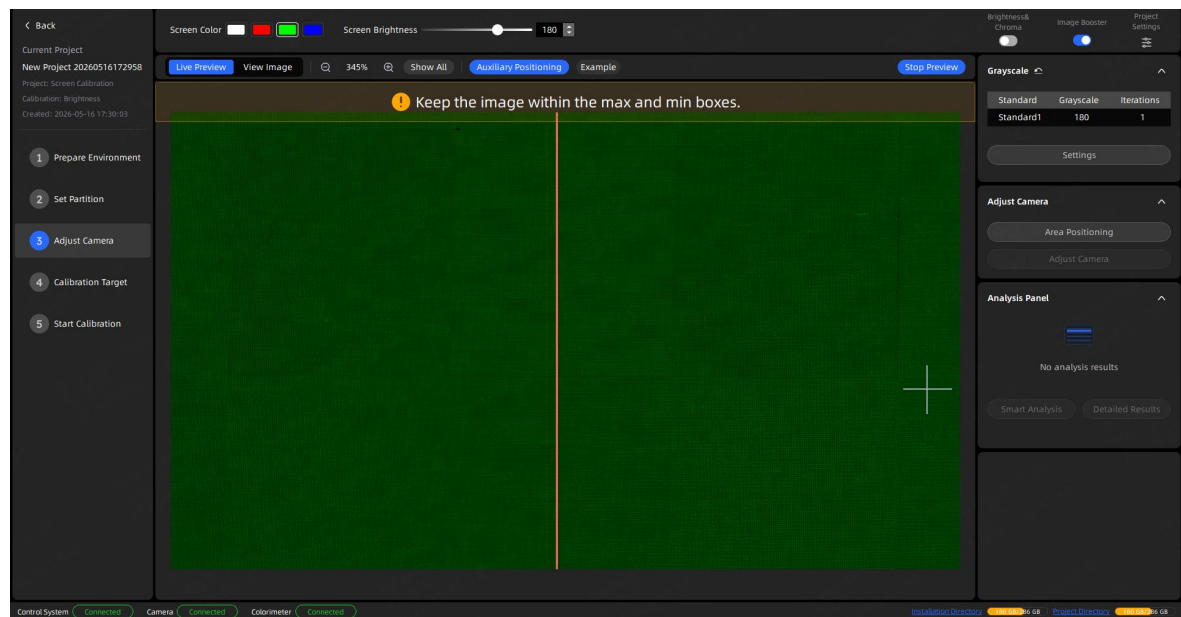
7.1.3.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.

Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-13 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

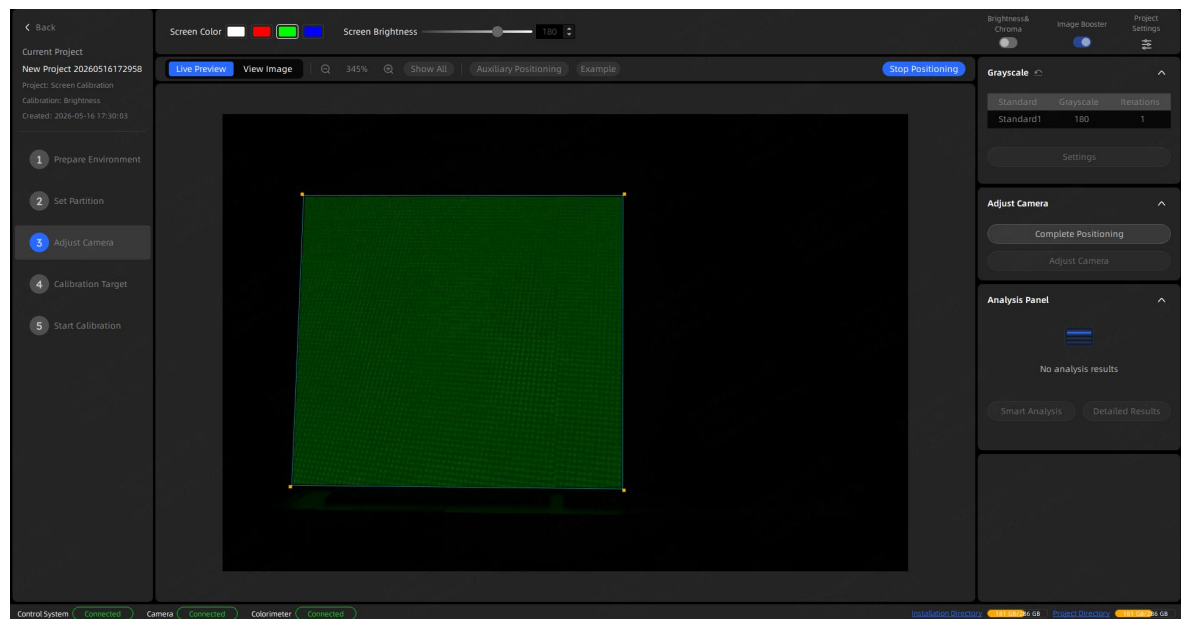
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.1.3.3 Area Positioning

Position the calibration area to improve the efficiency of parameter analysis and calibration.

- Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-14 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

Note

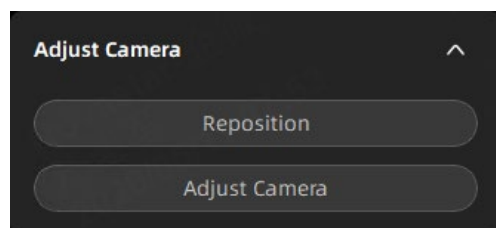
After the area positioning is completed, do not move the camera position during subsequent operations; if the camera needs to be moved, the area positioning must be performed again.

7.1.3.4 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

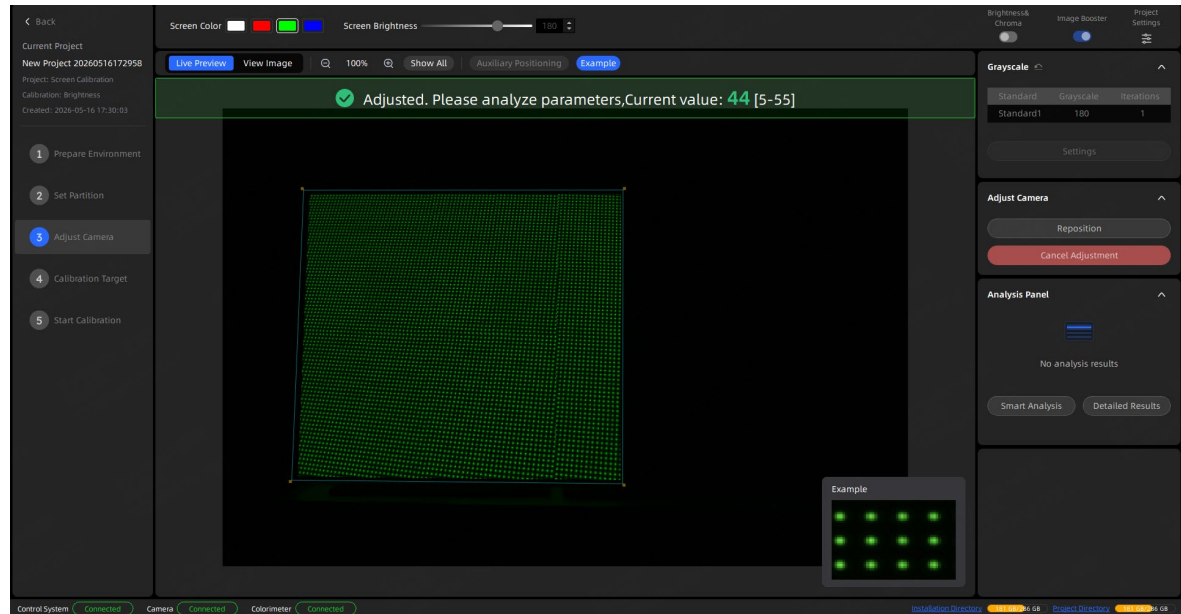
Figure 7-15 Adjusting camera



Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the exposure values on the screen. You can switch colors to check whether the image for each color falls within the acceptable range.

Figure 7-16 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

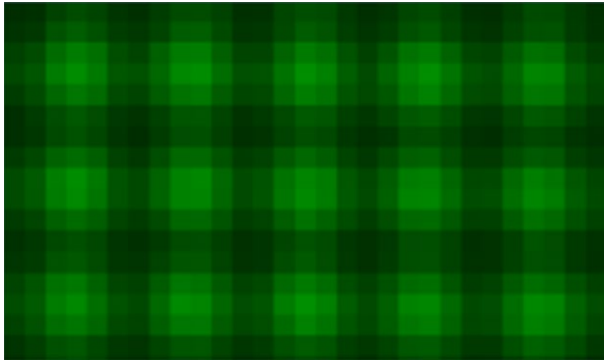
The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

The LED image should achieve the desired level of blurriness, as shown below.



7.1.3.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

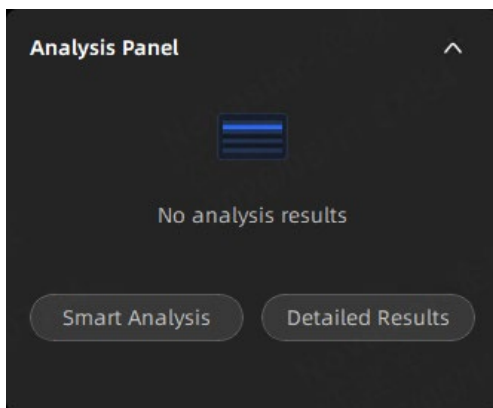
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

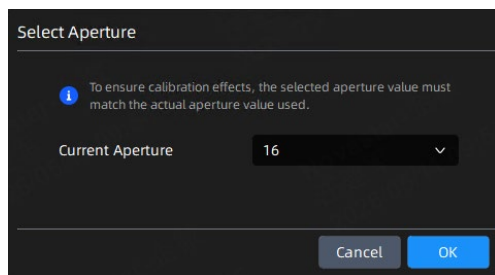
- Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-17 Smart analysis



- Step 2 (Optional) When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-18 Setting camera aperture



Step 3 Click **OK** to complete the aperture settings and start smart analysis.

Step 4 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.

- If a white value is displayed next to the color, the value is normal and the parameter analysis is completed.
- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 5](#).

Step 5 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 60, increase the aperture size or exposure time.
- If the peak brightness is greater than 80, decrease the aperture size or exposure time.
- If the image size is less than 5%, turn the focus ring to let the image become blurry.
- If the image size is greater than 60%, turn the focus ring to let the image become clearer.

Step 6 (Optional) Click **Detailed Results** to view the real-time analysis, exposure time, and gain of the Y filter for each color at the current capture grayscale in the pop-up window.

Figure 7-19 Detailed results

Color	Exposure	Gain	Aperture	Peak Brightness 60-80	Image Size 5-60
Y	450	100	2200	69	45
G	150	100	2200	69	40
B	1250	100	2200	69	37

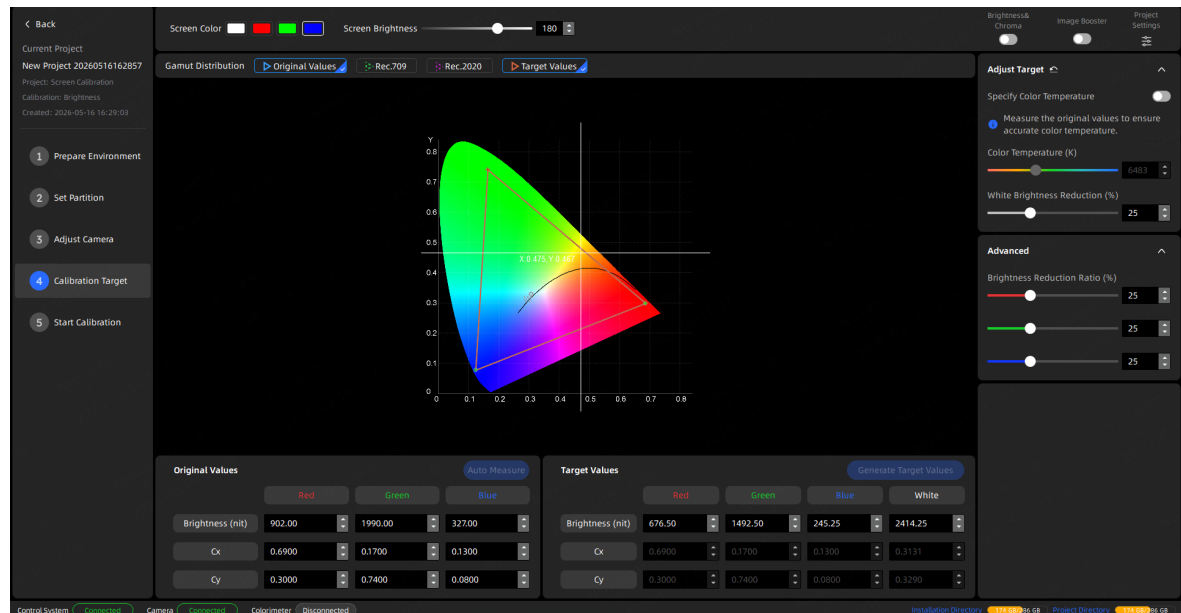
Note

- During parameter analysis, the software will automatically determine whether the current aperture settings can calibrate all grayscales. If the currently set calibration grayscale exceeds the camera's capture capability range, please set the grayscale within the range prompted by the pop-up window or adjust the camera parameters, and perform camera parameter analysis again.
- If the aperture is adjusted, you must reset the value in the Select Aperture pop-up window to ensure that the actual aperture value of the camera is consistent with the software settings.
- After the parameter analysis is completed, if any parameters of the camera are modified, you must perform the positioning and smart analysis again; otherwise the calibration effect will be affected.

7.1.4 Calibration Target

Obtain the original values of the screen brightness and chroma, and set the target values to complete the calibration target settings. The brightness calibration plan does not support the capture and setting of chroma-related values.

Figure 7-20 Calibration target values



7.1.4.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the screen to be calibrated, which can be set in the following ways:

- Colorimeter not connected

The system can automatically obtain the original values during the camera parameter analysis and generate the corresponding target values.

- Colorimeter connected

Use the colorimeter to measure the optical characteristics of the screen as original values.

Prerequisites

The control system and colorimeter are connected normally, and the colorimeter is properly placed:

- CA410 colorimeter: It should touch the cabinet closely.
- CS2000 colorimeter: It should be placed in the same position as the camera.

Procedure

Step 1 On the project home screen, select the **Calibration Target** tab.

- Step 2 In the **Original Values** area at the lower left, click the **Auto Measure** button on the left, and the software will automatically obtain the original values of brightness measured by the colorimeter and automatically calculate the target values.

Figure 7-21 Measuring original values

Original Values				Target Values				
	Red	Green	Blue		Red	Green	Blue	White
Brightness (nit)	902.00	1990.00	327.00	Brightness (nit)	676.50	1492.50	245.25	2414.25
Cx	0.6900	0.1700	0.1300	Cx	0.6900	0.1700	0.1300	0.3131
Cy	0.3000	0.7400	0.0800	Cy	0.3000	0.7400	0.0800	0.3290

Manually adjust the original values: Hold the colorimeter to measure the original brightness values and manually enter the measured values in the **Original Values** area. Click **Generate Target Values** on the right, and the system will automatically calculate and fill the calculation results into **Target Values**.

After any modification of the original values, you need to click **Generate Target Values** so that new target values can be generated and applied to the calibration procedure.

7.1.4.2 Set Target Values

Related Information

- For optimal results, use the target values automatically generated by the system.
- When adjusting the generated target values, ensure that the adjusted values do not turn red (indicating they are out of range). If necessary, adjust them to fall within the appropriate range.

Procedure

- Step 1 On the project home screen, select the **Calibration Target** tab.

- Step 2 Set the target values in any of the following ways:

- Enable **Custom Color Temperature**.

Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.

Adjust Target

Custom Color Temperature ☒

Measure the original values to ensure accurate color temperature.

Color Temperature (K)

6500

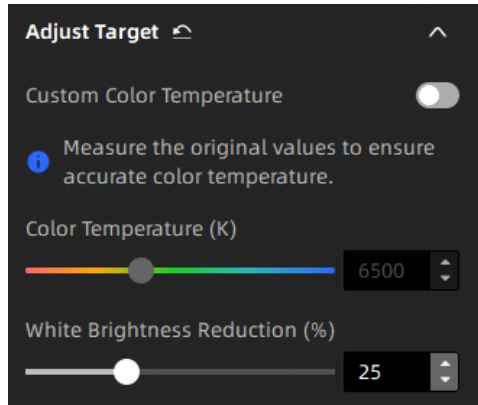
White Brightness Reduction (%)

30

Drag the **Color Temperature** and **White Brightness Reduction** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

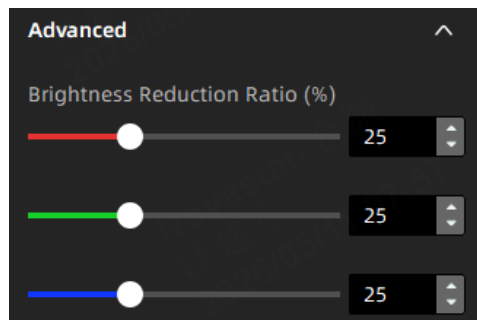
- Disable **Custom Color Temperature**.

After it is disabled, **Color Temperature** becomes disabled, and **White Brightness Reduction** becomes adjustable.



Drag the **White Brightness Reduction** slider, click the ▲ and ▼ buttons, or directly enter a value to set the white brightness reduction.

- Advanced editing
 - Adjust brightness reduction ratio
 - a. In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.
 - b. In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** slider, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Edit the target brightness values

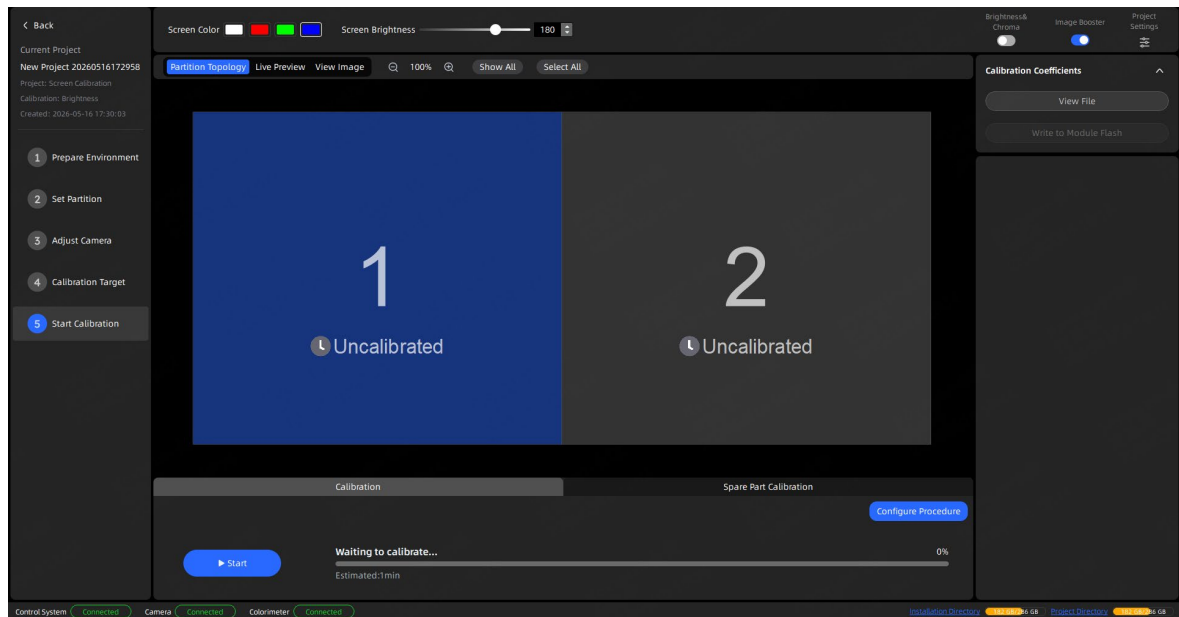
In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values. When **Custom Color Temperature** in the **Adjust Target** area on the right is turned on, the red, green, and blue brightness values in the target value table cannot be edited.

- Click ↶ next to **Adjust Target** to restore both original and target values to the default values.

7.1.5 Start Calibration

Configure effect optimization parameters, start calibration, view calibration results and export calibration coefficients.

Figure 7-22 Starting calibration



- Click **Partition Topology** on the **Start Calibration** screen to view the partition information of the current screen and select the partition to be calibrated.
- Click **Live Preview** in the top left corner and then click the **Live Preview** button in the center to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.1.5.1 Calibrate Partitions

Prerequisites

- All devices are connected normally.
- Image Booster effect is enabled on the current screen.
- Make sure the camera faces the partition to be calibrated during calibration.

Procedure

- Step 1 On the **Partition Topology** tab of the **Start Calibration** screen, select a calibration partition.
- Step 2 Click **Start** in the bottom left corner.
- Step 3 After a partition is calibrated, select the next partition from the partition topology to calibrate, and click **Start**. Repeat these actions until the entire screen is calibrated.

Note

When checking the calibration effect after calibration, use the CC3 software to display the test pattern and adjust the brightness.

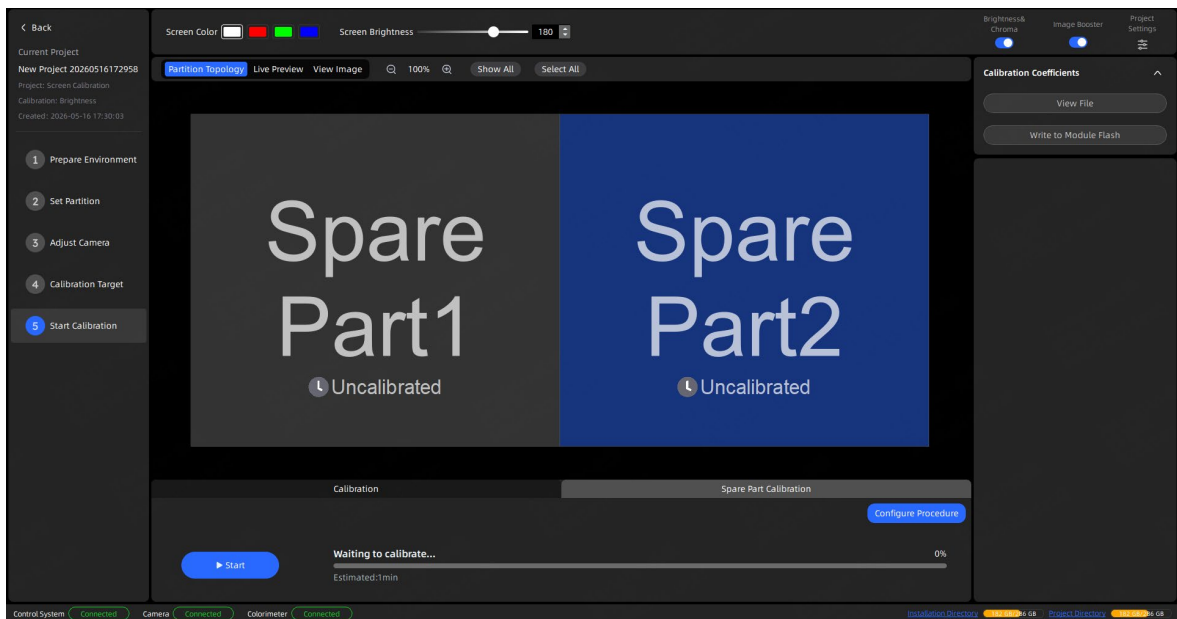
7.1.5.2 Calibrate Spare Parts

Step 1 When all partitions are calibrated, select a partition, remove the modules that are not at the edge of the partition or the screen, and install the spare module.

Step 2 Click the Spare Part Calibration tab.

Step 3 Click **Start** in the bottom left corner.

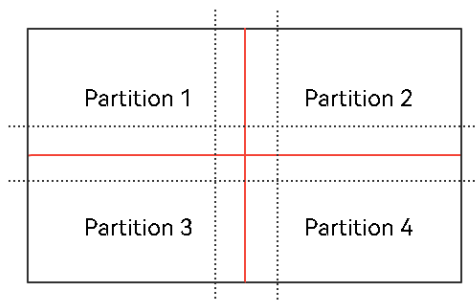
After the calibration is completed, confirm that the calibration effect of the current screen meets the expectations, and then it can be used. Keep the previously removed spare parts properly for later replacement.



Tips for Selecting Spare LED Boards

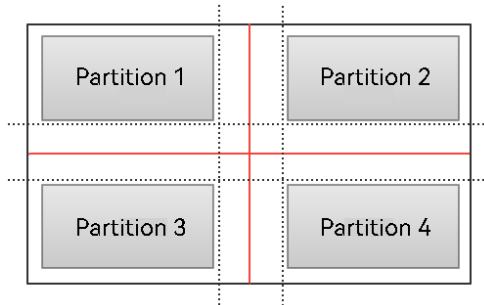
First, because there is a certain overlapping part between partitions, as shown in the figure below, bounded by the solid red line, there are a total of 4 partitions. The overlapping part between partitions is marked with a dashed line. The area inside the dashed line will be captured multiple times during partition calibration for subsequent boundary correction, playing a role in the uniform transition of partitions.

Therefore, for the position of replacing the spare module, do not select the partition overlapping area inside the dashed line as shown in the figure below.



Secondly, **it is also not recommended to replace the modules** near the edges. Due to the curved surface issue, replacing an edge module into the middle area will cause color difference issues in the curved transition.

Considering the above situations, when **replacing spare modules for calibration, please select the middle area of the partition**, which is **the shaded part shown in the figure below**. This can eliminate the impact of boundary correction and achieve a better spare module replacement effect.



7.2 High-Precision Brightness and Chroma Calibration

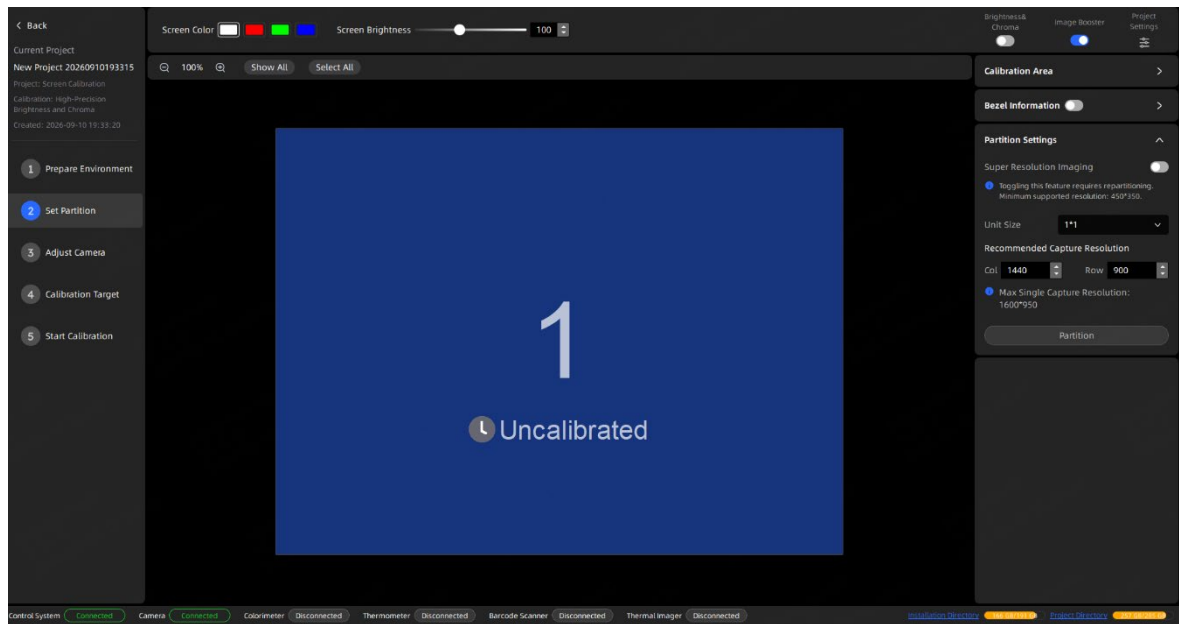
7.2.1 Prepare Environment

In the calibration software, connect a control system, set the module resolution, and connect a camera and a colorimeter. The preparation steps are the same as those for the brightness calibration. For details, see [7.1.1 Prepare Environment](#).

7.2.2 Set Partition

Set the calibration area and bezel information, set the partition, and view the partitioning result. If the screen resolution is very high, the camera cannot capture the image of the entire screen in just one time. You must divide the screen into multiple partitions for calibration.

Figure 7-23 Setting partition



Step 1 Check whether the screen has blocked parts or a bezel.

- No: Go to [Step 2](#).
- Yes: Set the calibration area or the bezel information. For details, see [7.1.2.1 Set Calibration Area](#) and [7.1.2.2 Set Bezel Information](#).

Step 2 Enable or disable **Super Resolution Imaging** as needed. Enabling it can significantly enhance the calibration speed.

Note

When connecting to the control system, the software automatically detects whether the connected controller supports Super Resolution Imaging. If supported, it is enabled by default.

Step 3 When you disable **Super Resolution Imaging**, click the drop-down list next to **Unit Size** to select a display pattern for the camera to capture the image.

The default unit size is calculated based on the screen resolution and camera capture capability. If there are no specific requirements, use the default parameters.

Step 4 Set the camera's recommended capture resolution, and the software will generate the camera's single capture resolution based on the input value and the actual screen resolution.

- Rows: Indicates the number of vertical LEDs that can be captured each time.
- Cols: Indicates the number of horizontal LEDs that can be captured each time.

The values of rows and columns captured once cannot be greater than the maximum resolution of the image that can be captured by the camera.

- When Super Resolution Imaging is enabled

Maximum capture resolution for the NOS-CC60: 2800×1700; recommended capture resolution: 2560×1440.

Maximum capture resolution for the C3200: 2300×1600; recommended capture resolution: 1950×1350.

- When Super Resolution Imaging is disabled

Maximum capture resolution for the NOS-CC60: 1600×950; recommended capture resolution: 1440×900.

Maximum capture resolution for the C3200: 1050×650; recommended capture resolution: 800×450

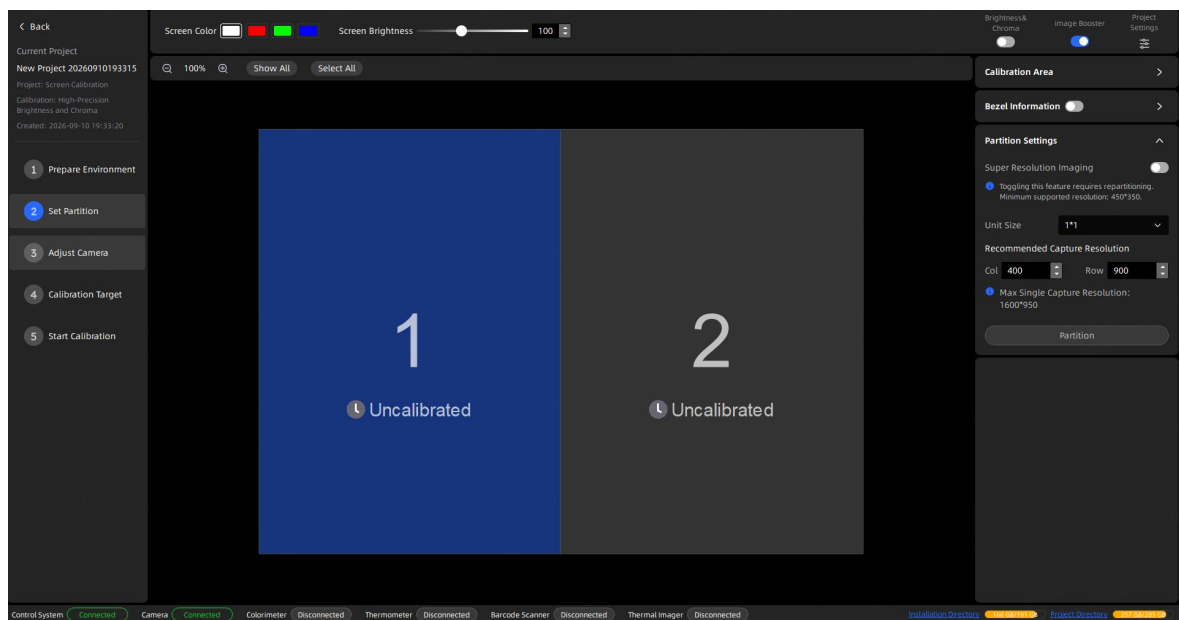
Step 5 Click the **Partition** button and the system will configure partitions based on the input parameters.



Modifying settings will reset existing partition data.

Step 6 Select a partition on the partition topology. The selected area becomes blue on the screen. When you move the mouse to the partition, the row, column, width and height values will be displayed.

Figure 7-24 Selecting a partition



- Rows: Indicates the vertical initial coordinate of the selected partition.
- Cols: Indicates the horizontal initial coordinate of the selected partition.
- W: Indicates the horizontal width of the selected partition.
- H: Indicates the vertical height of the selected partition.

7.2.3 Adjust Camera

Preview the images captured by the camera, set the calibration grayscale, camera parameters, and area positioning, and analyze the camera parameters to ensure the parameter analysis results meet the calibration requirements.

7.2.3.1 Set Calibration Grayscale

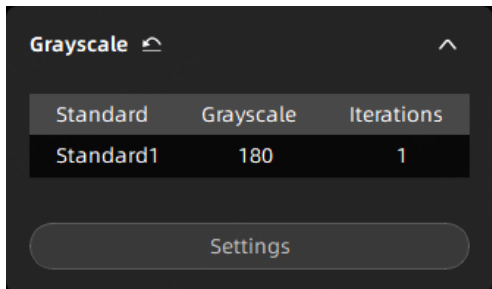
Set grayscale values for functions such as live preview, parameter analysis and calibration.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

Step 2 In the **Grayscale** area on the right, view the calibration grayscale information.

Click  next to **Grayscale** to restore the grayscale values to the default values.

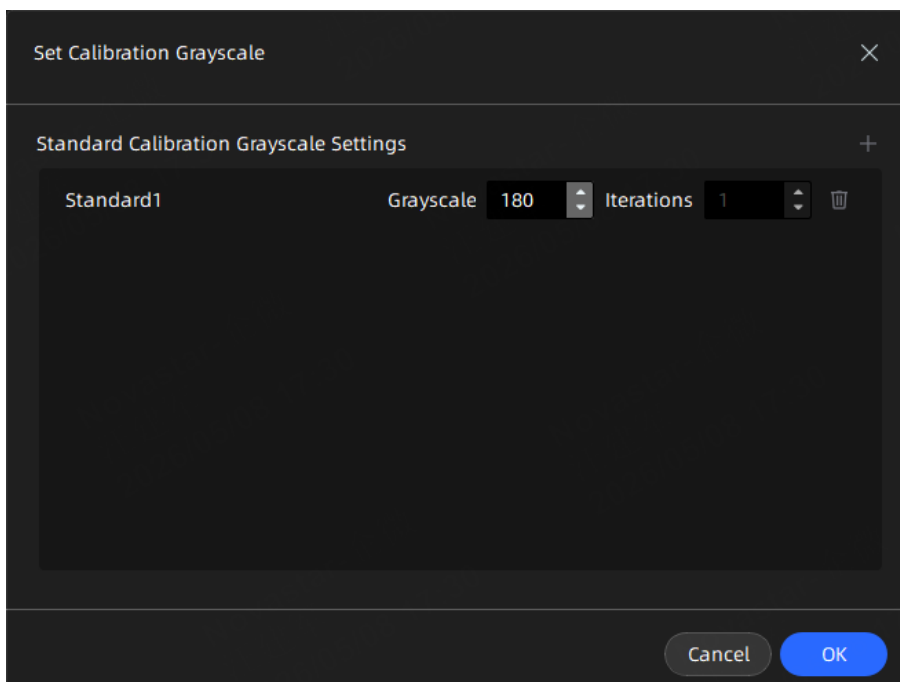
Figure 7-25 Calibration grayscale



Step 3 Click **Settings** in the **Grayscale** area to complete settings in the pop-up window.

- Calibration Grayscale: The default value is 180, and the value range is 0 to 255. This plan only supports settings of one layer of calibration grayscale.
- Iterations: It defaults to 1, and can be set between 1 and 10. Higher iteration counts will increase processing time. It can be adjusted on-site according to the actual situation of the screen, or you can contact NovaStar engineers for assistance.

Figure 7-26 Setting calibration grayscale



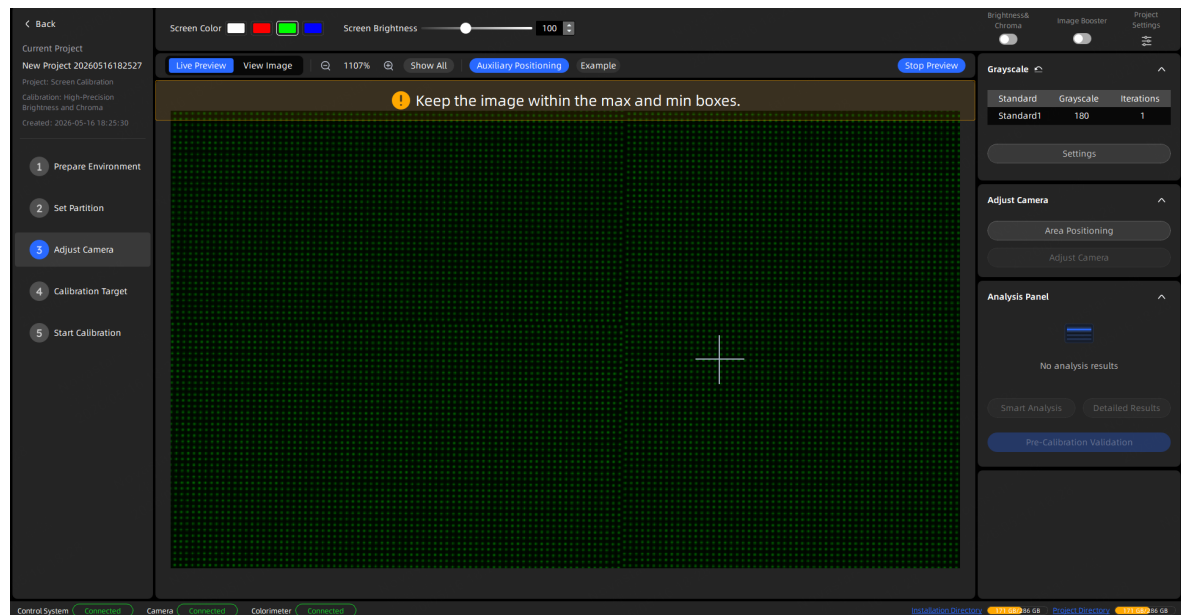
7.2.3.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.

Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-27 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

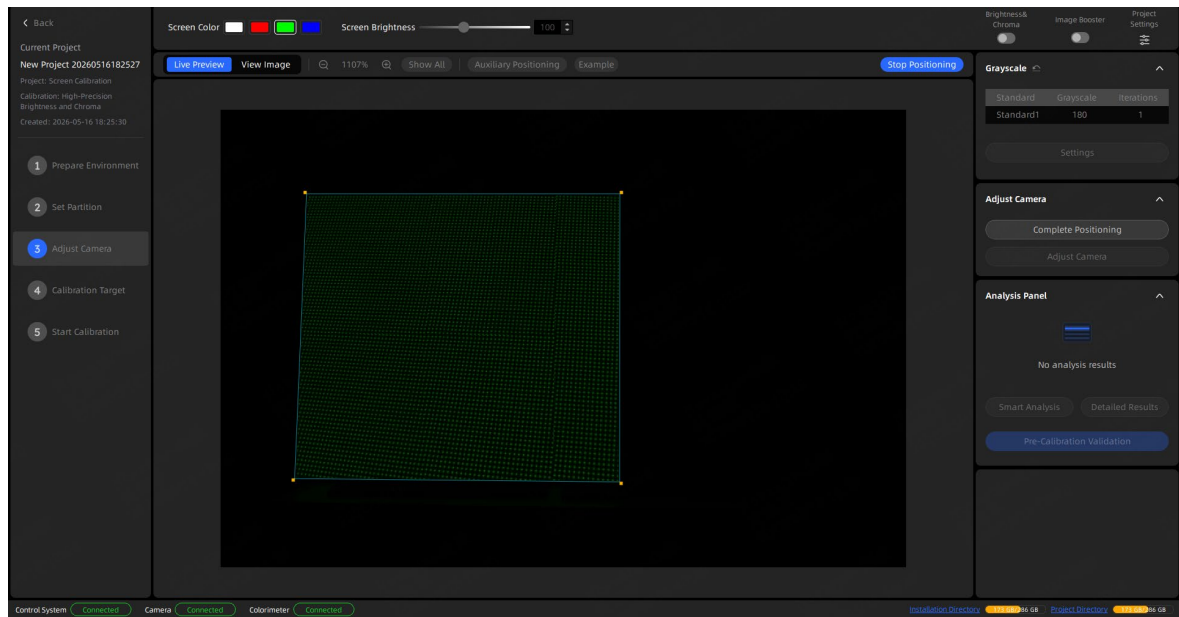
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.2.3.3 Area Positioning

Position the calibration area to improve the efficiency of parameter analysis and calibration.

Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-28 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

Note

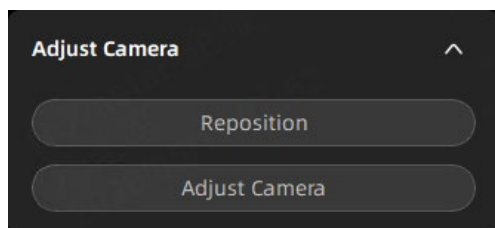
After the camera area positioning is completed, do not move the camera during subsequent operations; if the camera needs to be moved, the area positioning must be performed again.

7.2.3.4 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

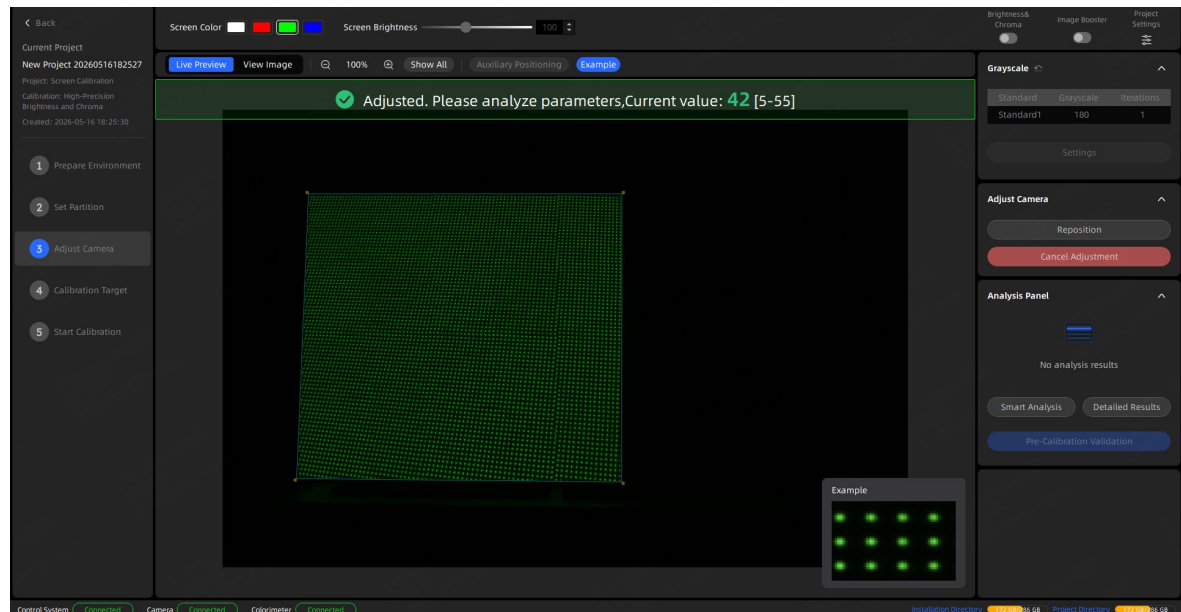
Figure 7-29 Adjusting camera



Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the exposure values on the screen. You can switch colors to check whether the image for each color falls within the acceptable range.

Figure 7-30 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

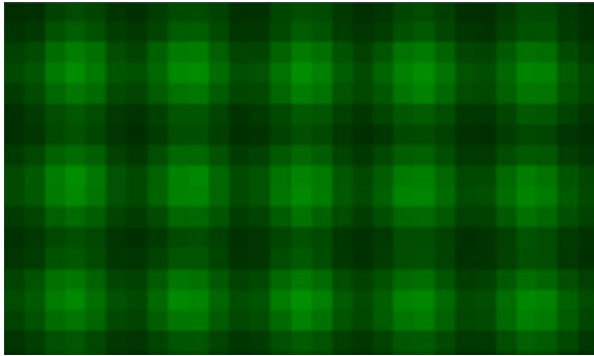
The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

The LED image should achieve the desired level of blurriness, as shown below.



7.2.3.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

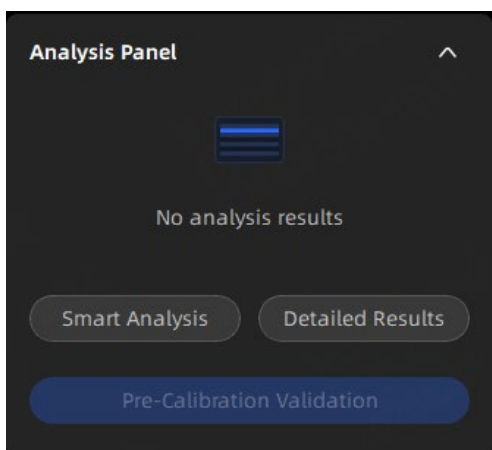
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

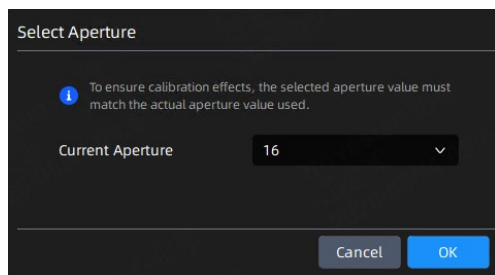
Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-31 Smart analysis



Step 2 (Optional) When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-32 Setting camera aperture



Step 3 Click **OK** to complete the aperture settings and start smart analysis.

Step 4 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.

- If a white value is displayed next to the color, the value is normal and the parameter analysis is completed.
- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 5](#).

Step 5 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 60, increase the aperture size or exposure time.
- If the peak brightness is greater than 80, decrease the aperture size or exposure time.
- If the image size is less than 5%, turn the focus ring to let the image become blurry.
- If the image size is greater than 60%, turn the focus ring to let the image become clearer.

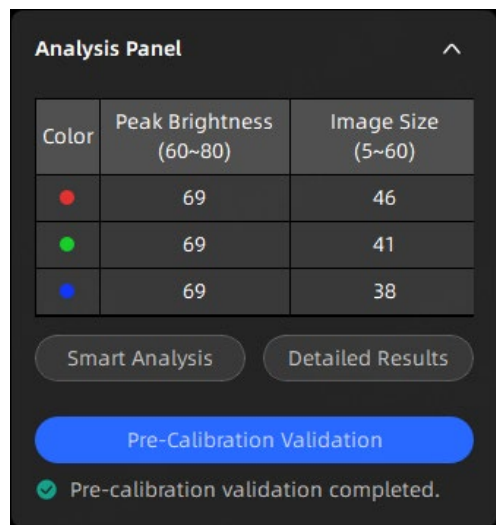
Step 6 (Optional) Click **Detailed Results** to view the real-time analysis, exposure time, and gain of the XYZ filters for each color at the current capture grayscale in the pop-up window.

Figure 7-33 Detailed results

Color	Exposure	Gain	Aperture	Peak Brightness 60-80	Image Size 5-60
X	150	100	2200	69	45
Y	350	100	2200	69	46
Z	100	1200	2200	--	--
x	850	100	2200	69	42
y	150	100	2200	69	41
z	1350	100	2200	70	40
X	300	100	2200	70	38
Y	1100	100	2200	69	38
Z	100	100	2200	71	38

Step 7 Click **Pre-Calibration Validation** to view the images captured during the camera parameter analysis in the camera preview area, and confirm that the screen in the images is not obstructed to ensure the subsequent calibration effect.

Figure 7-34 Pre-calibration verification results



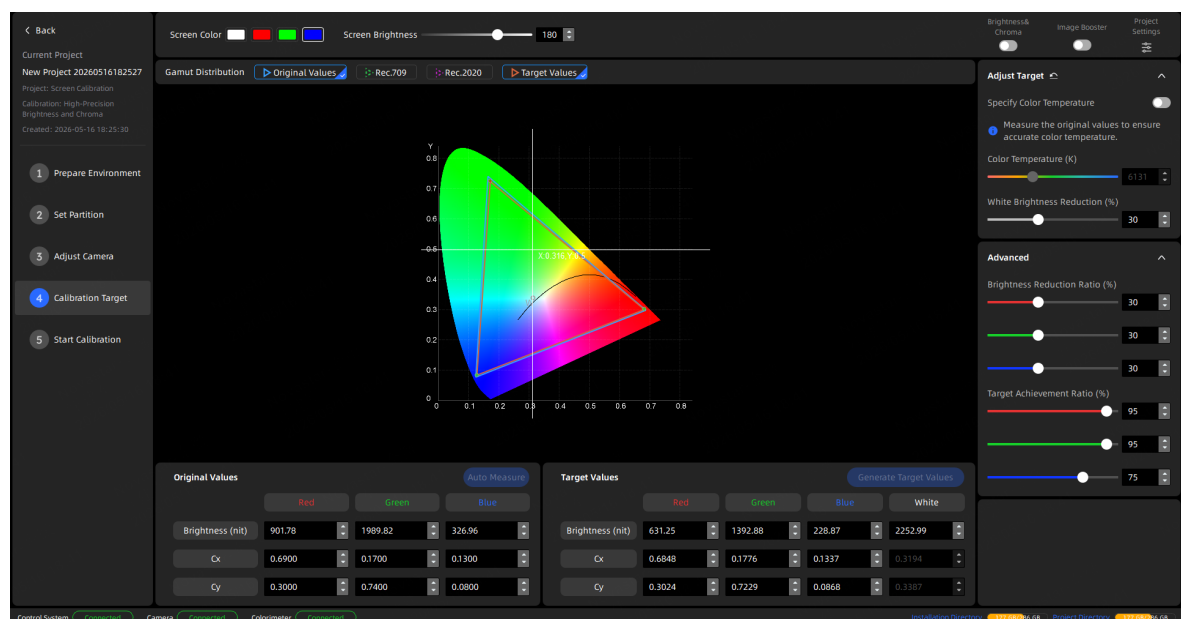
Note

- If the aperture is adjusted, you must reset the value in the Select Aperture pop-up window to ensure that the actual aperture value of the camera is consistent with the software settings.
- After the parameter analysis is completed, if any parameters of the camera are modified, you must perform the positioning and smart analysis again; otherwise the calibration effect will be affected.

7.2.4 Calibration Target

Obtain the original values of the screen brightness and chroma, and set the target values to complete the calibration target settings.

Figure 7-35 Calibration target



7.2.4.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the screen to be calibrated. They are used to calculate the calibration target values.

- Colorimeter not connected

The system can automatically obtain the original values during the camera parameter analysis and generate the corresponding target values.

- Colorimeter connected

Use the colorimeter to measure the optical characteristics of the screen as original values.

Prerequisites

The control system and colorimeter are connected normally, and the colorimeter is properly placed:

- CA410 colorimeter: It should touch the cabinet closely.
- CS2000 colorimeter: It should be placed in the same position as the camera.

Procedure

Step 1 On the project home screen, select the **Calibration Target** tab.

Step 2 In the **Original Values** area at the lower left, click the **Auto Measure** button on the left, and the software will automatically obtain the original values of brightness and chroma measured by the colorimeter.

Figure 7-36 Measuring original values

The screenshot displays two side-by-side panels. The left panel, titled 'Original Values', has an 'Auto Measure' button at the top right. It contains three tabs: 'Red', 'Green', and 'Blue'. Under each tab, there are three rows of data: 'Brightness (nit)', 'Cx', and 'Cy'. The right panel, titled 'Target Values', has a 'Generate Target Values' button at the top right. It contains four tabs: 'Red', 'Green', 'Blue', and 'White'. Under each tab, there are three rows of data: 'Brightness (nit)', 'Cx', and 'Cy'. At the bottom of the interface, there are status indicators for 'Camera' (Connected) and 'Colorimeter' (Connected), and a link for 'Installation Directio'.

Section	Parameter	Red	Green	Blue	White
Original Values	Brightness (nit)	901.78	1989.82	326.96	
	Cx	0.6900	0.1700	0.1300	
	Cy	0.3000	0.7400	0.0800	
Target Values	Brightness (nit)	631.25	1392.88	228.87	2252.99
	Cx	0.6848	0.1776	0.1337	0.3194
	Cy	0.3024	0.7229	0.0868	0.3387

Manually adjust the original values: Hold the colorimeter to measure the original values and manually enter the measured values in the **Original Values** area. Click **Generate Target Values** on the right, and the system will automatically calculate and fill the calculation results into **Target Values**.

After any modification of the original values, you need to click **Generate Target Values** so that new target values can be generated and applied to the calibration procedure.

7.2.4.2 Set Target Values

Related Information

- For optimal results, use the target values automatically generated by the system.

- When adjusting the generated target values, ensure that the adjusted values do not turn red (indicating they are out of range). If necessary, adjust them to fall within the appropriate range.

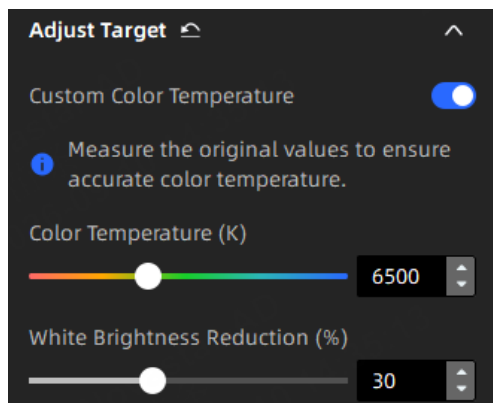
Procedure

Step 1 On the project home screen, select the **Calibration Target** tab.

Step 2 Set the target values using one or a combination of the following ways.

- Enable **Custom Color Temperature**.

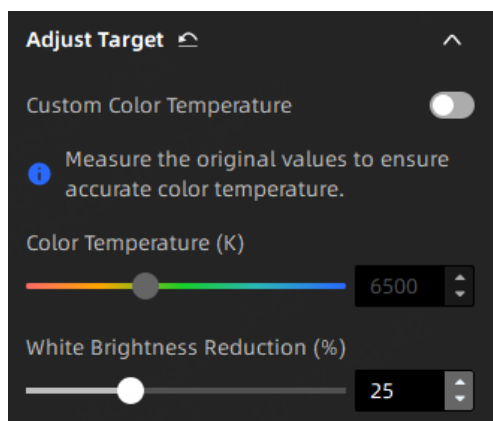
Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.



Drag the **Color Temperature** and **White Brightness Reduction** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

- Disable **Custom Color Temperature**.

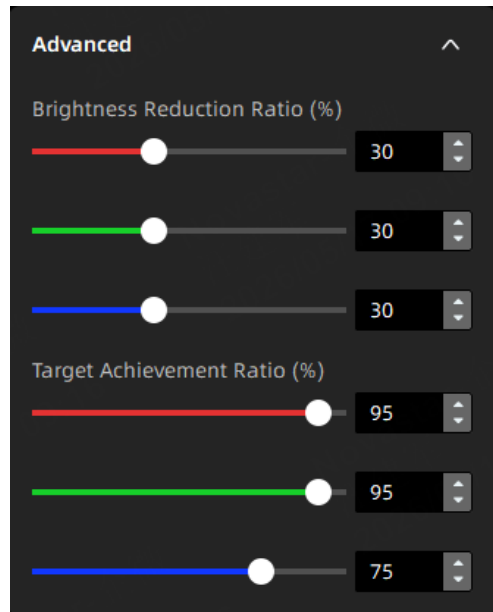
After it is disabled, **Color Temperature** becomes disabled, and **White Brightness Reduction** becomes adjustable.



Drag the **White Brightness Reduction** slider, click the ▲ and ▼ buttons, or directly enter a value to set the white brightness reduction.

- Advanced editing
 - Manually adjust brightness reduction ratio
 - a. In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.

- b. In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** and **Target Achievement Ratio** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Manually edit the target brightness and chroma values

In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values.

- Set the target values in the color gamut distribution chart

In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values.

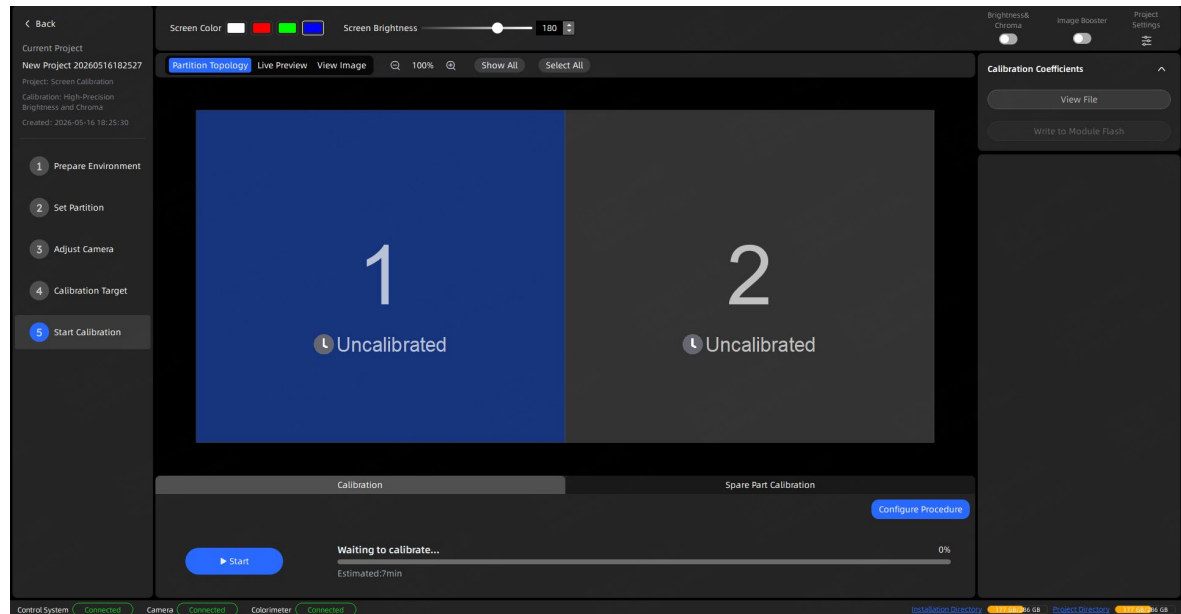
- Click  next to **Adjust Target** to restore both original and target values to the default values.

7.2.5 Start Calibration

Configure effect optimization parameters, start calibration, view calibration results and export calibration

coefficients.

Figure 7-37 Starting calibration



- Click **Partition Topology** on the **Start Calibration** screen to view the partition information of the current screen and select the partition to be calibrated.
- Click **Live Preview** in the top left corner and then click the **Live Preview** button in the center to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.2.5.1 Calibrate Partitions

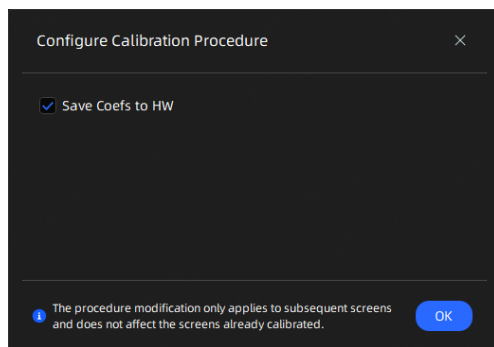
Prerequisites

- All devices are connected normally.
- Make sure the camera faces the partition to be calibrated during calibration.

Procedure

Step 1 Click **Configure Procedure** in the lower right corner to open the **Configure Procedure** page.

Figure 7-38 Configuring procedure



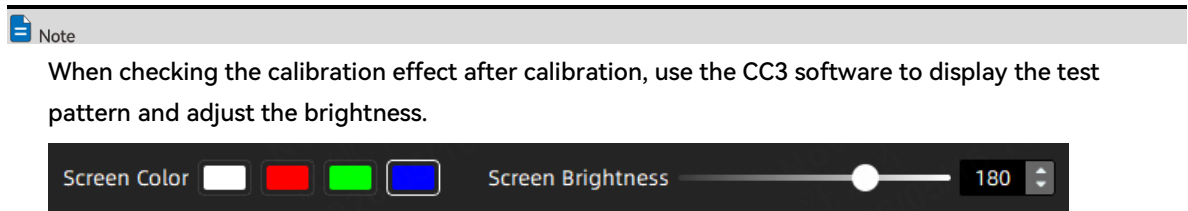
Step 2 Check **Save Coefs to HW**, and the parameters after calibration will be automatically saved into the receiving card.

Step 3 Click **OK** to complete the calibration procedure configuration.

Step 4 Select a calibration partition on the **Calibration** tab.

Step 5 Click **Start** in the bottom left corner.

Step 6 After a partition is calibrated, select the next calibration partition from the **Calibration** tab page and click **Start**. Repeat these actions until the entire screen is calibrated.



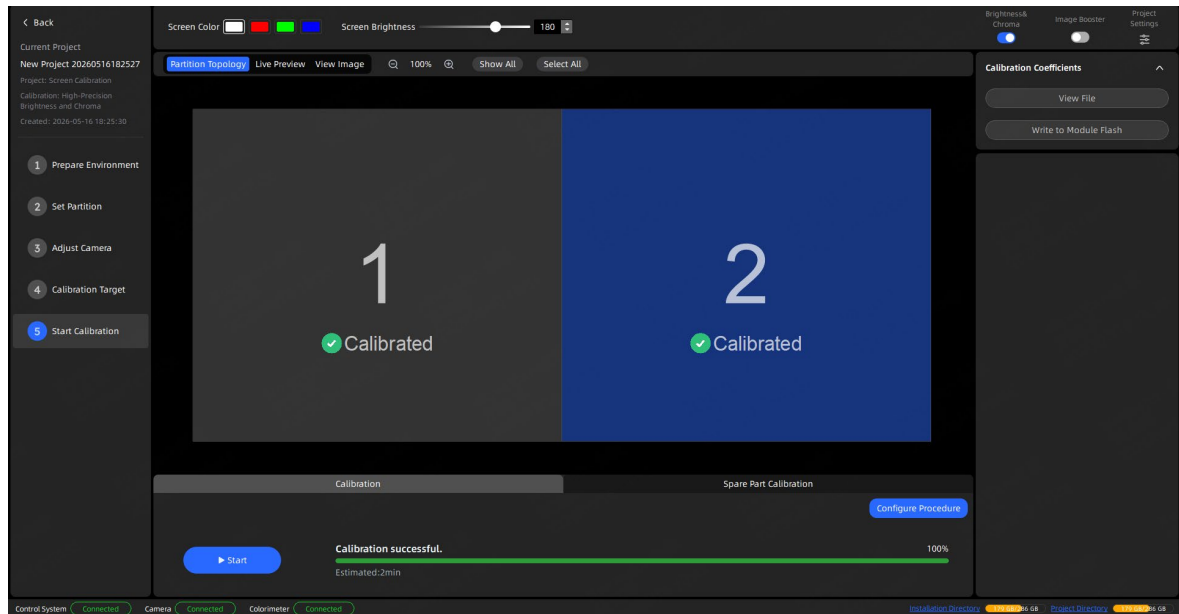
7.2.5.2 Calibrate Spare Parts

Step 1 Select a partition, remove the modules that are not at the edge of the partition or the screen, and install the spare module.

Step 2 Click the Spare Part Calibration tab.

Step 3 Click **Start** in the bottom left corner.

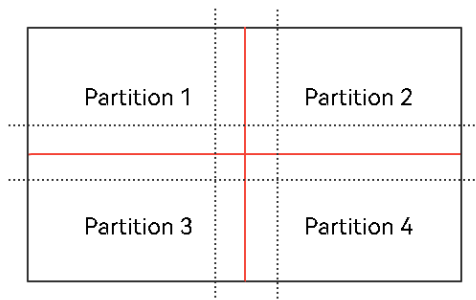
After the calibration is completed, confirm that the calibration effect of the current screen meets the expectations, and then it can be used. Keep the previously removed spare parts properly for later replacement.



Tips for Selecting Spare LED Boards

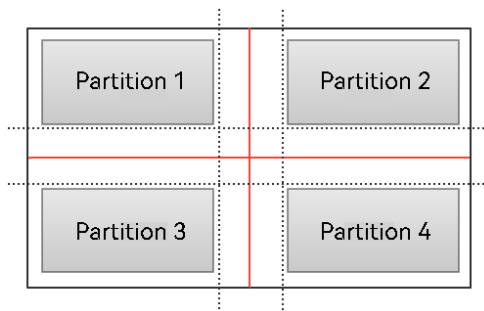
First, because there is a certain overlapping part between partitions, as shown in the figure below, bounded by the solid red line, there are a total of 4 partitions. The overlapping part between partitions is marked with a dashed line. The area inside the dashed line will be captured multiple times during partition calibration for subsequent boundary correction, playing a role in the uniform transition of partitions.

Therefore, for the position of replacing the spare module, do not select the partition overlapping area inside the dashed line as shown in the figure below.



Secondly, **it is also not recommended to replace the modules near the edges.** Due to the curved surface issue, replacing an edge module into the middle area will cause color difference issues in the curved transition.

Considering the above situations, when **replacing spare modules for calibration, please select the middle area of the partition**, which is **the shaded part shown in the figure below**. This can eliminate the impact of boundary correction and achieve a better spare module replacement effect.

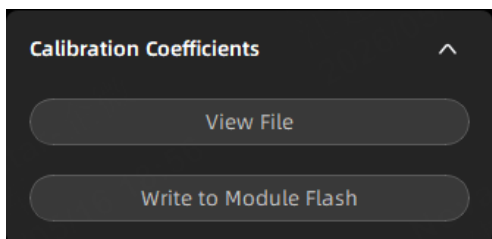


7.2.5.3 Manage Calibration Coefficients

After the calibration is completed, the software will automatically export the calibration coefficients to the coefficient storage location specified in **Settings**. The coefficient file is used for future screen maintenance.

- View File: Click **View File**, and the software will automatically open the folder where the coefficients are stored.
- Write to Module Flash: Click Write to Module Flash to save the calibration coefficients to the module Flash of the receiving card for easy one-click recall later.

Figure 7-39 Calibration coefficients



7.3 Low-Grayscale Calibration

7.3.1 Prepare Environment

In the calibration software, connect a control system, set the module resolution, and connect a camera and a colorimeter. The preparation steps are the same as those for the brightness calibration. For details, see [7.1.1 Prepare Environment](#).

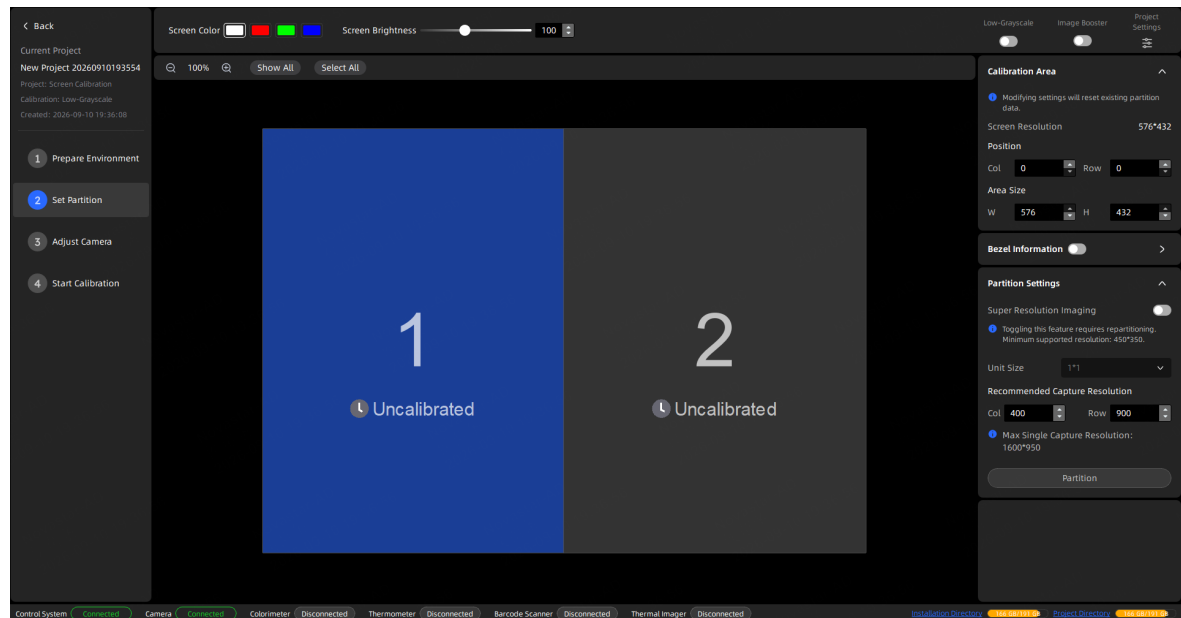
Notes

- Only the NOS-CC60 imaging colorimeter and the C3200 industrial camera are supported. Digital cameras are not supported.
- It is recommended to use this in conjunction with a controller. Please select the following models with the latest firmware from the official NovaStar website.
 - Control System: COEX series and MCTRL4K devices (latest version).
 - Video processing: Video wall splicers and all-in-one controllers (latest models and version)

7.3.2 Set Partition

Set the calibration area and bezel information, set the partition, and view the partitioning result. If the screen resolution is very high, the camera cannot capture the image of the entire screen in just one time. You must divide the screen into multiple partitions for calibration.

Figure 7-40 Setting partition



- Step 1 Check whether the screen has blocked parts or a bezel.
- No: Go to [Step 2](#).
 - Yes: Set the calibration area or the bezel information. For details, see [7.1.2.1 Set Calibration Area](#) and [7.1.2.2 Set Bezel Information](#).
- Step 2 Enable or disable **Super Resolution Imaging** as needed. Enabling it can significantly enhance the calibration speed.

Note

When connecting to the control system, the software automatically detects whether the connected controller supports Super Resolution Imaging. If supported, it is enabled by default.

- Step 3 When you disable **Super Resolution Imaging**, click the drop-down list next to **Unit Size** to select a display pattern for the camera to capture the image.
- The default unit size is calculated based on the screen resolution and camera capture capability. If there are no specific requirements, use the default parameters.
- Step 4 Set the camera's recommended capture resolution, and the software will generate the camera's single capture resolution based on the input value and the actual screen resolution.
- Rows: Indicates the number of vertical LEDs that can be captured each time.
 - Cols: Indicates the number of horizontal LEDs that can be captured each time.

The values of rows and columns captured once cannot be greater than the maximum resolution of the image that can be captured by the camera.

- When Super Resolution Imaging is enabled

Maximum capture resolution for the NOS-CC60: 2800×1700; recommended capture resolution: 2560×1440.

Maximum capture resolution for the C3200: 2300×1600; recommended capture resolution: 1950×1350.

- When Super Resolution Imaging is disabled

Maximum capture resolution for the NOS-CC60: 1600×950; recommended capture resolution: 1440×900.

Maximum capture resolution for the C3200: 1050×650; recommended capture resolution: 800×450

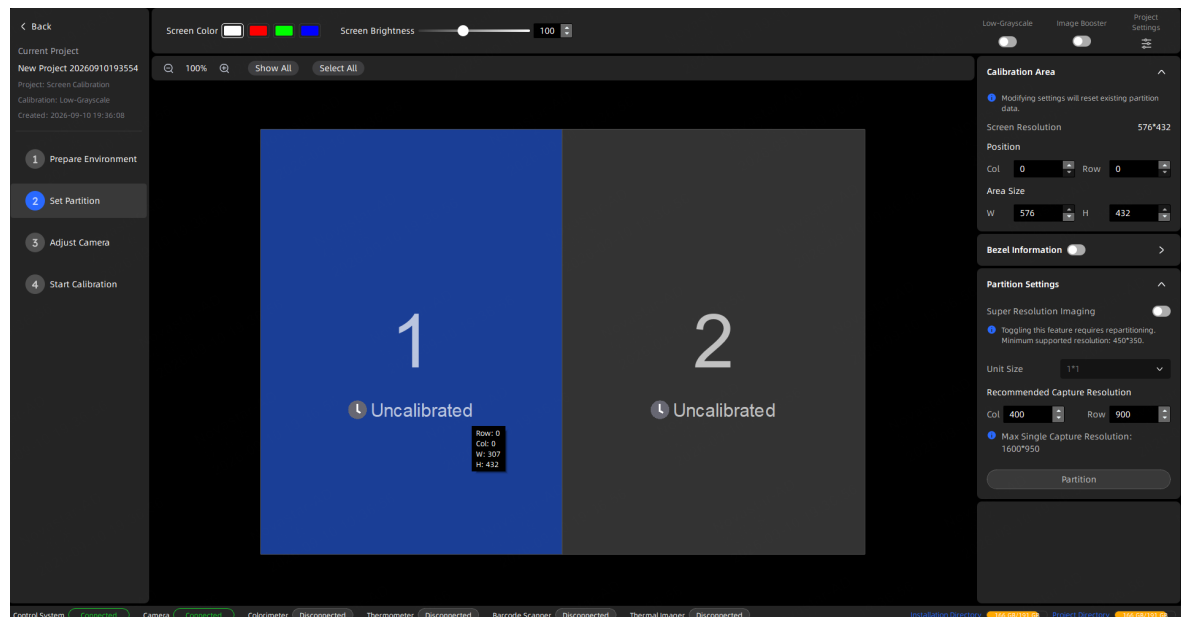
Step 5 Click the **Partition** button and the system will configure partitions based on the input parameters.



Modifying settings will reset existing partition data.

Step 6 Select a partition on the partition topology. The selected area becomes blue on the screen. When you move the mouse to the partition, the row, column, width and height values will be displayed.

Figure 7-41 Selecting a partition



- Rows: Indicates the vertical initial coordinate of the selected partition.
- Cols: Indicates the horizontal initial coordinate of the selected partition.
- W: Indicates the horizontal width of the selected partition.
- H: Indicates the vertical height of the selected partition.

7.3.3 Adjust Camera

Click **Adjust Camera** to enter the camera adjustment screen. Here, you can preview the images captured by the camera, set the low-grayscale parameters, camera parameters, and area positioning, and analyze the camera parameters to ensure the smart analysis results meet the calibration requirements.

7.3.3.1 Configure Low-Grayscale Parameters

Since different chips require different values, please follow the parameters recommended by the chip manufacturer for configuration. Some low-grayscale parameters affect display performance, so it is advisable to verify and apply them before conducting smart analysis and calibration.

Step 1 In the **Low-Grayscale Parameters** area on the right, configure the parameters based on the used chip.

Figure 7-42 Low-grayscale parameters

Other manufacturers' chip

The screenshot shows the 'Low-Grayscale Parameters' interface for 'Other manufacturers' chip'. It includes the following settings:

- Step:** 1
- Max Coef:** 15
- Initial Coefs:** R (empty), G (empty), B (empty)
- Apply to Current Partition** button
- Low-Grayscale Uniformity:** (empty)
- * Calibration Grayscale Gamma:** 64
- Apply to Current Partition** button

TBSilicon chip

The screenshot shows the 'Low-Grayscale Parameters' interface for 'TBSilicon chip'. It includes the following settings:

- Step:** 1
- Max Coef:** 15
- Initial Coefs:** R 7, G 7, B 7
- Apply** button
- * Current Value:** R 64, G 64, B 64
- Brightness coef:** 1
- Apply** button

- **Step:** This sets an incremental value on top of the initial low-grayscale coefficient, used for calculating parameters during the low-grayscale calibration process.
- **Max Coef:** To prevent coefficients from exceeding the receiving card's range and causing display anomalies, you can set the maximum value for the low-grayscale calibration coefficient. All coefficients generated through calibration will not exceed this value.
- **Initial Coefs:** This sets the initial baseline for red, green, and blue colors during the camera calibration. Subsequent calibration coefficients will iterate based on this baseline.
- **Low-Grayscale Uniformity:** Enter a low-grayscale uniformity value to make the non-uniform characteristics of the display more apparent in low-grayscale segments, facilitating later calibration.

- **Calibration Grayscale Gamma:** This sets the gamma for calibration grayscale. A higher value results in brighter calibration grayscale, which can enhance low-grayscale brightness for calibration.
- **Current:** This sets the current value. When using the TBS chip, which supports variable current, the entered current will serve as the calibration current. Higher current results in brighter calibration grayscale. This parameter is visible and configurable when the cabinet chip is a TBS chip. The default value is 64.
- **Brightness Coef:** This sets the brightness coefficient. For displays with a scan count below 32, it's recommended to select 1 or 2. For those above 32, select 4 or 8. This parameter is visible and configurable when the cabinet chip is a TBS chip.

Step 2 Click **Apply** to send the parameters to the cabinet to be calibrated.

Note

- It is recommended to use the default values for all low-grayscale parameters for calibration, as they cover most use cases. If default values do not yield satisfactory results, contact NovaStar official technical support for tuning and optimization.
- After low-grayscale calibration is complete, restore the **Calibration Grayscale Gamma** parameter to its original value, as failing to do so may affect subsequent calibration or debugging results.

Reference

Recommended low-grayscale parameter values differ based on the cabinet's chip. The table below provides the recommended values for several IC manufacturers.

Chip Manufacturer	Model	Step	Max Coef	Initial Coefs (RGB)	Low-Grayscale Uniformity
Chipone	2260	2	15	5 or 9	0 or 3
	2270	2	15	5 or 9	0 or 3
Sunplus	XM11202G	1	255	6	1
	XM11480G	3	255	15	1

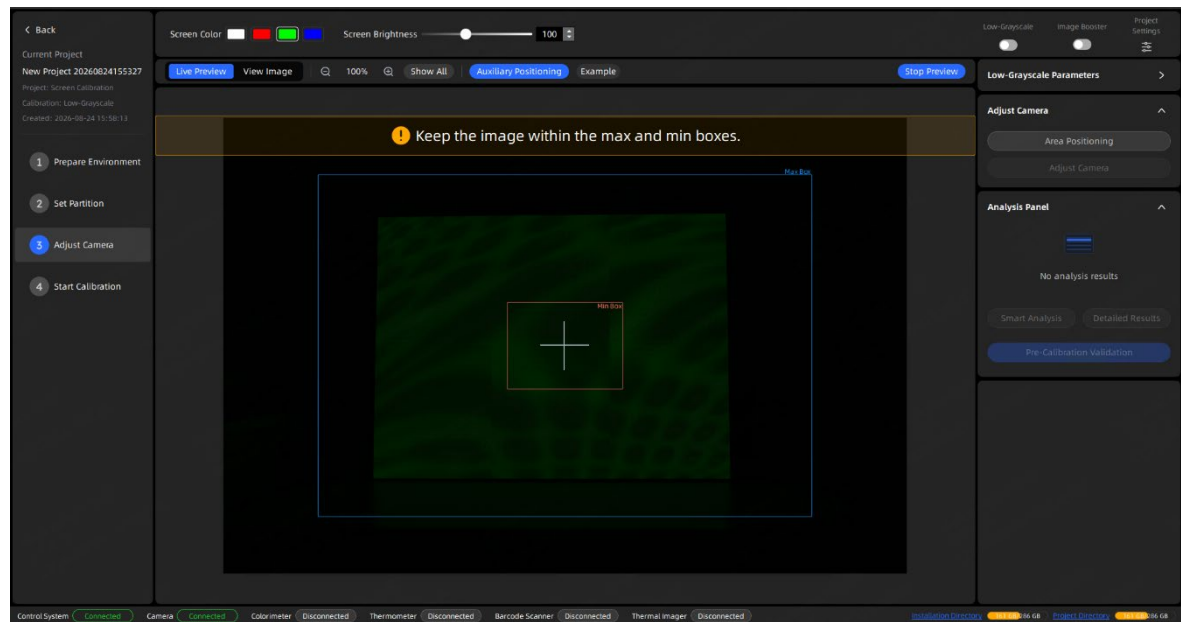
7.3.3.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.

Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-43 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

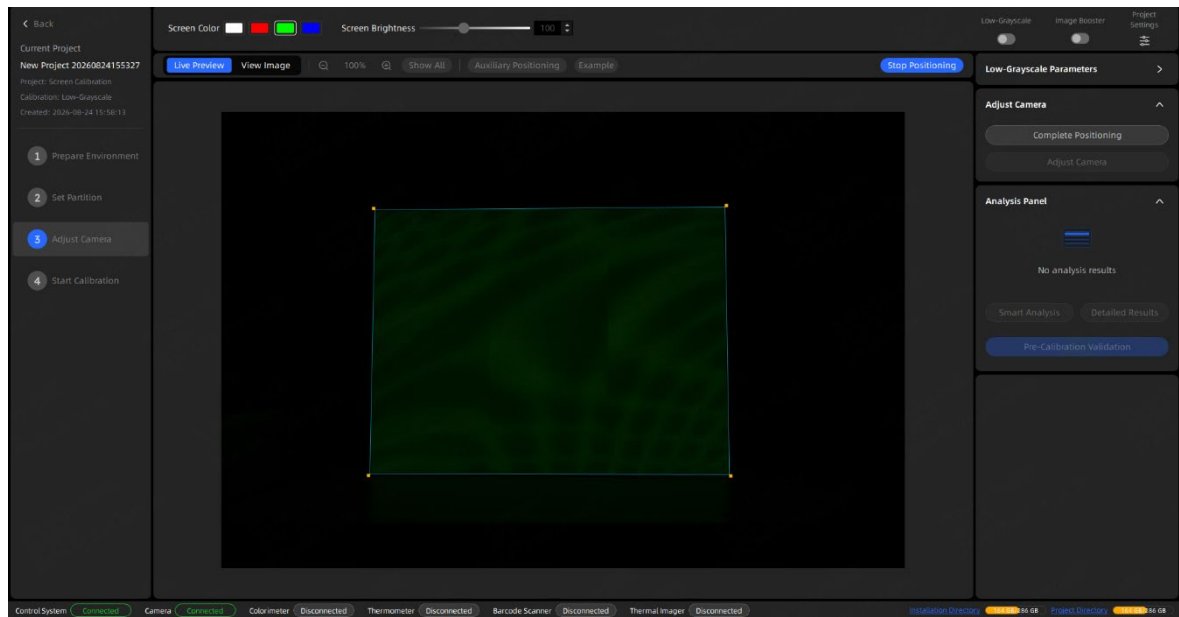
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.3.3.3 Area Positioning

Position the calibration area to improve the efficiency of parameter analysis and calibration.

- Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-44 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

Note

After the camera area positioning is completed, do not move the camera during subsequent operations; if the camera needs to be moved, the area positioning must be performed again.

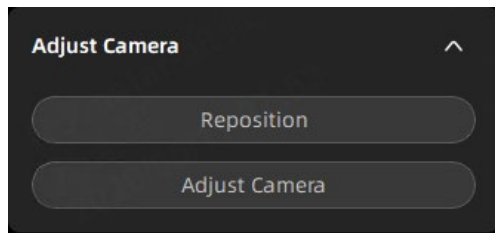
7.3.3.4 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Before proceeding with camera adjustment, ensure you have configured the low-grayscale parameters as described in [7.3.3.1 Configure Low-Grayscale Parameters](#).

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

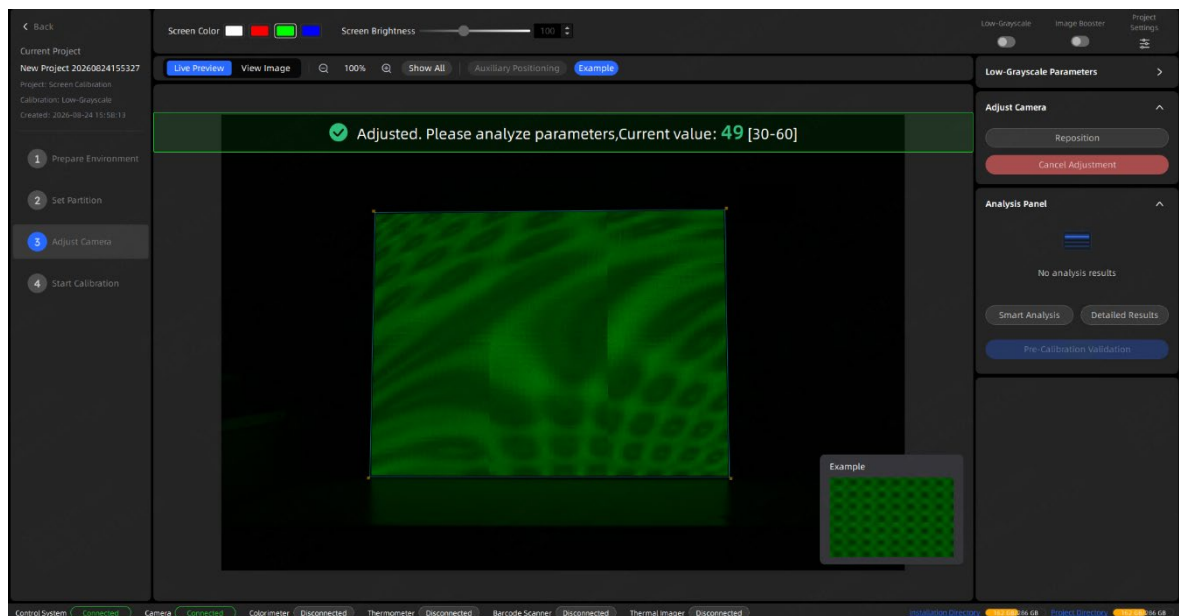
Figure 7-45 Adjusting camera



Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the exposure values on the screen. You can switch colors to check whether the image for each color falls within the acceptable range.

Figure 7-46 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

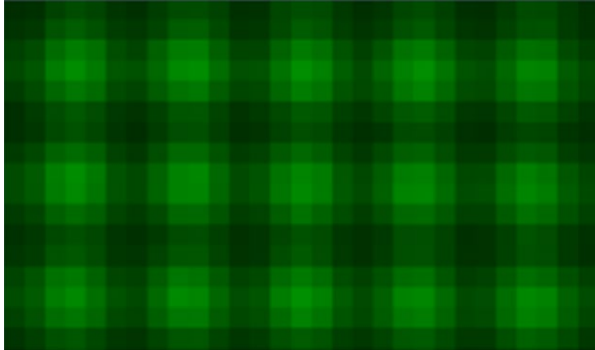
Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

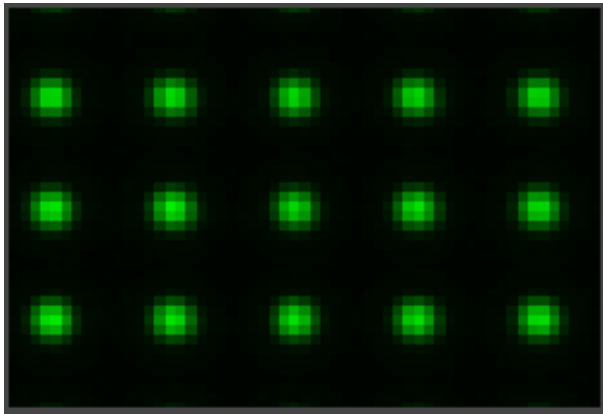
- LED imaging requirements

The LED imaging requirements vary depending on whether Super Resolution Imaging is enabled.

- Super Resolution Imaging enabled: The LED image should achieve the desired level of blurriness, as shown below.



- Super Resolution Imaging disabled: The LED image should be clear, as shown below.



7.3.3.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

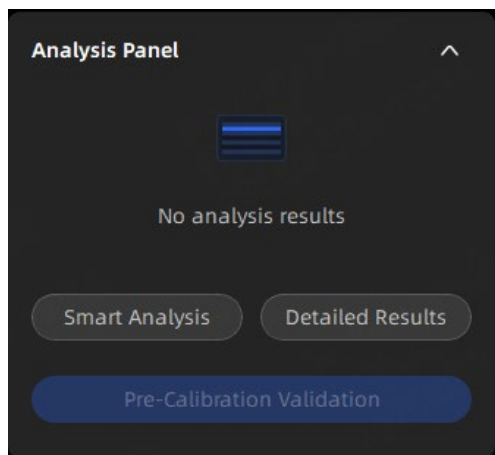
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

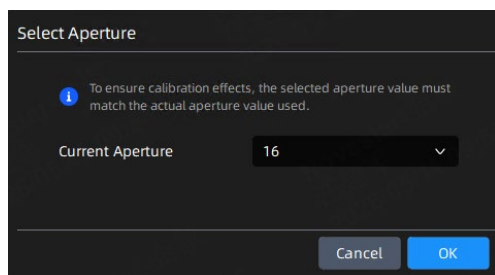
- Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-47 Smart analysis



Step 2 (Optional) When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-48 Setting camera aperture



Step 3 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.

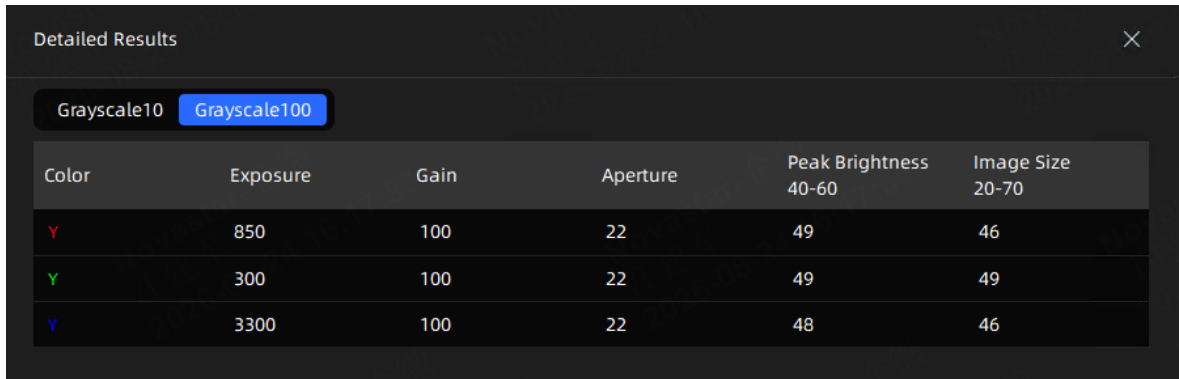
- If a white value is displayed next to the color, the value is normal and the parameter analysis is completed.
- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 4](#).

Step 4 Adjust the abnormal values by adjusting the camera-related parameters.

- When Super Resolution Imaging is enabled
 - If the peak brightness is less than 40, increase the aperture size or exposure time.
 - If the peak brightness is greater than 60, decrease the aperture size or exposure time.
 - If the image size is less than 20%, turn the focus ring to let the image become blurry.
 - If the image size is greater than 70%, turn the focus ring to let the image become clearer.
- When Super Resolution Imaging is disabled
 - If the peak brightness is less than 40, increase the aperture size or exposure time.
 - If the peak brightness is greater than 60, decrease the aperture size or exposure time.
 - If the image size is less than 18%, turn the focus ring to let the image become blurry.
 - If the image size is greater than 55%, turn the focus ring to let the image become clearer.

- Step 5 (Optional) Click **Detailed Results** to view the real-time analysis, exposure time, and gain of the XYZ filters for each color at the current capture grayscale in the pop-up window.

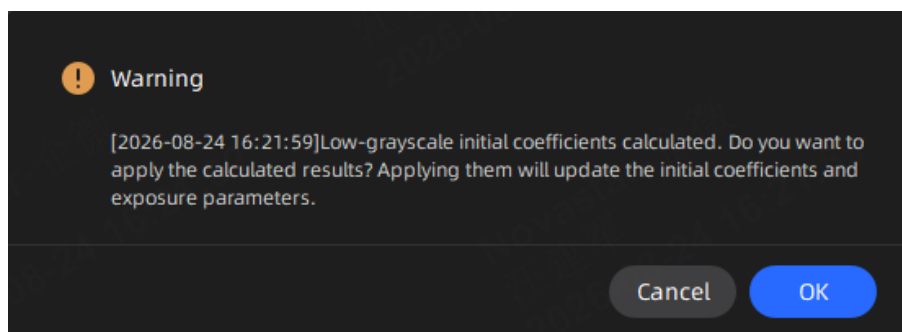
Figure 7-49 Detailed results



Color	Exposure	Gain	Aperture	Peak Brightness 40-60	Image Size 20-70
R	850	100	22	49	46
G	300	100	22	49	49
B	3300	100	22	48	46

- Step 6 Click **Pre-Calibration Validation** to view the images captured during the camera parameter analysis in the camera preview area, and confirm that the screen in the images is not obstructed to ensure the subsequent calibration effect.

Figure 7-50 Pre-calibration verification complete prompt



- Step 7 If no camera adjustment is required, click **OK**.

 Note

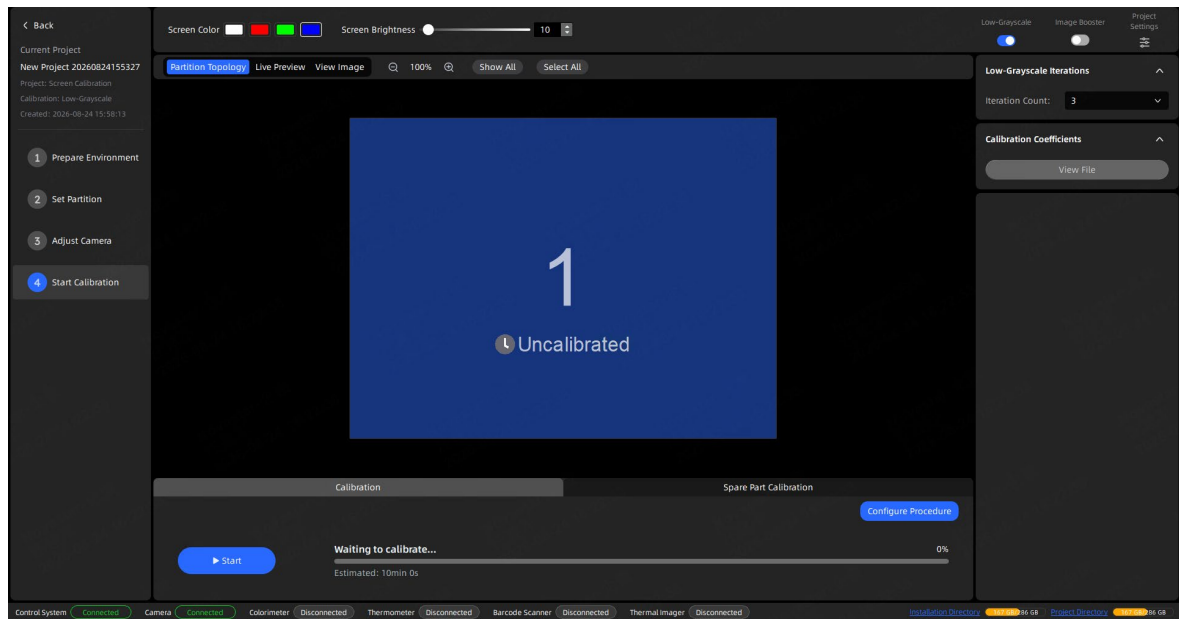
- During parameter analysis, the software will automatically determine whether the current aperture settings can calibrate all grayscales. If the currently set calibration grayscale exceeds the camera's capture capability range, please set the grayscale within the range prompted by the pop-up window or adjust the camera parameters, and perform camera parameter analysis again.
- If the aperture is adjusted, you must reset the value in the **Select Aperture** pop-up window to ensure that the actual aperture value of the camera is consistent with the software settings.
- After the parameter analysis is completed, if any parameters of the camera are modified, you must perform the positioning and smart analysis again; otherwise the calibration effect will be affected.

7.3.4 Start Calibration

Configure the calibration parameters and procedure, start calibration, view calibration results and export calibration coefficients.

Click **Start Calibration** on the left to enter the corresponding screen.

Figure 7-51 Starting calibration



- Click **Partition Topology** on the **Start Calibration** screen to view the partition information of the current screen and select the partition to be calibrated.
- Click **Live Preview** in the top left corner and then click the **Live Preview** button in the center to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.3.4.1 Set Low-Grayscale Iterations

Click the **Iteration Count** drop-down list to select the number of times to perform low-grayscale calibration. This can be set based on the uniformity of the display and calibration experience, with a default of 3 times.

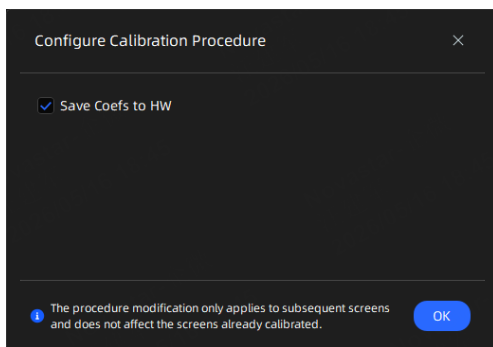
Figure 7-52 Setting low-grayscale iterations



7.3.4.2 Configure Calibration Procedure

Step 1 Click **Configure Procedure** in the lower right corner to open the **Configure Procedure** page.

Figure 7-53 Configuring procedure



Step 2 Check **Save Coefs to HW**, and the parameters after calibration will be automatically saved into the receiving card.

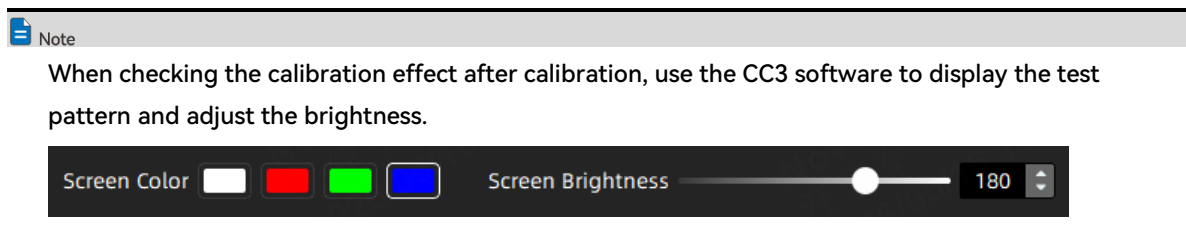
Step 3 Click **OK** to complete the calibration procedure configuration.

7.3.4.3 Start Calibration

Step 1 Select a calibration partition on the **Calibration** tab.

Step 2 Click **Start** in the bottom left corner.

Step 3 After a partition is calibrated, select the next calibration partition from the **Calibration** tab page and click **Start**. Repeat these actions until the entire screen is calibrated.



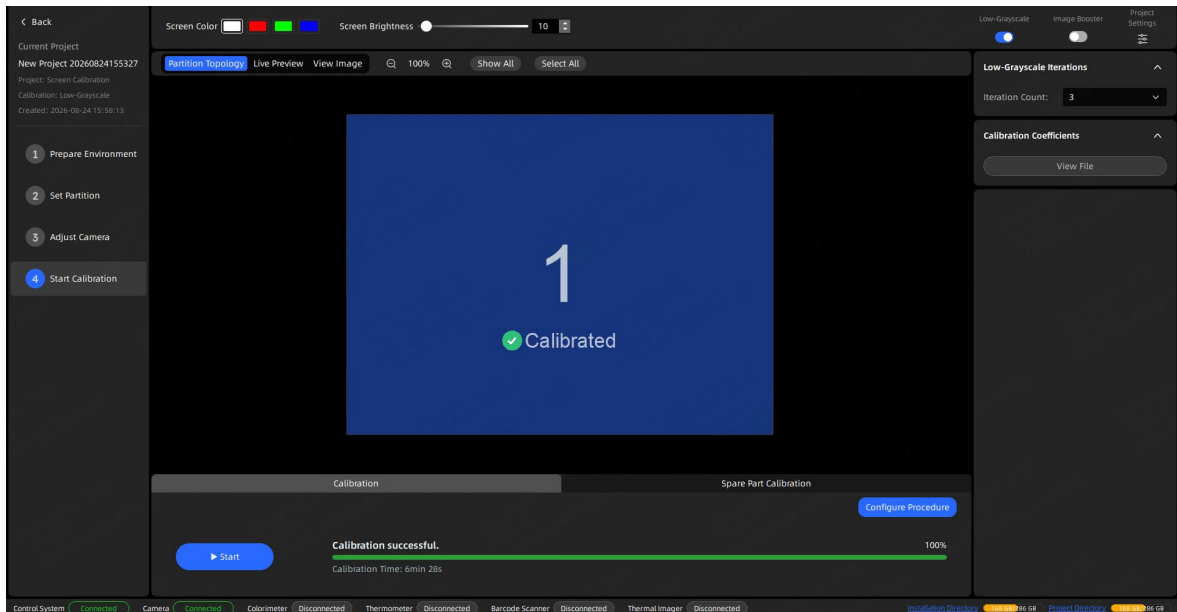
7.3.4.4 Calibrate Spare Parts

Step 1 Select a partition, remove the modules that are not at the edge of the partition or the screen, and install the spare module.

Step 2 Click the Spare Part Calibration tab.

Step 3 Click **Start** in the bottom left corner.

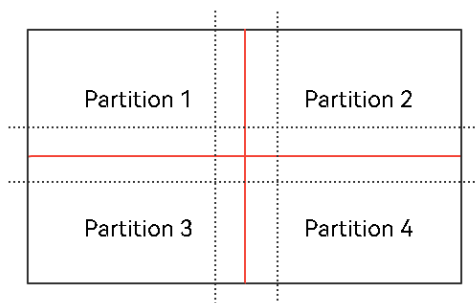
After the calibration is completed, confirm that the calibration effect of the current screen meets the expectations, and then it can be used. Keep the previously removed spare parts properly for later replacement.



Tips for Selecting Spare LED Boards

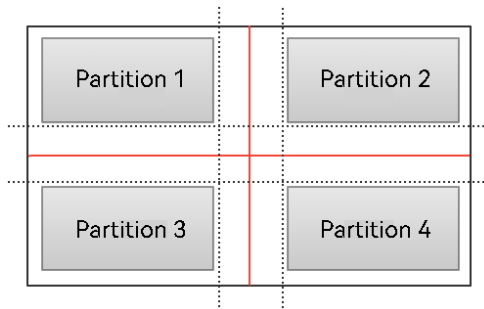
First, because there is a certain overlapping part between partitions, as shown in the figure below, bounded by the solid red line, there are a total of 4 partitions. The overlapping part between partitions is marked with a dashed line. The area inside the dashed line will be captured multiple times during partition calibration for subsequent boundary correction, playing a role in the uniform transition of partitions.

Therefore, for the position of replacing the spare module, do not select the partition overlapping area inside the dashed line as shown in the figure below.



Secondly, **it is also not recommended to replace the modules** near the edges. Due to the curved surface issue, replacing an edge module into the middle area will cause color difference issues in the curved transition.

Considering the above situations, when **replacing spare modules for calibration, please select the middle area of the partition**, which is **the shaded part shown in the figure below**. This can eliminate the impact of boundary correction and achieve a better spare module replacement effect.



7.3.4.5 View Calibration Coefficients

After the calibration is completed, the software will automatically export the calibration coefficients to the coefficient storage location specified in **Settings**. The coefficient file is used for future screen maintenance.

Click **View File**, and the software will automatically open the folder where the coefficients are stored.

7.4 Full-Grayscale Calibration 1.0

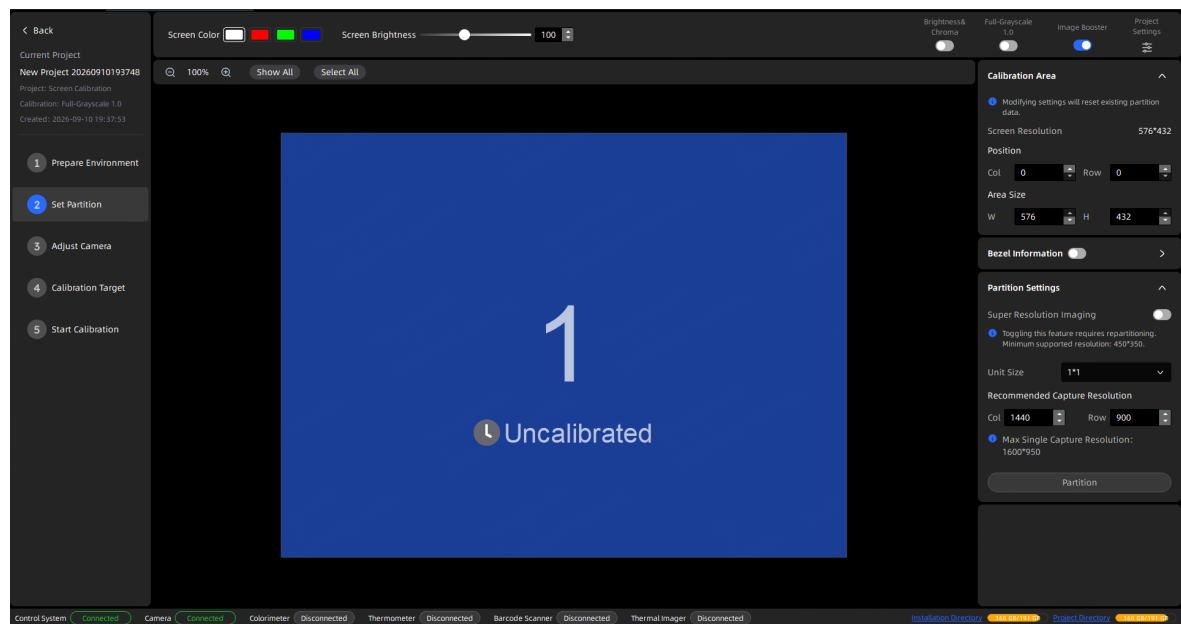
7.4.1 Prepare Environment

In the calibration software, connect a control system, set the module resolution, and connect a camera and a colorimeter. The preparation steps are the same as those for the brightness calibration. For details, see [7.1.1 Prepare Environment](#).

7.4.2 Set Partition

Set the calibration area and bezel information, set the partition, and view the partitioning result. If the screen resolution is very high, the camera cannot capture the image of the entire screen in just one time. You must divide the screen into multiple partitions for calibration.

Figure 7-54 Setting partition



Step 1 Check whether the screen has blocked parts or a bezel.

- No: Go to [Step 2](#).
- Yes: Set the calibration area or the bezel information. For details, see [7.1.2.1 Set Calibration Area](#) and [7.1.2.2 Set Bezel Information](#).

Step 2 Enable or disable **Super Resolution Imaging** as needed. Enabling it can significantly enhance the calibration speed.

Note

When connecting to the control system, the software automatically detects whether the connected controller supports Super Resolution Imaging. If supported, it is enabled by default.

Step 3 When you disable **Super Resolution Imaging**, click the drop-down list next to **Unit Size** to select a display pattern for the camera to capture the image.

The default unit size is calculated based on the screen resolution and camera capture capability. If there are no specific requirements, use the default parameters.

Step 4 Set the camera's recommended capture resolution, and the software will generate the camera's single capture resolution based on the input value and the actual screen resolution.

- Rows: Indicates the number of vertical LEDs that can be captured each time.
- Cols: Indicates the number of horizontal LEDs that can be captured each time.

The values of rows and columns captured once cannot be greater than the maximum resolution of the image that can be captured by the camera.

- When Super Resolution Imaging is enabled

Maximum capture resolution for the NOS-CC60: 2800×1700; recommended capture resolution: 2560×1440.

Maximum capture resolution for the C3200: 2300×1600; recommended capture resolution: 1950×1350.

- When Super Resolution Imaging is disabled

Maximum capture resolution for the NOS-CC60: 1600×950; recommended capture resolution: 1440×900.

Maximum capture resolution for the C3200: 1050×650; recommended capture resolution: 800×450

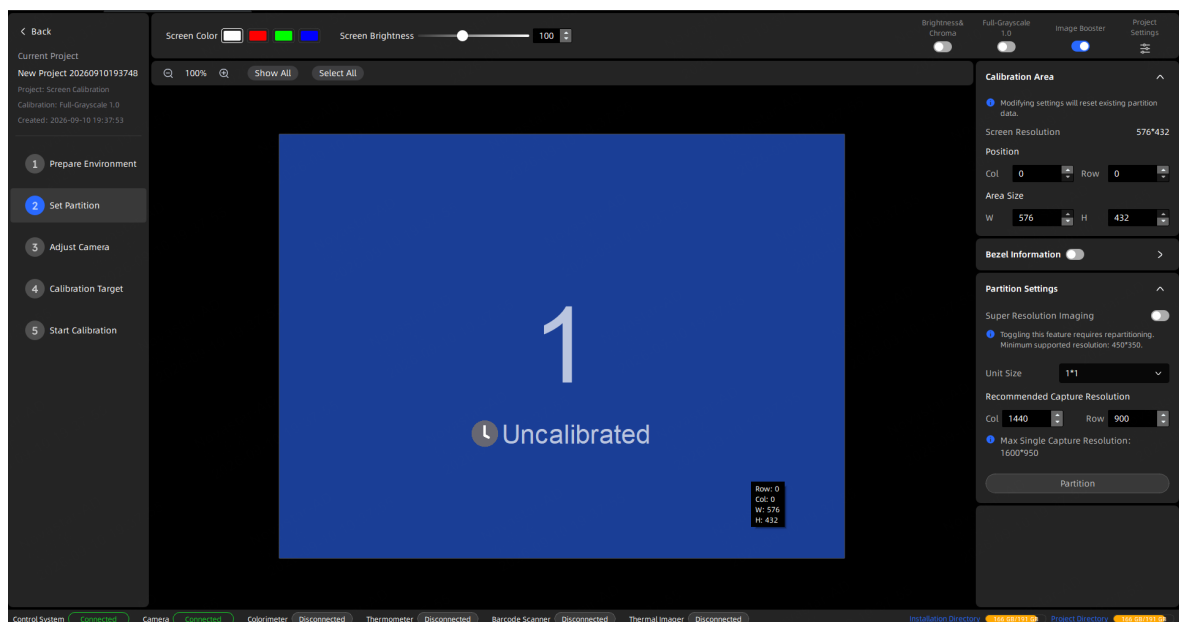
Step 5 Click the **Partition** button and the system will configure partitions based on the input parameters.



Modifying settings will reset existing partition data.

Step 6 Select a partition on the partition topology. The selected area becomes blue on the screen. When you move the mouse to the partition, the row, column, width and height values will be displayed.

Figure 7-55 Selecting a partition



- Row: Indicates the vertical initial coordinate of the selected partition.
- Col: Indicates the horizontal initial coordinate of the selected partition.
- W: Indicates the horizontal width of the selected partition.
- H: Indicates the vertical height of the selected partition.

7.4.3 Adjust Camera

Preview the images captured by the camera, set the calibration grayscale, camera parameters, and area positioning, and analyze the camera parameters to ensure the parameter analysis results meet the calibration requirements.

7.4.3.1 Set Calibration Grayscale

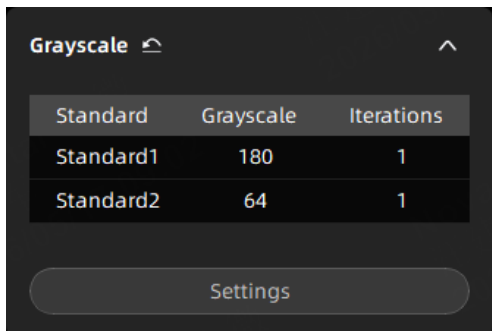
Set grayscale values for functions such as live preview, parameter analysis and calibration. The full-grayscale calibration 1.0 plan supports settings of multiple layers of standard calibration grayscale.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

Step 2 In the **Grayscale** area on the right, view the calibration grayscale information.

Click  next to **Grayscale** to restore the grayscale values to the default values.

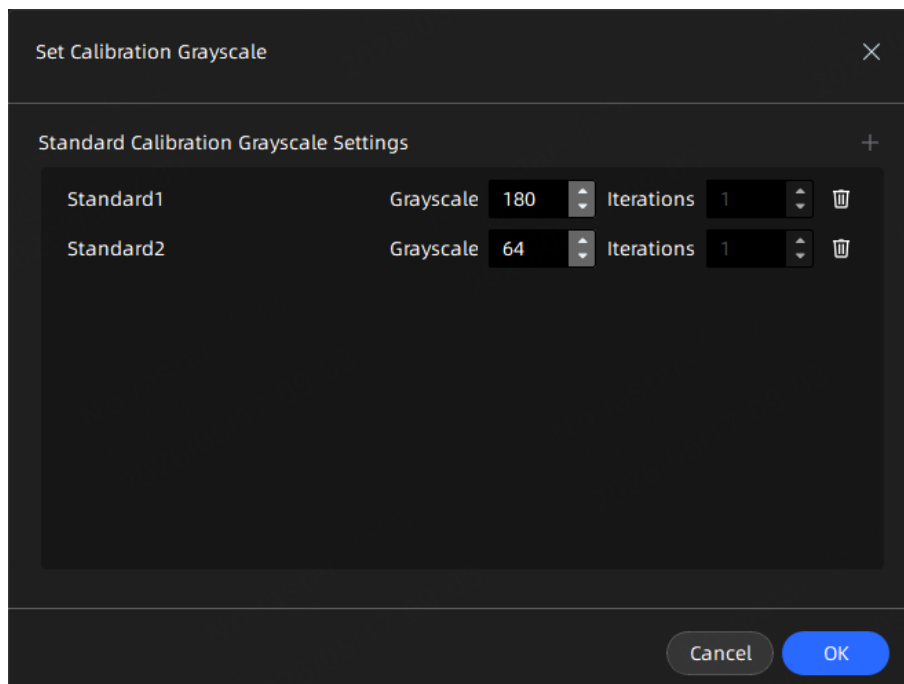
Figure 7-56 Calibration grayscale



Step 3 Click **Settings** in the **Grayscale** area to complete settings in the pop-up window.

- Calibration Grayscale: Multi-layer standard calibration grayscale is supported depending on the receiving card model used. For regular screens, the default capture grayscale can be used for calibration. At the same time, the calibration grayscale can be specifically set according to the screen characteristics.
- Iterations: Set the number of iteration for each layer of calibration grayscale. It defaults to 1, and can be set between 1 and 10. Higher iteration counts will increase processing time. It can be adjusted on-site according to the actual situation of the screen, or you can contact NovaStar engineers for assistance.

Figure 7-57 Setting calibration grayscale

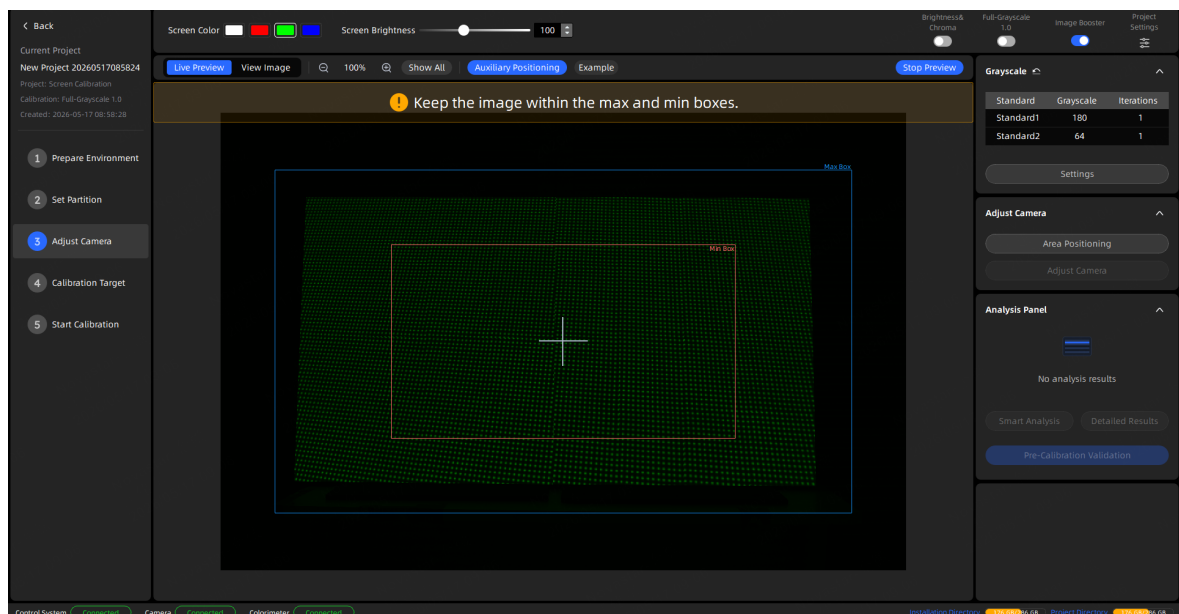


7.4.3.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

- Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.
- Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-58 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

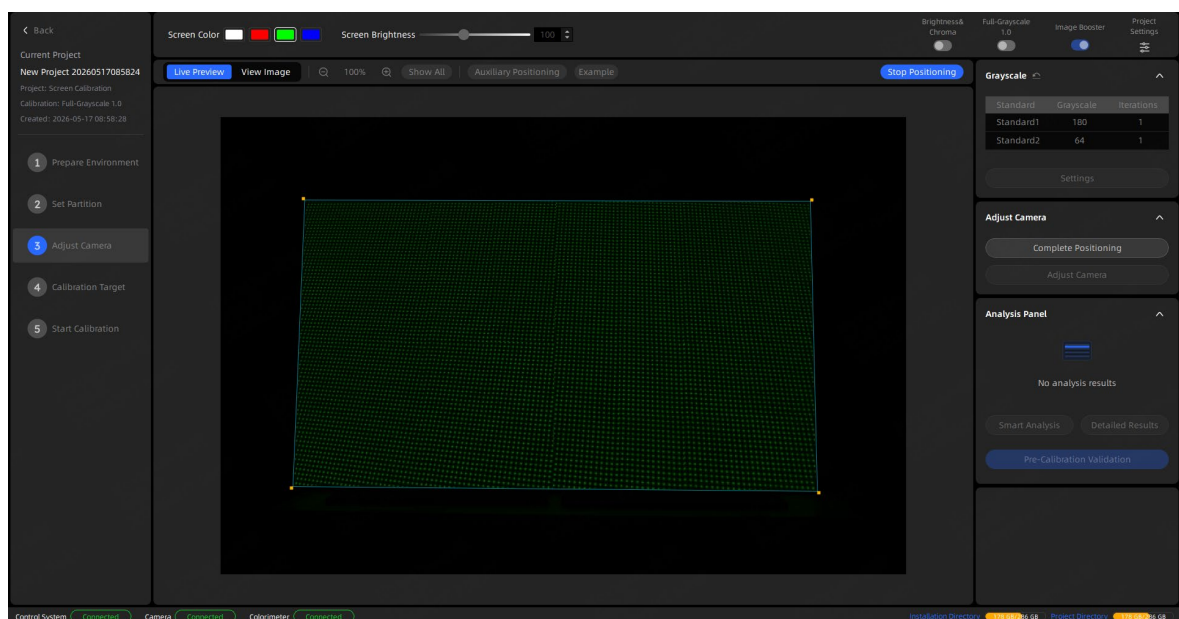
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.4.3.3 Area Positioning

Position the calibration area to improve the efficiency of parameter analysis and calibration.

- Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-59 Area positioning



- Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

- Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.



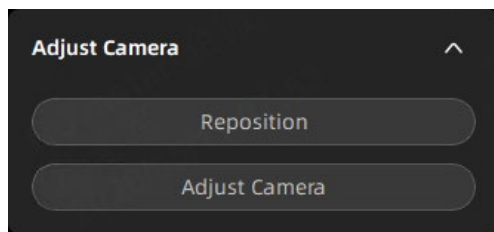
After the camera area positioning is completed, do not move the camera during subsequent operations; if the camera needs to be moved, the area positioning must be performed again.

7.4.3.4 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

- Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

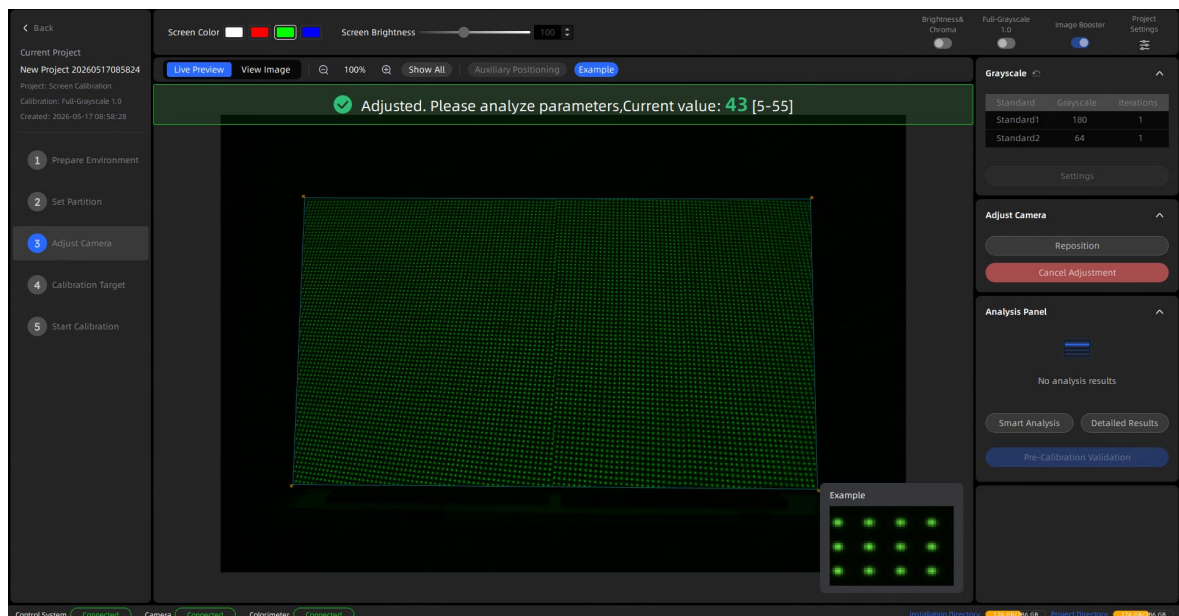
Figure 7-60 Adjusting camera



- Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the exposure values on the screen. You can switch colors to check whether the image for each color falls within the acceptable range.

Figure 7-61 Adjusting camera



- Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area or the upper right corner to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

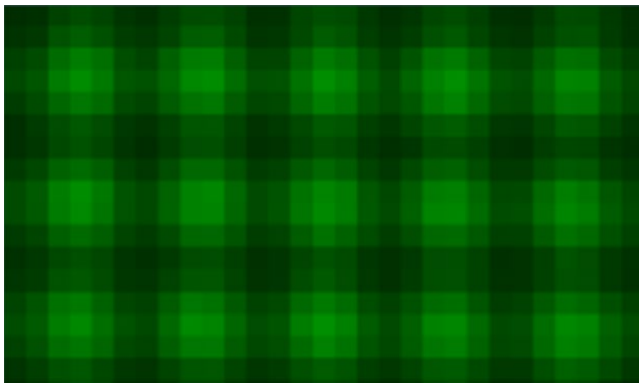


Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

The LED image should achieve the desired level of blurriness, as shown below.



7.4.3.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

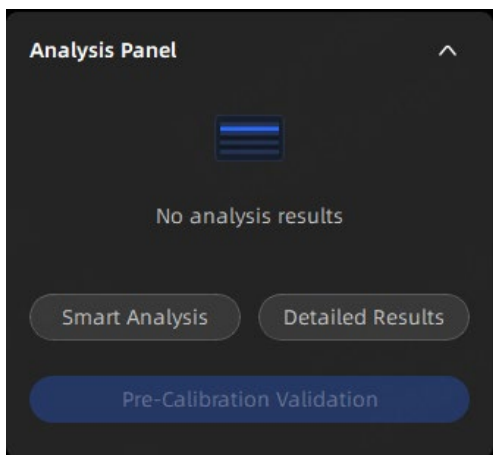
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

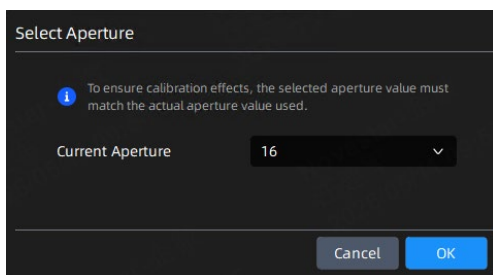
- Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-62 Smart analysis



Step 2 (Optional) When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-63 Aperture settings



Step 3 Click **OK** to complete the aperture settings and start smart analysis.

Step 4 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.

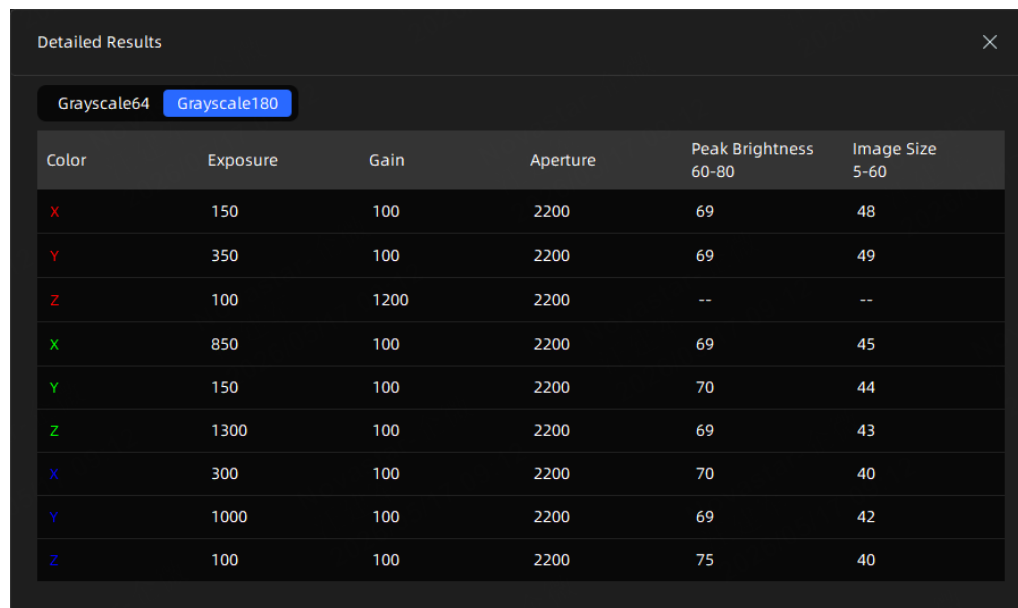
- If a white value is displayed next to the color, the value is normal and the parameter analysis is completed.
- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 5](#).

Step 5 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 60, increase the aperture size or exposure time.
- If the peak brightness is greater than 80, decrease the aperture size or exposure time.
- If the image size is less than 5%, turn the focus ring to let the image become blurry.
- If the image size is greater than 60%, turn the focus ring to let the image become clearer.

Step 6 (Optional) Click **Detailed Results** to view the real-time analysis, exposure time, and gain of the XYZ filters for each color at each capture grayscale in the pop-up window.

Figure 7-64 Detailed results



Color	Exposure	Gain	Aperture	Peak Brightness 60-80	Image Size 5-60
X	150	100	2200	69	48
Y	350	100	2200	69	49
Z	100	1200	2200	--	--
X	850	100	2200	69	45
Y	150	100	2200	70	44
Z	1300	100	2200	69	43
X	300	100	2200	70	40
Y	1000	100	2200	69	42
Z	100	100	2200	75	40

Step 7 Click **Pre-Calibration Validation** to view the images captured during the camera parameter analysis in the camera preview area, and confirm that the screen in the images is not obstructed to ensure the subsequent calibration effect.

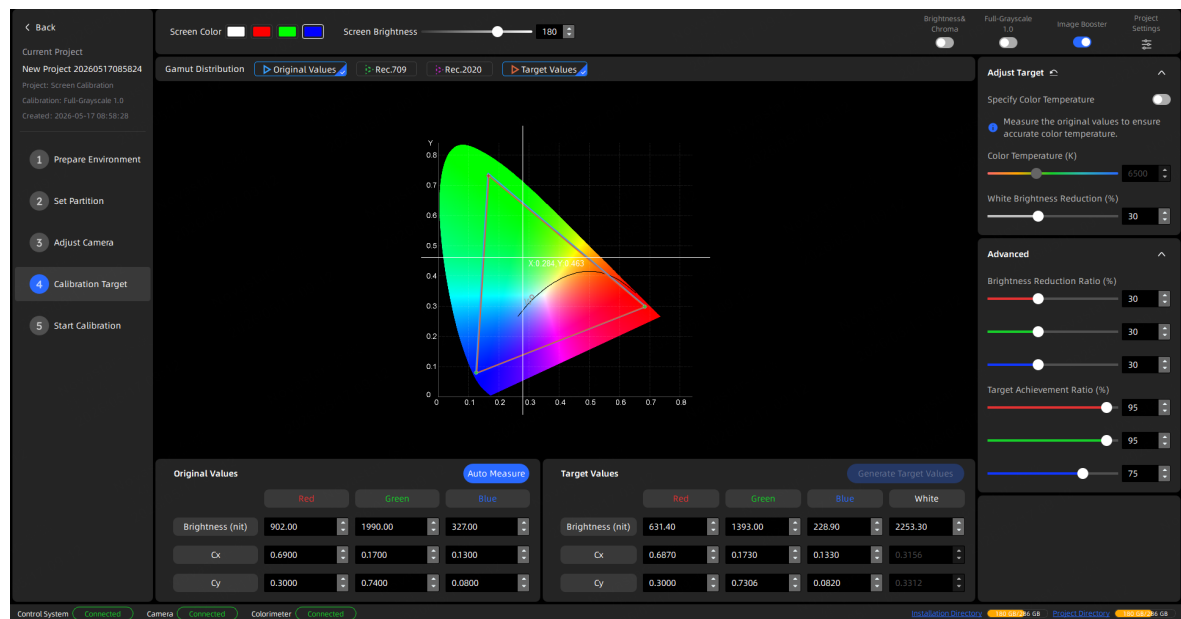
Note

- During parameter analysis, the software will automatically determine whether the current aperture settings can calibrate all grayscale. If the currently set calibration grayscale exceeds the camera's capture capability range, please set the grayscale within the range prompted by the pop-up window or adjust the camera parameters, and perform camera parameter analysis again.
- If the aperture is adjusted, you must reset the value in the Select Aperture pop-up window to ensure that the actual aperture value of the camera is consistent with the software settings.
- After the parameter analysis is completed, if any parameters of the camera are modified, you must perform the positioning and smart analysis again; otherwise the calibration effect will be affected.

7.4.4 Calibration Target

Obtain the original values of the screen brightness and chroma, and set the target values to complete the calibration target settings.

Figure 7-65 Calibration target



7.4.4.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the screen to be calibrated, which can be set in the following ways:

- Colorimeter not connected
The system can automatically obtain the original values during the camera parameter analysis and generate the corresponding target values.
- Colorimeter connected
Use the colorimeter to measure the optical characteristics of the screen as original values.

Prerequisites

The control system and colorimeter are connected normally, and the colorimeter is properly placed:

- CA410 colorimeter: It should touch the cabinet closely.
- CS2000 colorimeter: It should be placed in the same position as the camera.

Procedure

- Step 1 On the project home screen, select the **Calibration Target** tab.
- Step 2 In the **Original Values** area at the lower left, click the **Auto Measure** button on the left, and the software will automatically obtain the original values of brightness and chroma measured by the colorimeter and automatically calculate the target values.

Figure 7-66 Measuring original values

Original Values				Target Values				
	Red	Green	Blue		Red	Green	Blue	White
Brightness (nit)	902.00	1990.00	327.00	Brightness (nit)	631.40	1393.00	228.90	2253.30
Cx	0.6900	0.1700	0.1300	Cx	0.6870	0.1730	0.1330	0.3156
Cy	0.3000	0.7400	0.0800	Cy	0.3000	0.7306	0.0820	0.3312

Manually adjust the original values: Hold the colorimeter to measure the original values and manually enter the measured values in the **Original Values** area. Click **Generate Target Values** on the right, and the system will automatically calculate and fill the calculation results into **Target Values**.

After any modification of the original values, you need to click **Generate Target Values** so that new target values can be generated and applied to the calibration procedure.

7.4.4.2 Set Target Values

Related Information

- For optimal results, use the target values automatically generated by the system.
- When adjusting the generated target values, ensure that the adjusted values do not turn red (indicating they are out of range). If necessary, adjust them to fall within the appropriate range.

Procedure

Step 1 On the project home screen, select the **Calibration Target** tab.

Step 2 Set the target values using one or a combination of the following ways.

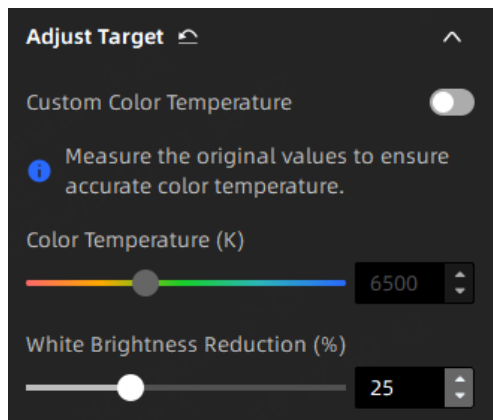
- Enable **Custom Color Temperature**.

Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.

Drag the **Color Temperature** and **White Brightness Reduction** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

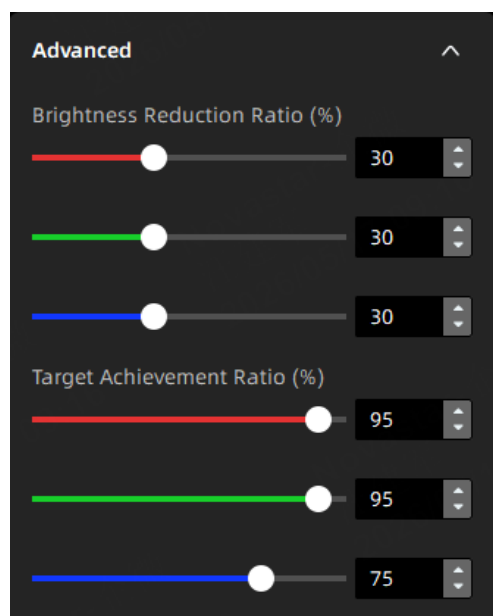
- Disable **Custom Color Temperature**.

After it is disabled, **Color Temperature** becomes disabled, and **White Brightness Reduction** becomes adjustable.



Drag the **White Brightness Reduction** slider, click the ▲ and ▼ buttons, or directly enter a value to set the white brightness reduction.

- Advanced editing
 - Manually adjust brightness reduction ratio
 - a. In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.
 - b. In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** and **Target Achievement Ratio** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Manually edit the target brightness and chroma values

In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values.

- Set the target values in the color gamut distribution chart

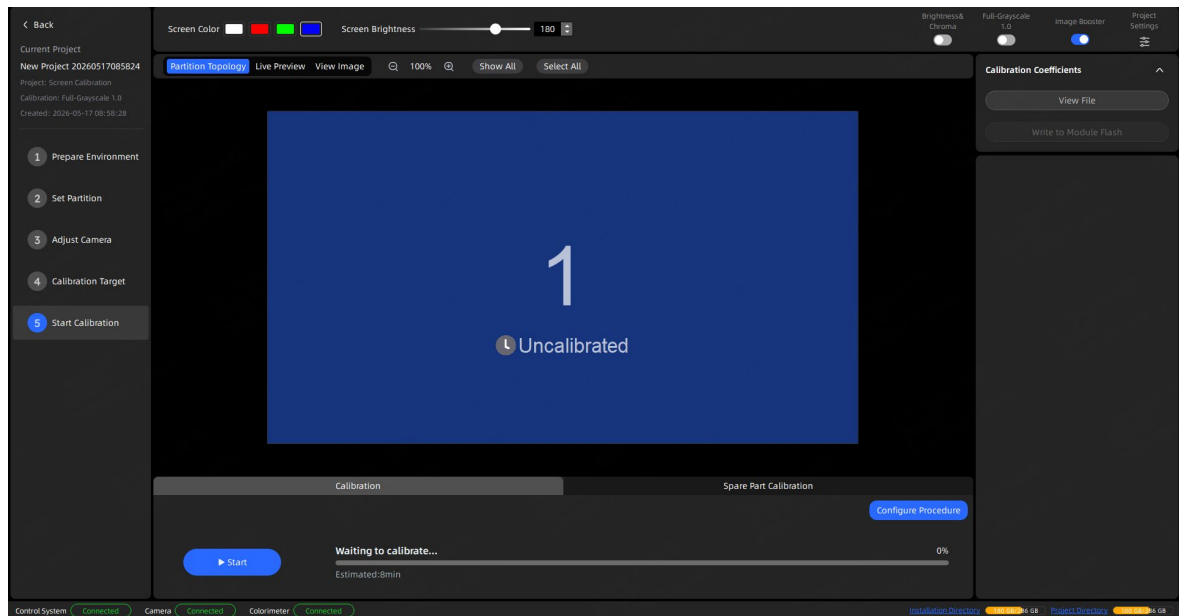
In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values.

- Click  next to **Adjust Target** to restore both original and target values to the default values.

7.4.5 Start Calibration

Configure effect optimization parameters, start calibration, view calibration results and export calibration coefficients.

Figure 7-67 Starting calibration



- Click **Partition Topology** on the **Start Calibration** screen to view the partition information of the current screen and select the partition to be calibrated.
- Click **Live Preview** in the top left corner and then click the **Live Preview** button in the center to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.4.5.1 Calibrate Partitions

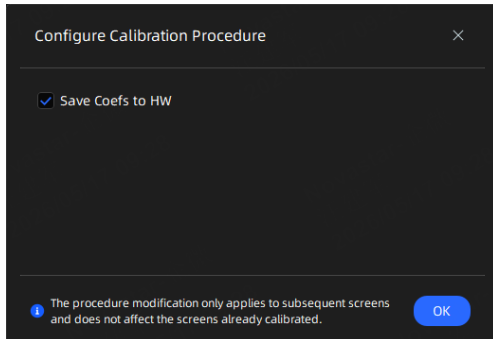
Prerequisites

- All devices are connected normally.
- Image Booster effect is enabled on the current screen.
- Make sure the camera faces the partition to be calibrated during calibration.

Procedure

Step 1 Click **Configure Procedure** in the lower right corner to open the **Configure Procedure** page.

Figure 7-68 Configuring procedure



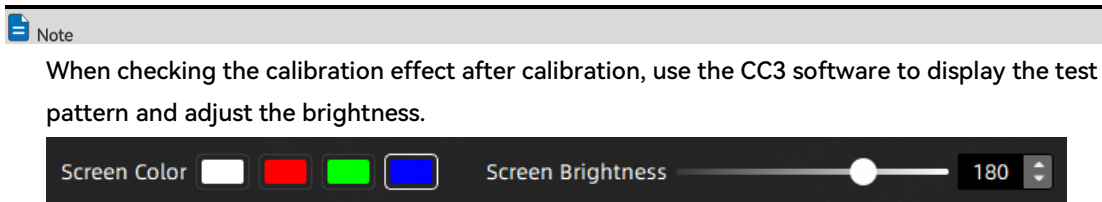
Step 2 Check **Save Coefs to HW**, and the parameters after calibration will be automatically saved into the receiving card.

Step 3 Click **OK** to complete the calibration procedure configuration.

Step 4 Select a calibration partition on the **Calibration** tab.

Step 5 Click **Start** in the bottom left corner.

Step 6 After a partition is calibrated, select the next partition from the partition topology to calibrate, and click **Start**. Repeat these actions until the entire screen is calibrated.



7.4.5.2 Calibrate Spare Parts

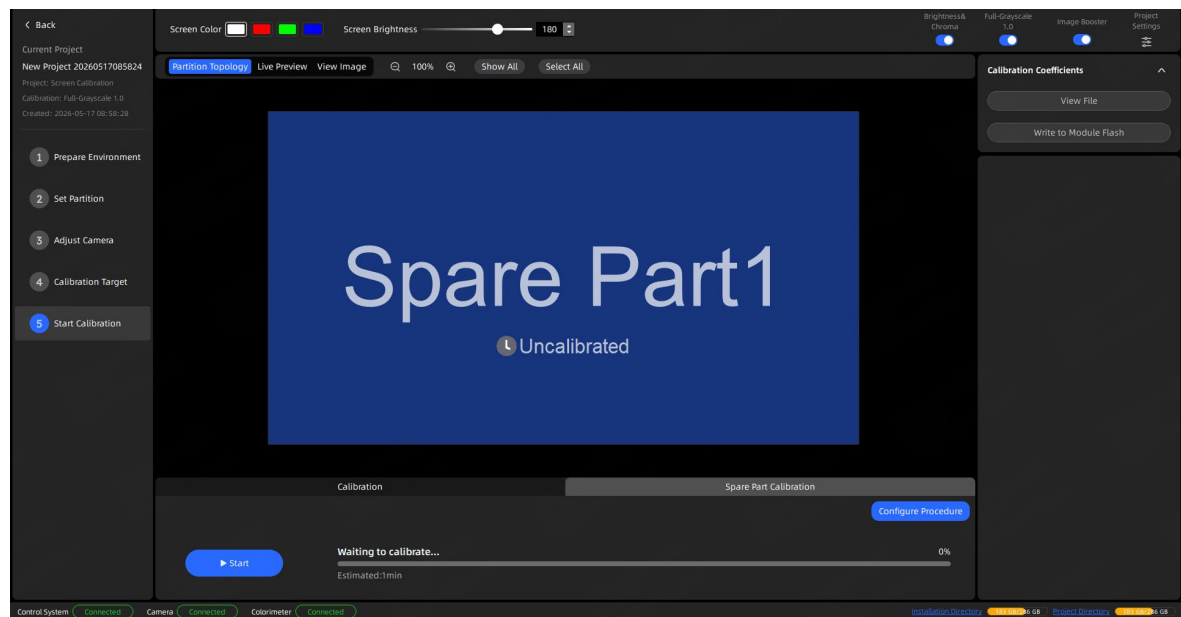
Step 1 When all partitions are calibrated, select a partition, remove the modules that are not at the edge of the partition or the screen, and install the spare module.

Step 2 Click the **Spare Part Calibration** tab.

Step 3 Click **Start** in the bottom left corner.

After the calibration is completed, confirm that the calibration effect of the current screen meets the expectations, and then it can be used. Keep the previously removed spare parts properly for later replacement.

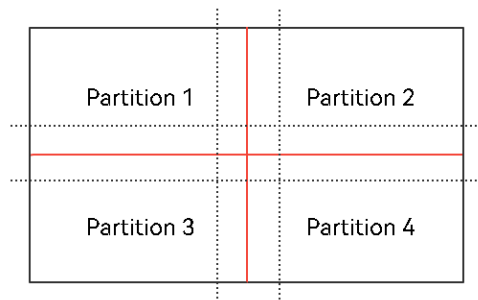
Figure 7-69 Calibrating spare parts



Tips for Selecting Spare LED Boards

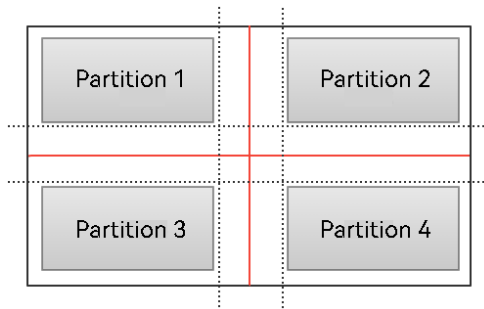
First, because there is a certain overlapping part between partitions, as shown in the figure below, bounded by the solid red line, there are a total of 4 partitions. The overlapping part between partitions is marked with a dashed line. The area inside the dashed line will be captured multiple times during partition calibration for subsequent boundary correction, playing a role in the uniform transition of partitions.

Therefore, for the position of replacing the spare module, do not select the partition overlapping area inside the dashed line as shown in the figure below.



Secondly, **it is also not recommended to replace the modules near the edges.** Due to the curved surface issue, replacing an edge module into the middle area will cause color difference issues in the curved transition.

Considering the above situations, when **replacing spare modules for calibration, please select the middle area of the partition**, which is **the shaded part shown in the figure below**. This can eliminate the impact of boundary correction and achieve a better spare module replacement effect.

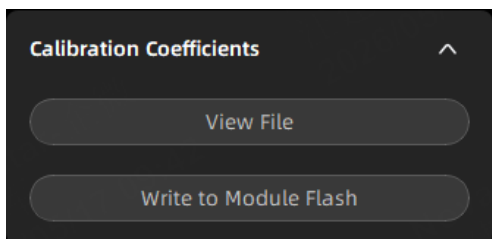


7.4.5.3 Manage Calibration Coefficients

After the calibration is completed, the software will automatically export the calibration coefficients to the coefficient storage location specified in **Settings**. The coefficient file is used for future screen maintenance.

- View File: Click **View File**, and the software will automatically open the folder where the coefficients are stored.
- Write to Module Flash: Click Write to Module Flash to save the calibration coefficients to the module Flash of the receiving card for easy one-click recall later.

Figure 7-70 Calibration coefficients



7.5 Full-Grayscale Calibration 2.0



Caution

Before performing full-grayscale calibration 2.0, you must first contact the FAE (Field Application Engineer) to confirm that the current link version supports this function. If the link version does not support it, do not perform calibration.

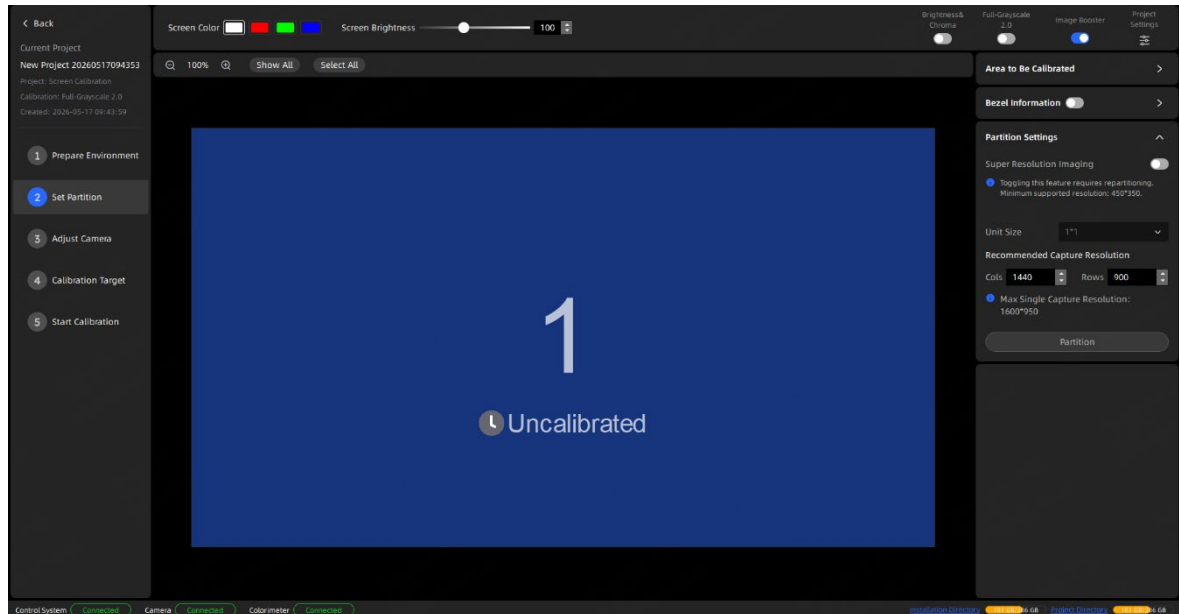
7.5.1 Prepare Environment

In the calibration software, connect a control system, set the module resolution, and connect a camera and a colorimeter. The preparation steps are the same as those for the brightness calibration. For details, see [7.1.1 Prepare Environment](#).

7.5.2 Set Partition

Set the calibration area and bezel information, set the partition, and view the partitioning result. If the screen resolution is very high, the camera cannot capture the image of the entire screen in just one time. You must divide the screen into multiple partitions for calibration.

Figure 7-71 Setting partition



Step 1 Check whether the screen has blocked parts or a bezel.

- No: Go to [Step 2](#).
- Yes: Set the calibration area or the bezel information. For details, see [7.1.2.1 Set Calibration Area](#) and [7.1.2.2 Set Bezel Information](#).

Step 2 Set the camera's recommended capture resolution, and the software will generate the camera's single capture resolution based on the input value and the actual screen resolution.

- Rows: Indicates the number of vertical LEDs that can be captured each time.
- Cols: Indicates the number of horizontal LEDs that can be captured each time.

The values of rows and columns captured once cannot be greater than the maximum resolution of the image that can be captured by the camera.

- When Super Resolution Imaging is enabled

Maximum capture resolution for the NOS-CC60: 2800×1700; recommended capture resolution: 2560×1440.

Maximum capture resolution for the C3200: 2300×1600; recommended capture resolution: 1950×1350.

- When Super Resolution Imaging is disabled

Maximum capture resolution for the NOS-CC60: 1600×950; recommended capture resolution: 1440×900.

- Maximum capture resolution for the C3200: 1050×650; recommended capture resolution: 800×450

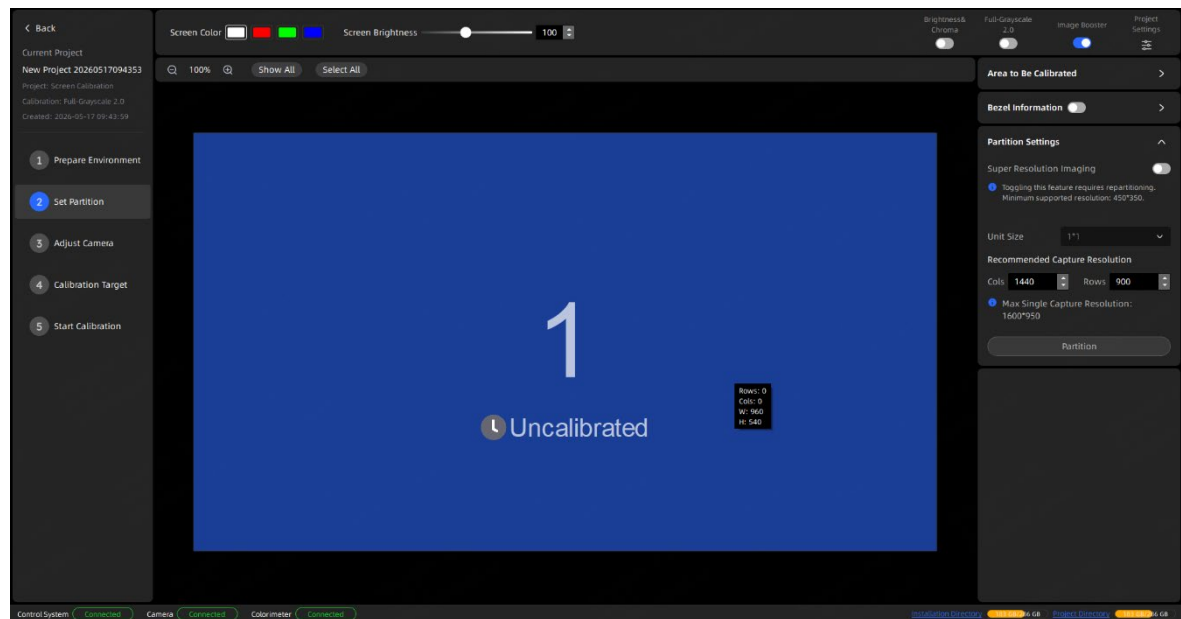
Step 3 Click the **Partition** button and the system will configure partitions based on the input parameters.



Modifying settings will reset existing partition data.

Step 4 Select a partition on the partition topology. The selected area becomes blue on the screen. When you move the mouse to the partition, the row, column, width and height values will be displayed.

Figure 7-72 Selecting a partition



- Rows: Indicates the vertical initial coordinate of the selected partition.
- Cols: Indicates the horizontal initial coordinate of the selected partition.
- W: Indicates the horizontal width of the selected partition.
- H: Indicates the vertical height of the selected partition.

7.5.3 Adjust Camera

After the partition is set, click **Next** to enter the camera adjustment screen, where you can set the calibration grayscale and area positioning, and analyze the camera parameters.

7.5.3.1 Set Calibration Grayscale

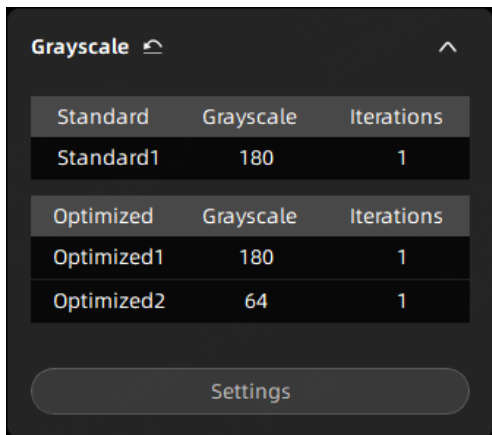
Set grayscale values for functions such as live preview, parameter analysis and calibration. The full-grayscale calibration 2.0 plan supports setting multi-layer of capture grayscale, including standard calibration grayscale and optimized calibration grayscale.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

Step 2 In the **Grayscale** area on the right, view the calibration grayscale information.

Click  next to **Grayscale** to restore the grayscale values to the default values.

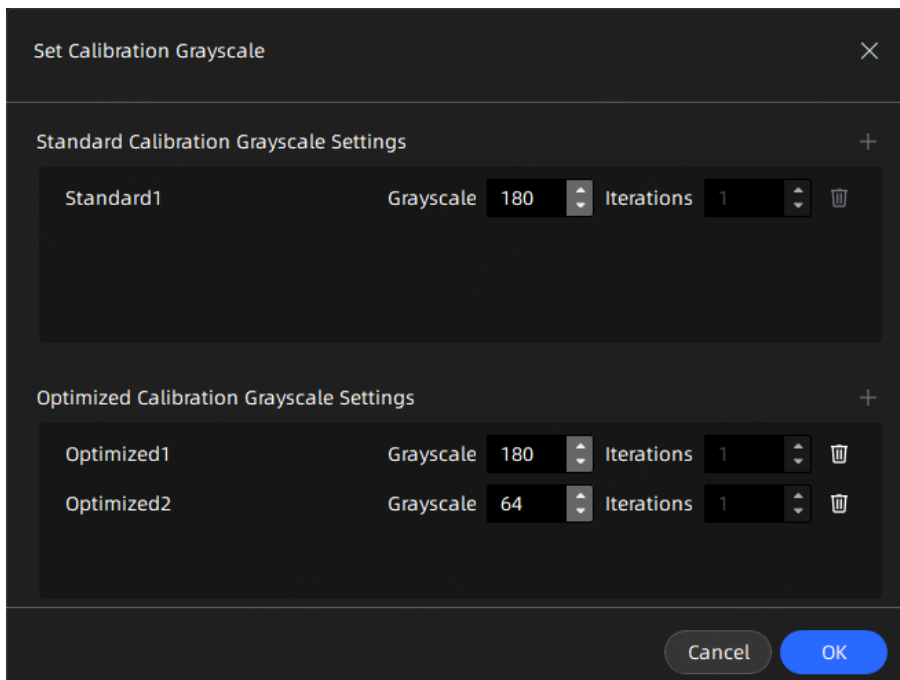
Figure 7-73 Calibration grayscale



Step 3 Click **Settings** in the **Grayscale** area to complete settings in the pop-up window.

- Calibration Grayscale: Multi-layer standard and optimized calibration grayscale are supported. The number of layers depends on the receiving card model used. For regular screens, the default capture grayscale can be used for calibration. At the same time, the calibration grayscale can be specifically set according to the screen characteristics.
 - Standard Calibration Grayscale: The ordinary brightness and chroma calibration grayscale, only for R, G, and B colors.
 - Optimized Calibration Grayscale: The white calibration grayscale, which can solve the white coupling issue.
- Iterations: Set the number of iteration for each layer of calibration grayscale. It defaults to 1, and can be set between 1 and 10. Higher iteration counts will increase processing time. It can be adjusted on-site according to the actual situation of the screen, or you can contact NovaStar engineers for assistance.

Figure 7-74 Setting calibration grayscale



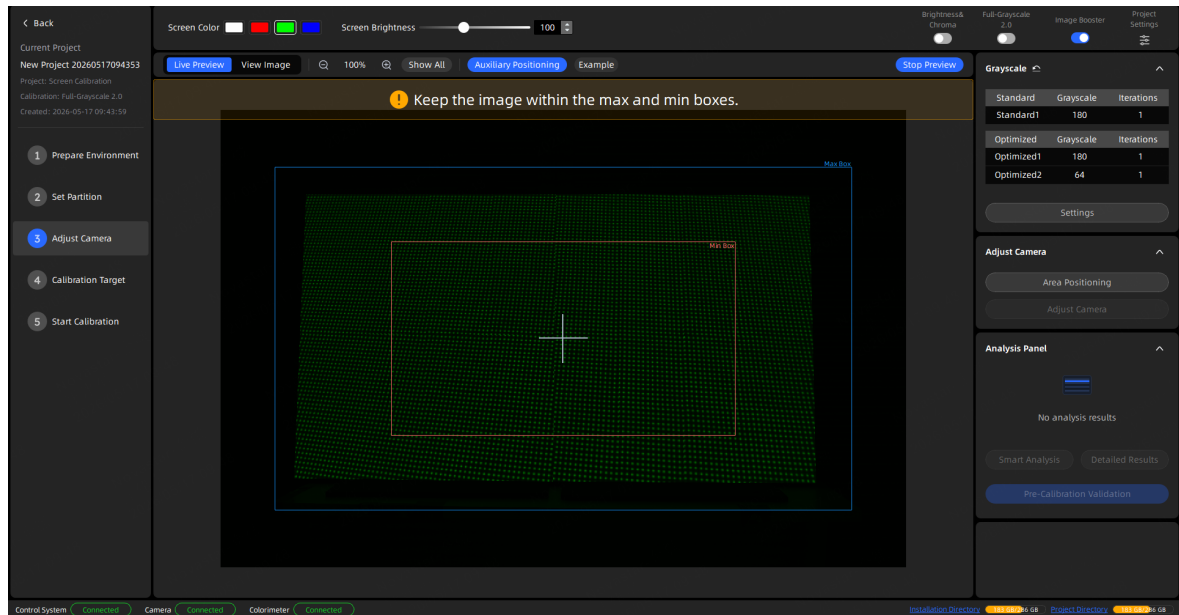
7.5.3.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.

Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-75 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

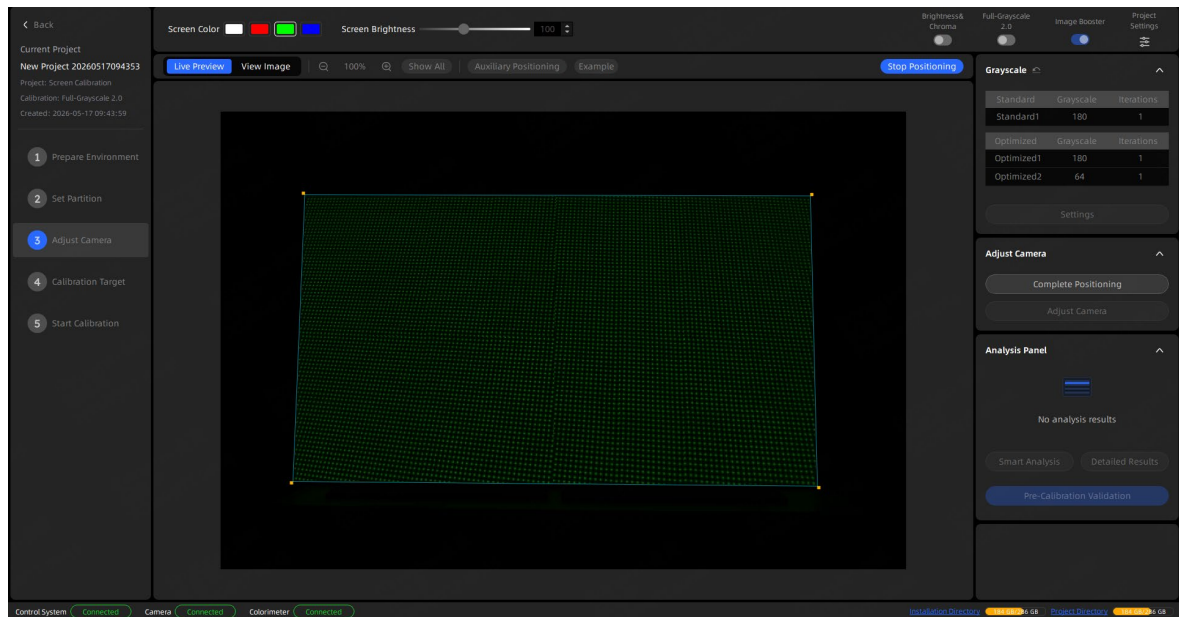
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.5.3.3 Area Positioning

Position the calibration area to improve the efficiency of parameter analysis and calibration.

Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-76 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

Note

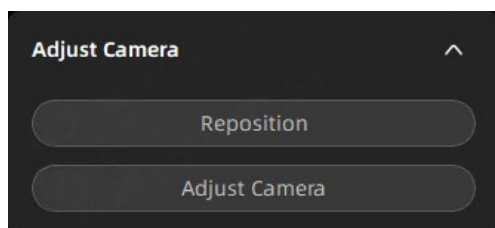
After the camera area positioning is completed, do not move the camera during subsequent operations; if the camera needs to be moved, the area positioning must be performed again.

7.5.3.4 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

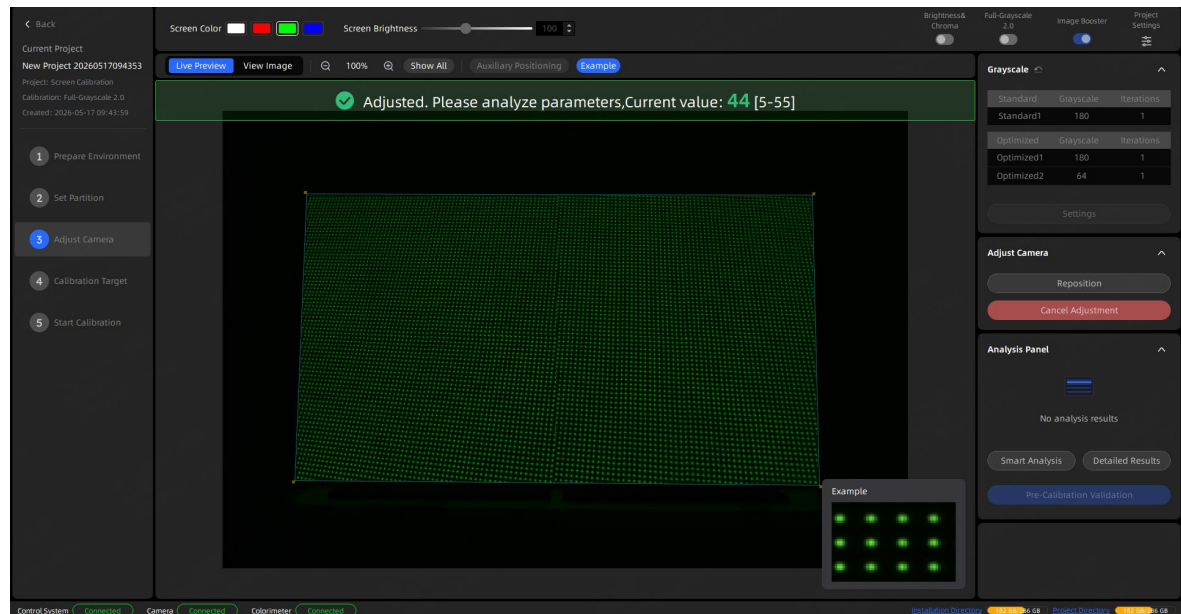
Figure 7-77 Adjusting camera



Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the exposure values on the screen. You can switch colors to check whether the image for each color falls within the acceptable range.

Figure 7-78 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area or the upper right corner to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

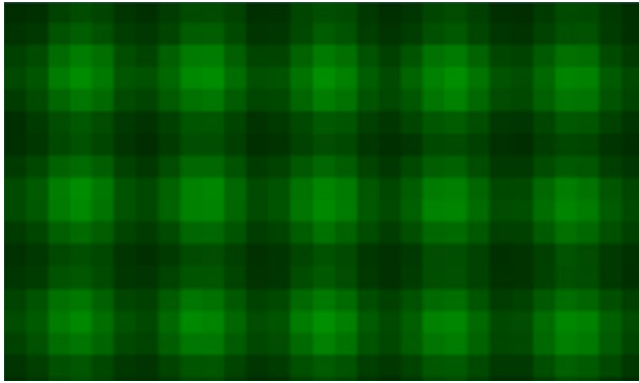
The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

The LED image should achieve the desired level of blurriness, as shown below.



7.5.3.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

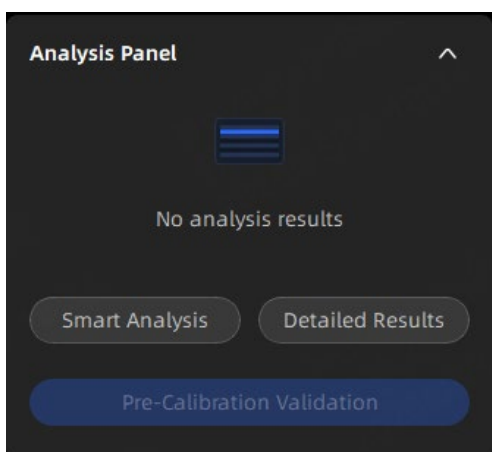
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.
- The actual aperture value of the camera is consistent with the value selected in **Select Aperture**.

Procedure

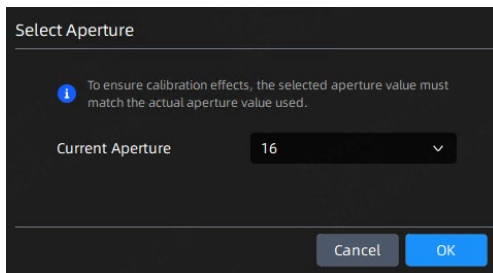
- Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-79 Smart analysis



- Step 2 (Optional) When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-80 Setting camera aperture



Step 3 Click **OK** to complete the aperture settings and start smart analysis.

Step 4 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.

- If a white value is displayed next to the color, the value is normal and the parameter analysis is completed.
- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 5](#).

Step 5 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 60, increase the aperture size or exposure time.
- If the peak brightness is greater than 80, decrease the aperture size or exposure time.
- If the image size is less than 5%, turn the focus ring to let the image become blurry.
- If the image size is greater than 60%, turn the focus ring to let the image become clearer.

Step 6 (Optional) Click **Detailed Results** to view the real-time analysis, exposure time, and gain of the XYZ filters for each color at each capture grayscale in the pop-up window.

Figure 7-81 Detailed results

Detailed Results					
Grayscale64 Grayscale180					
Color	Exposure	Gain	Aperture	Peak Brightness 60-80	Image Size 5-60
X	150	100	2200	69	48
Y	350	100	2200	69	49
Z	100	1200	2200	--	--
X	850	100	2200	69	45
Y	150	100	2200	70	44
Z	1350	100	2200	69	43
X	300	100	2200	69	41
Y	1000	100	2200	69	42
Z	100	100	2200	75	40
X	100	100	2200	69	59
Y	100	100	2200	62	48
Z	100	100	2200	68	41

Step 7 Click **Pre-Calibration Validation** to view the images captured during the camera parameter analysis in the camera preview area, and confirm that the screen in the images is not obstructed to ensure the subsequent calibration effect.

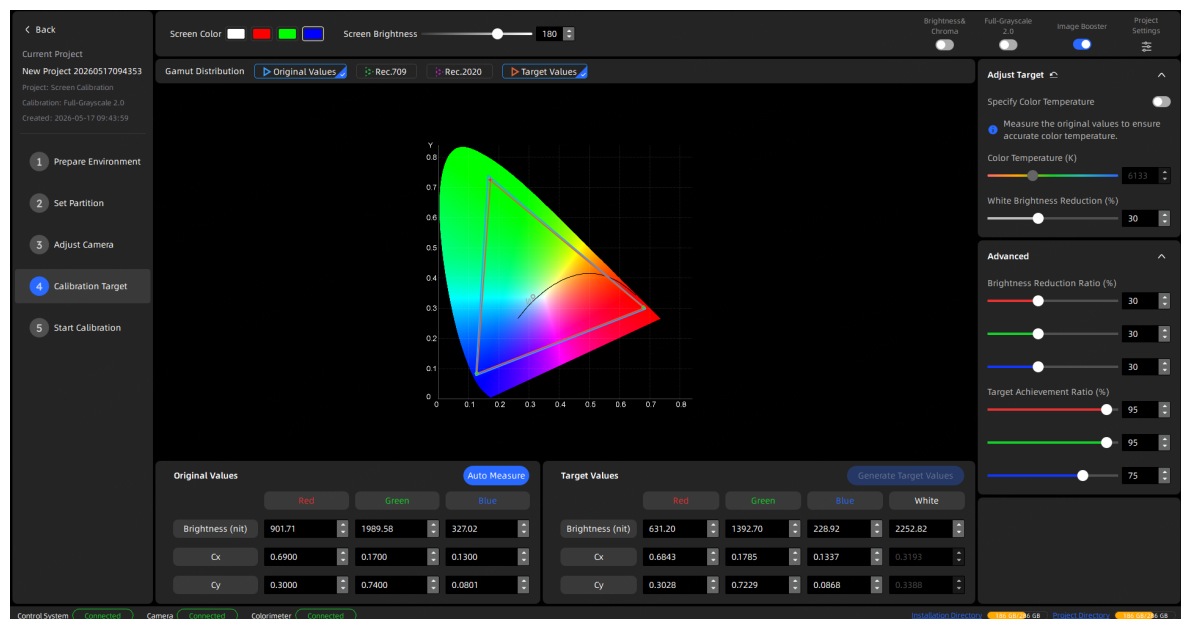
Note

- During parameter analysis, the software will automatically determine whether the current aperture settings can calibrate all grayscale. If the currently set calibration grayscale exceeds the camera's capture capability range, please set the grayscale within the range prompted by the pop-up window or adjust the camera parameters, and perform camera parameter analysis again.
- If the aperture is adjusted, you must reset the value in the Select Aperture pop-up window to ensure that the actual aperture value of the camera is consistent with the software settings.
- After the parameter analysis is completed, if any parameters of the camera are modified, you must perform the positioning and smart analysis again; otherwise the calibration effect will be affected.

7.5.4 Calibration Target

Obtain the original values of the screen brightness and chroma, and set the target values to complete the calibration target settings.

Figure 7-82 Set Target Values



7.5.4.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the screen to be calibrated. They are used to calculate the calibration target values.

- Colorimeter not connected

The system can automatically obtain the original values during the camera parameter analysis and generate the corresponding target values.

- Colorimeter connected

Use the colorimeter to measure the optical characteristics of the screen as original values.

Prerequisites

The control system and colorimeter are connected normally, and the colorimeter is properly placed:

- CA410 colorimeter: It should touch the cabinet closely.
- CS2000 colorimeter: It should be placed in the same position as the camera.

Procedure

- Step 1 On the project home screen, select the **Calibration Target** tab.
- Step 2 In the **Original Values** area at the lower left, click the **Auto Measure** button on the left, and the software will automatically obtain the original values of brightness and chroma measured by the colorimeter and automatically calculate the target values.

Figure 7-83 Measuring original values

Original Values				Target Values				
	Red	Green	Blue		Red	Green	Blue	White
Brightness (nit)	901.71	1989.58	327.02	Brightness (nit)	631.20	1392.70	228.92	2252.82
Cx	0.6900	0.1700	0.1300	Cx	0.6843	0.1785	0.1337	0.3193
Cy	0.3000	0.7400	0.0801	Cy	0.3028	0.7229	0.0868	0.3388

Manually adjust the original values: Hold the colorimeter to measure the original values and manually enter the measured values in the **Original Values** area. Click **Generate Target Values** on the right, and the system will automatically calculate and fill the calculation results into **Target Values**.

After any modification of the original values, you need to click **Generate Target Values** so that new target values can be generated and applied to the calibration procedure.

7.5.4.2 Set Target Values

Related Information

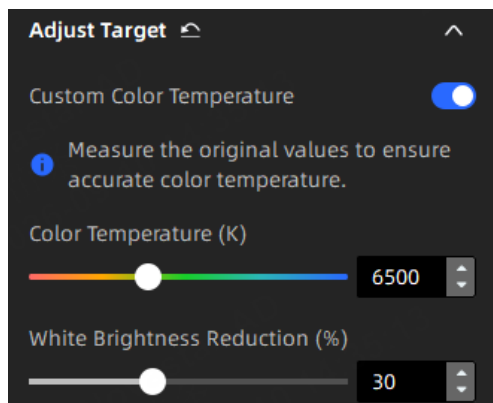
- For optimal results, use the target values automatically generated by the system.
- When adjusting the generated target values, ensure that the adjusted values do not turn red (indicating they are out of range). If necessary, adjust them to fall within the appropriate range.

Procedure

- Step 1 On the project home screen, select the **Calibration Target** tab.
- Step 2 Set the target values in any of the following ways:

- Enable **Custom Color Temperature**.

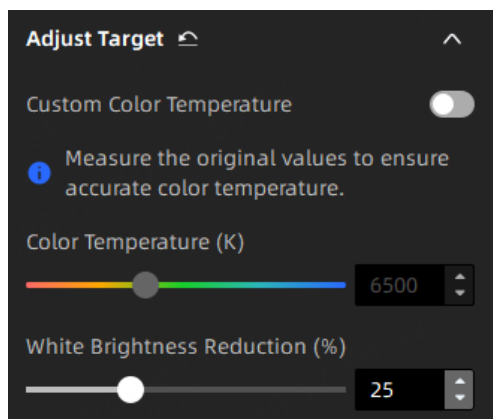
Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.



Drag the **Color Temperature** and **White Brightness Reduction** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

- Disable **Custom Color Temperature**.

After it is disabled, **Color Temperature** becomes disabled, and **White Brightness Reduction** becomes adjustable.

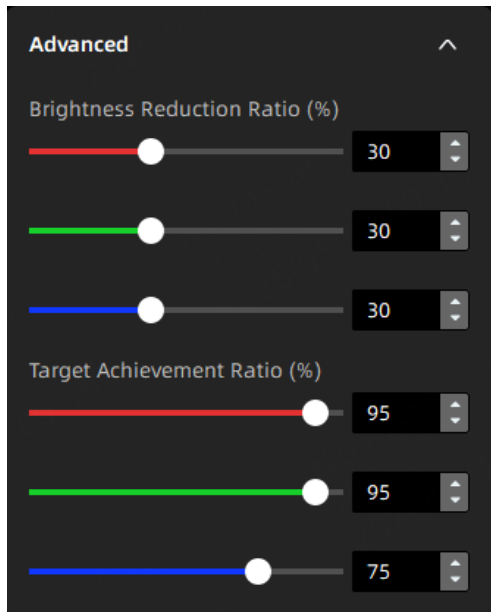


Drag the **White Brightness Reduction** slider, click the ▲ and ▼ buttons, or directly enter a value to set the white brightness reduction.

- Advanced editing
 - Manually adjust brightness reduction ratio

In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.

In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** and **Target Achievement Ratio** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Manually edit the target brightness and chroma values

In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values.

- Set the target values in the color gamut distribution chart

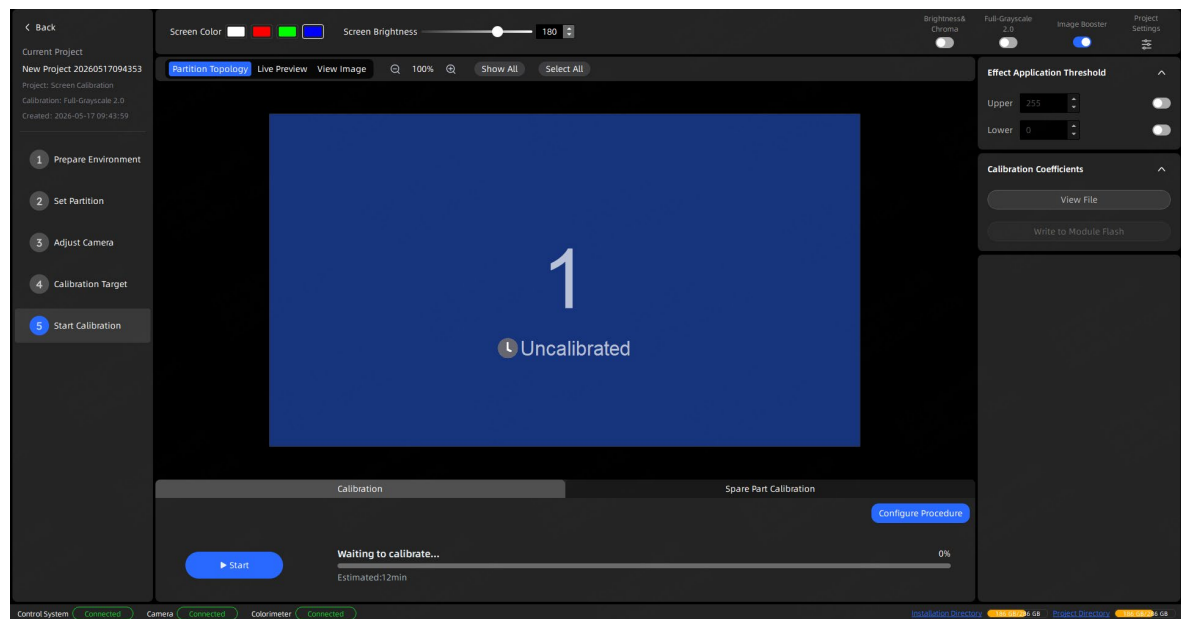
In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values.

- Click ↶ next to **Adjust Target** to restore both original and target values to the default values.

7.5.5 Start Calibration

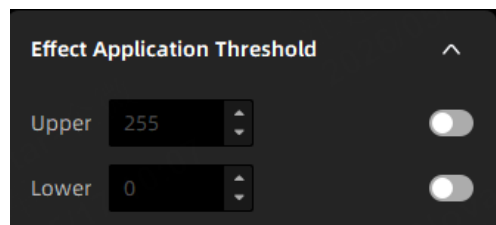
Configure effect optimization parameters, start calibration, view calibration results and export calibration coefficients.

Figure 7-84 Starting calibration



- Click **Partition Topology** on the **Start Calibration** screen to view the partition information of the current screen and select the partition to be calibrated.
- Click the **Live Preview** button to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.5.5.1 Configure Effect Application Threshold



Set the application threshold of the calibration effect (including the upper threshold and lower threshold) and its on/off status.

- Upper threshold: The default is 255, and the range is from the highest calibration grayscale of full-grayscale 2.0 to 255.
- Lower threshold: The default is 0, and the range is from 0 to the lowest calibration grayscale of full-grayscale 2.0.

For example: If the full-grayscale 2.0 calibration grayscales are 64 and 180, the upper threshold range is 180 to 255 (including 180), and the lower threshold range is 0 to 64 (including 64). Setting any value between 64 and 180 is not supported.

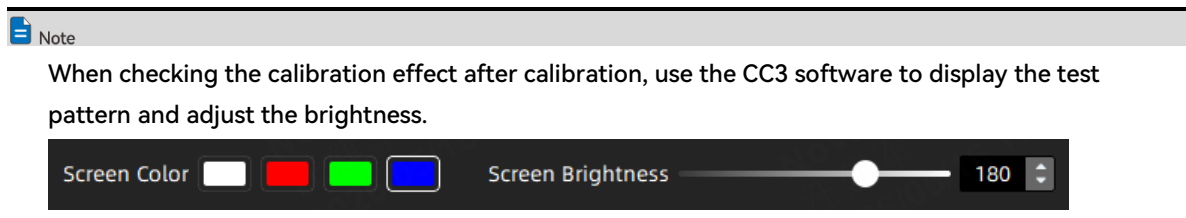
7.5.5.2 Calibrate Partitions

Prerequisites

- All devices are connected normally.
- Image Booster effect is enabled on the current screen.
- Make sure the camera faces the partition to be calibrated during calibration.

Procedure

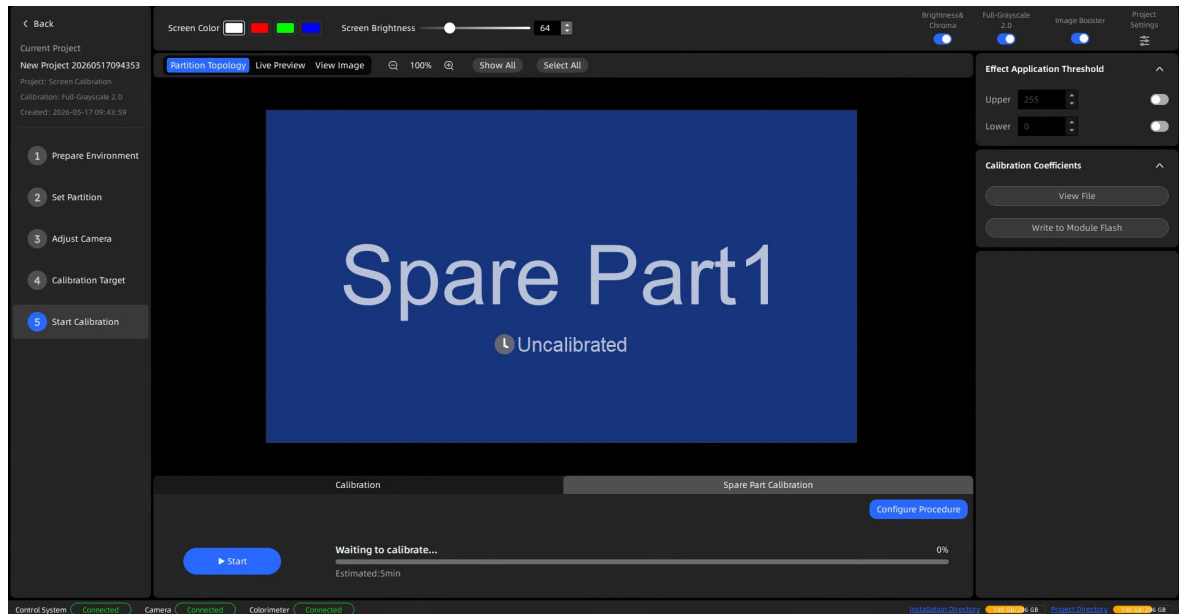
- Step 1 On the **Partition Topology** tab of the **Start Calibration** screen, select a calibration partition.
- Step 2 Click **Start** in the bottom left corner.
- Step 3 After a partition is calibrated, select the next partition from the partition topology to calibrate, and click **Start**. Repeat these actions until the entire screen is calibrated.



7.5.5.3 Calibrate Spare Parts

- Step 1 When all partitions are calibrated, select a partition, remove the modules that are not at the edge of the partition or the screen, and install the spare module.
- Step 2 Click the Spare Part Calibration tab.
- Step 3 Click **Start** in the bottom left corner.

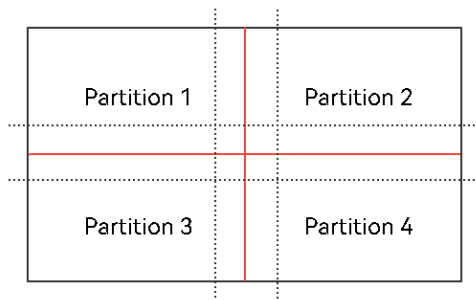
After the calibration is completed, confirm that the calibration effect of the current screen meets the expectations, and then it can be used. Keep the previously removed spare parts properly for later replacement.



Tips for Selecting Spare LED Boards

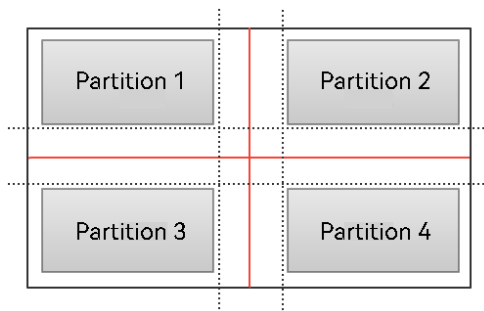
First, because there is a certain overlapping part between partitions, as shown in the figure below, bounded by the solid red line, there are a total of 4 partitions. The overlapping part between partitions is marked with a dashed line. The area inside the dashed line will be captured multiple times during partition calibration for subsequent boundary correction, playing a role in the uniform transition of partitions.

Therefore, for the position of replacing the spare module, do not select the partition overlapping area inside the dashed line as shown in the figure below.



Secondly, **it is also not recommended to replace the modules near the edges.** Due to the curved surface issue, replacing an edge module into the middle area will cause color difference issues in the curved transition.

Considering the above situations, when **replacing spare modules for calibration, please select the middle area of the partition**, which is **the shaded part shown in the figure below**. This can eliminate the impact of boundary correction and achieve a better spare module replacement effect.



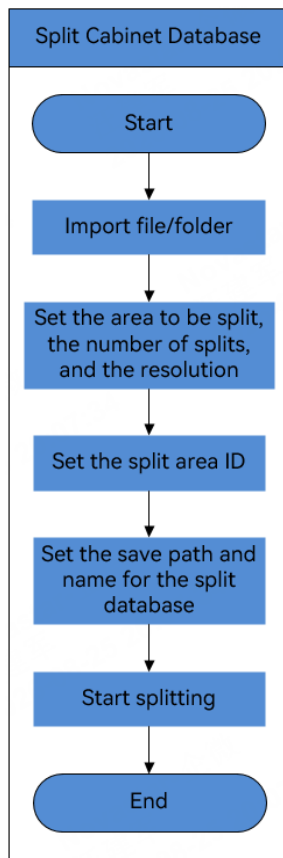
8 Calibration Coefficient Management

8.1 Split Coefficients

The Coefficient Splitting Tool allows you to divide the screen database into cabinet or module database based on the actual screen resolution and number of cabinet rows/columns. Depending on different needs, a screen database can be converted into a single or multiple databases.

Since an LED screen is typically composed of multiple cabinets, if a user needs to obtain calibration coefficients for individual cabinets after calibrating the entire screen, the screen calibration coefficients can be split into calibration coefficients for each individual cabinet.

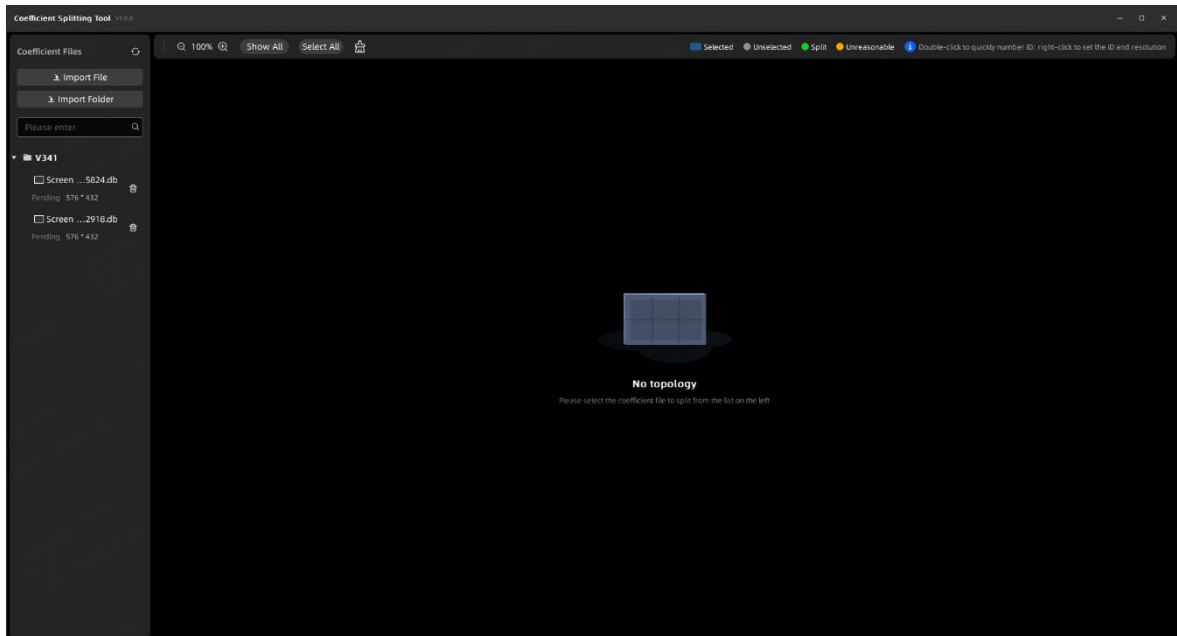
Figure 8-1 Procedure of splitting screen database



8.1.1 Import/Select Screen Database

- Step 1 From the top menu bar, choose **Tools > Coefficient Splitting Tool**.
- Step 2 Select a local project, or click **Import File** or **Import Folder** to import an existing project.

Figure 8-2 Importing screen database

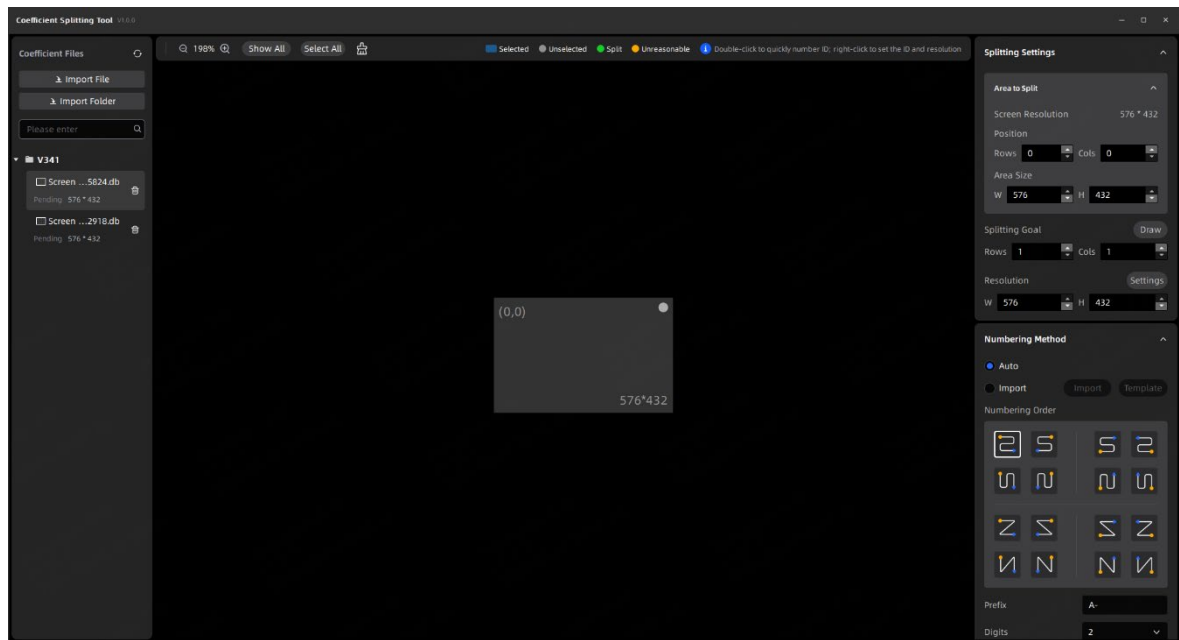


8.1.2 Configure Splitting Settings

- Step 1 Click an imported screen database on the left.
- Step 2 In the **Splitting Settings** area on the right, set the position and area size for the area to split based on the splitting range.
- Under **Position**, set the starting row and column of the area to split.
 - Under **Area Size**, set the width and height of the area to split in pixels.

The default area to split is the entire screen. You can modify it as needed, but the area to split you set must not exceed the size of the entire screen.

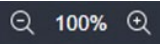
Figure 8-3 Splitting settings



Step 3 Set **Splitting Goal** based on the size of the desired area size.

Enter the values of rows and columns. They range from 1 to the screen width/height.

Step 4 Click **Draw** to generate the split topology.

Click  to zoom the topology in or out, or restore the topology size to 1:1. You can also press **Ctrl** and roll the mouse wheel at the same time to zoom the topology.

Step 5 Under **Resolution**, enter the cabinet resolution and click **Settings**.

Right-click a cabinet and select **Set Resolution**. In the dialog box that appears, set the width and height. You can simultaneously set the height for the entire row where the selected cabinet is located.

Hold down the **Ctrl** key and click to select multiple target cabinets.

Note

Cabinets can have different resolutions, but they must follow the rules below. If the resolution settings are invalid, the topology will turn yellow.

- The sum of the row resolutions of all cabinets must equal the row resolution of the full screen, and the sum of the column resolutions of all cabinets must equal the column resolution of the full screen.
- Cabinets in the same row must have the same row resolution, and cabinets in the same column must have the same column resolution.

8.1.3 Set Cabinet ID

Cabinet IDs can be assigned automatically, manually, or by importing.

Auto IDs

- Step 1 Select Auto under Numbering Method.
- Step 2 Set Numbering Order, Prefix, Digits, and Start Value.
- Step 3 Click ID Settings.

Figure 8-4 Automatic numbering

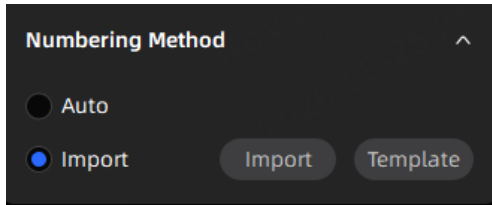
The screenshot shows the 'Numbering Method' settings interface. At the top, 'Auto' is selected under 'Numbering Method'. Below this, there are 'Import' and 'Template' buttons. The 'Numbering Order' section displays a grid of 16 icons representing different cabinet shapes. Below the grid, the 'Prefix' is set to 'A-', 'Digits' is set to '2', and 'Start Value' is set to '1'. An 'Example' field shows 'A-01'. At the bottom, there is an 'ID Settings' button.

- Numbering Order: Includes Z Shape, N Shape, ㄱ Shape, and ~ Shape.
The software will number all the cabinets according to the selected shape.
- Prefix: The prefix does not change with the cabinet ID. It is just a mark.
- Digits: Set the length of numeric codes in the ID, which defaults to 3.
 - If the actual number of digits exceeds the selected value, all digits are displayed.
 - If the actual number of digits is less than the selected value, leading zeros are added.
- Start Value: Set the starting sequence number for the cabinet to be calibrated.
For example, if you set **Prefix** to "A-", **Digits** to "2", and **Start Value** to "1", the cabinet ID during calibration will be "A-01".

Import IDs

You can set the cabinet ID by importing a table.

Figure 8-5 Importing IDs



- Click **Import** to import a table containing IDs previously read back and exported using the NovaLCT control software.
- Click **Template**, download and fill out the template, and then import it.



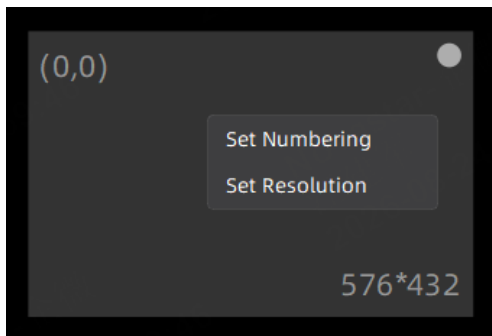
Note

Before importing, you need to draw the topology diagram, and the imported IDs must be unique, with no duplicates allowed.

Manual IDs

Right-click on a cabinet in the topology diagram to select it and assign an ID to it. For example, select the first cabinet, right-click on it, choose **Set Numbering**, and enter “A-01” to assign it to the first cabinet. Repeat this process to complete the numbering of all cabinets.

Figure 8-6 Manually numbering cabinets

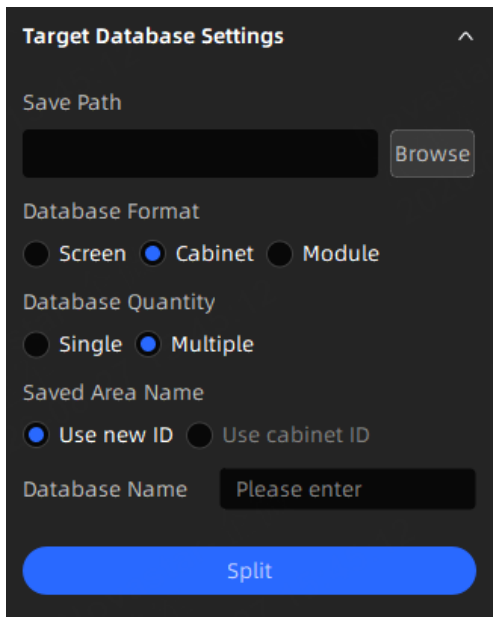


You can also double-click a cabinet to automatically assign a numeric ID to it.

8.1.4 Set Target Databases

Step 1 Under **Save Path**, select a save path for the target database.

Figure 8-7 Setting save path



Step 2 Set the database save format to **Screen**, **Cabinet** or **Module**.

Step 3 Set the number of target databases to **Single** or **Multiple**.

- Single: Save the data of all the cabinets or modules into one database, resulting in a single database.
- Multiple: Save the data of each cabinet or module as a separate database, resulting in multiple databases, each named according to the cabinet or module ID.

Step 4 Configure the saved area name type. Options include **Use new ID** and **Use cabinet ID**.

This parameter is available only when the database save format is set to **Cabinet** and the database save quantity is set to **Multiple**.

- Use new ID: Uses the cabinet IDs configured in 8.1.3 Set Cabinet ID as the names for each target database.
- Use cabinet ID: Uses the original cabinet IDs from the screen's database as the names for each target database. This option is available when the imported data contains data for multiple cabinets.

Step 5 Next to **Database Name**, enter a name for the target database or the folder name for multiple target databases.

Step 6 Click **Split** to split the database.

Note

- The new database name cannot be the same as the original database name.
- Once the data is successfully split, you cannot modify the parameters to split it again.

8.2 Simulate Coefficients

The pre-calibration display effect of an LED screen can be restored using calibration coefficients. The restored image is a simulation image, which calibration engineers can compare with the actual pre-calibration effect to determine if the calibration is correct.



Note

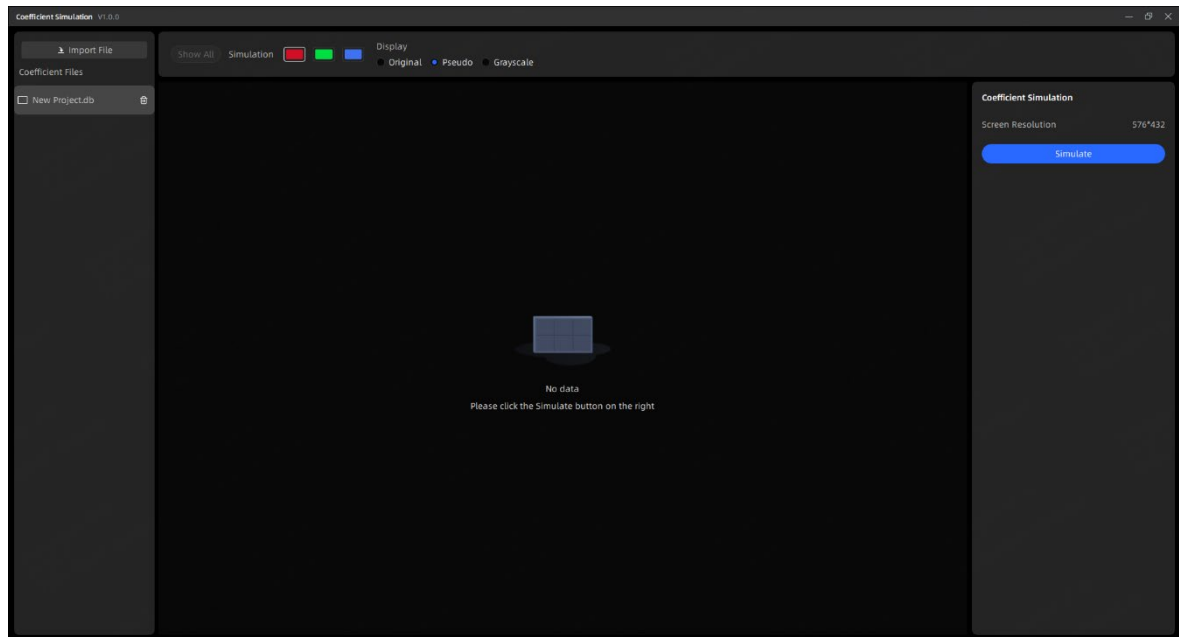
Coefficient simulation is not supported for “modules” after coefficient splitting.

8.2.1 Import/Select Screen Database

Step 1 From the top menu bar, choose **Tools > Coefficient Simulation Tool**.

Step 2 Click **Import File** to import a data file containing completed screen calibration data.

Figure 8-8 Importing a screen database



8.2.2 Check Simulation Effects

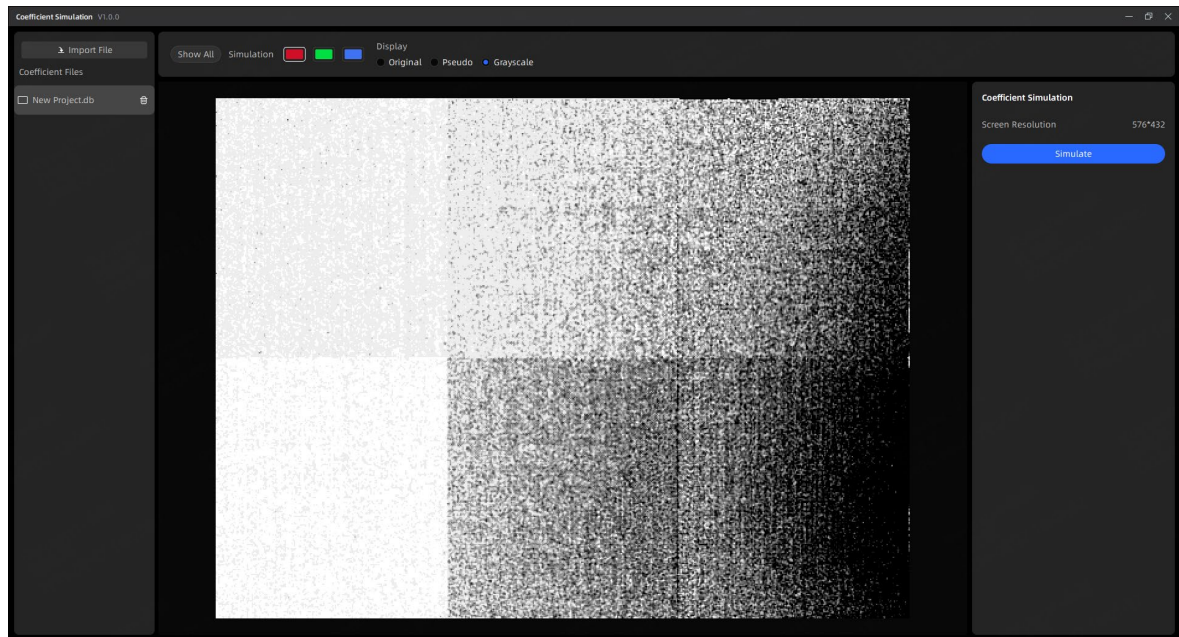
Step 1 Click **Simulate** on the right and check the coefficient simulation effects.

Step 2 Select the display color for the simulated screen. Options are red, green, and blue.

Step 3 Set the display mode for the simulation image. Three modes are supported:

- Original: Displays the simulation image using the actual selected color.
- Grayscale: Converts the brightness of the selected color into a grayscale image.
- Pseudo: Uses different colors to represent different brightness levels.

Figure 8-9 Coefficient simulation effect



9 FAQ

9.1 How to configure network connection?

During calibration, if the control computer and calibration computer are two separate computers, you can use Ethernet cable to connect them directly. Or, you can use a router and connect the two computers to the router's LAN ports with Ethernet cables. The IP addresses of the two computers and the router's default IP address must be on the same network segment.

The following section will use the router depicted in [Figure 9-1](#) to explain in detail its setup and usage.

Figure 9-1 Router



- Step 1 Connect the computer that controls the screen (control computer) to the LAN port of the router with an Ethernet cable.

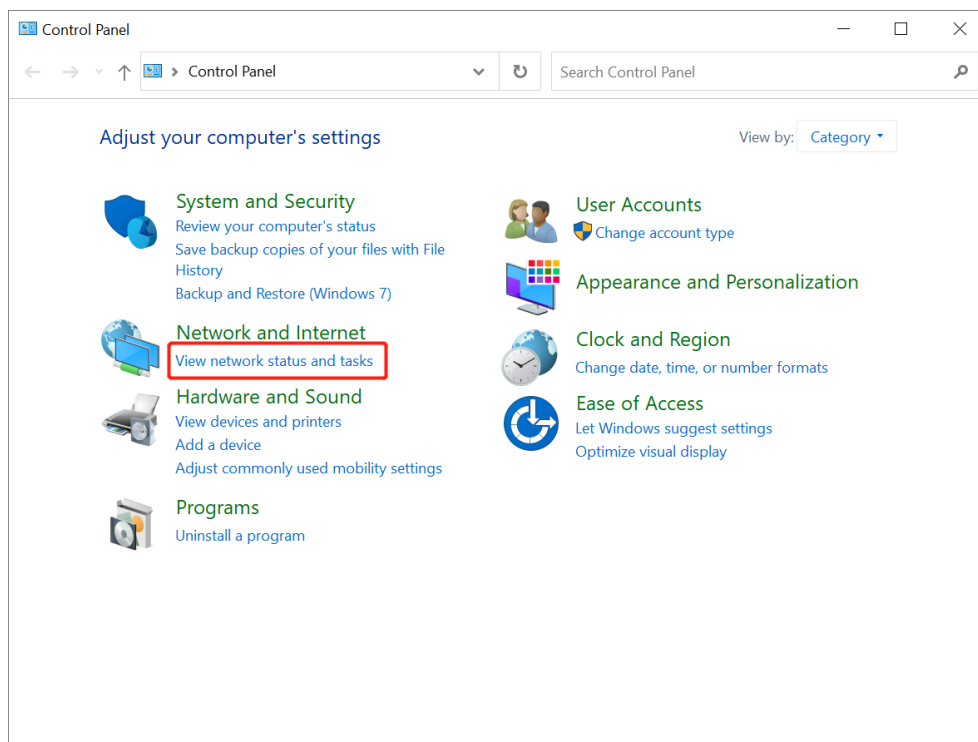
Figure 9-2 Ports of wireless router



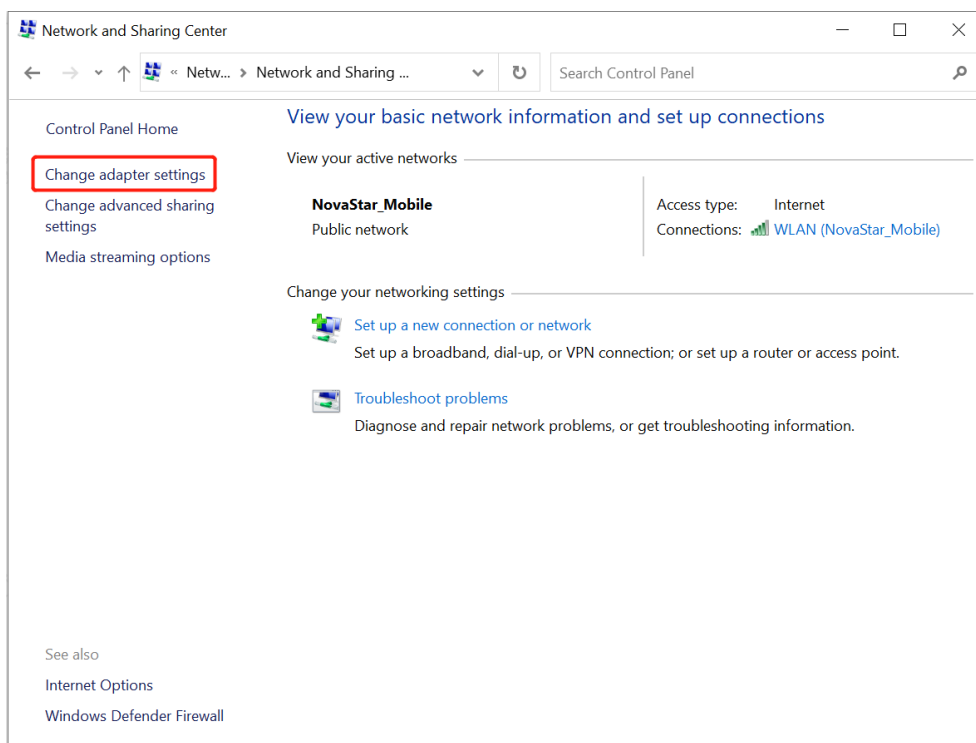
Step 2 Connect the calibration computer to the router with an Ethernet cable.

Step 3 Set the IP addresses of the two computers and the router's default IP address to be on the same network segment. Using the Windows system as an example, the specific setup instructions are as follows.

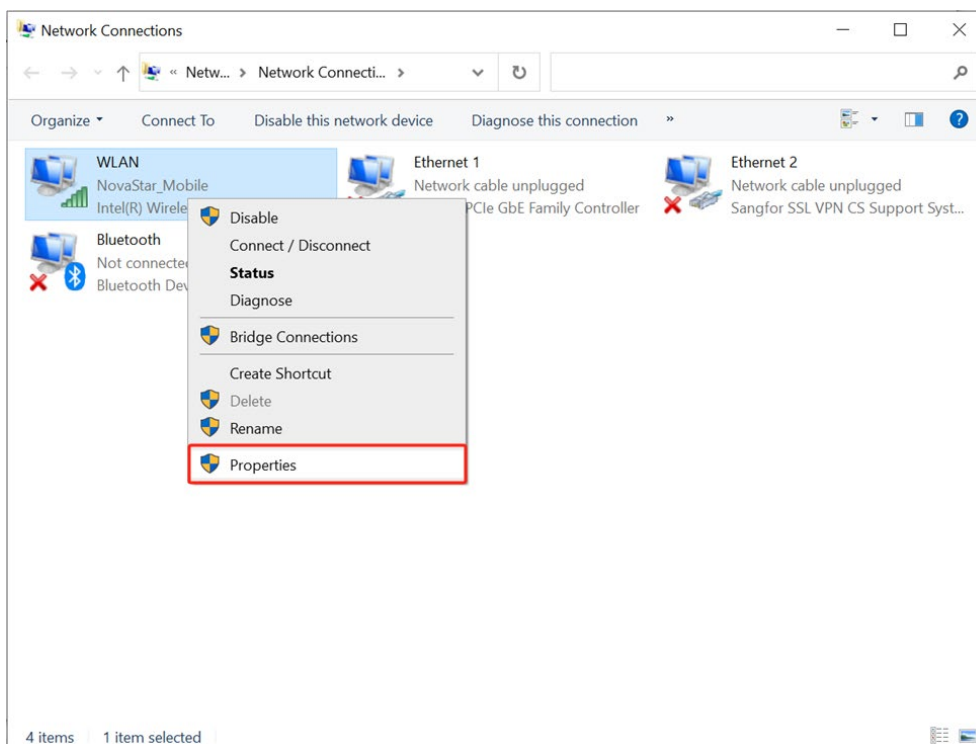
1. On your computer, go to the control panel and click **View network status and tasks**.



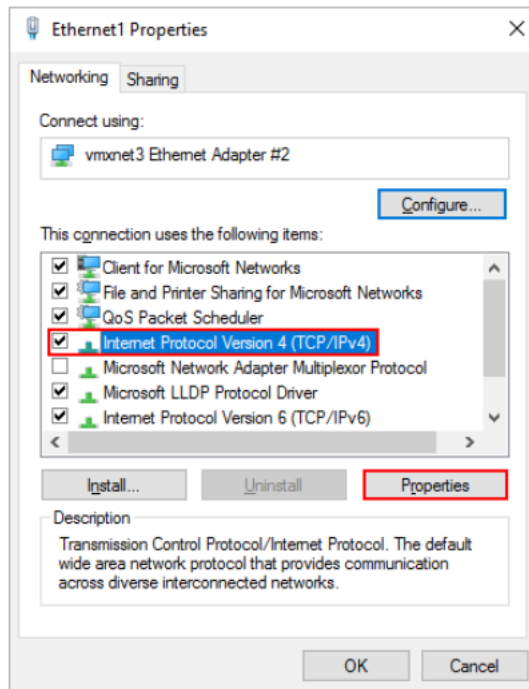
2. On the displayed Network and Sharing Center window, click Change adapter settings on the left.



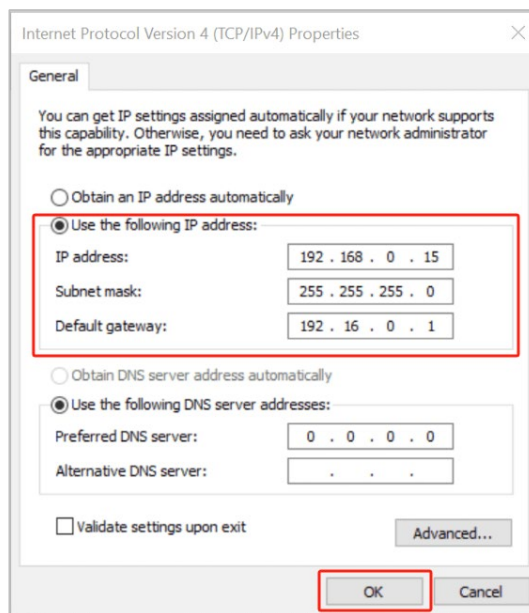
3. On the displayed **Network Connections** window, right click the adapter you use and select **Properties**.



4. On the displayed WLAN Properties window, select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.



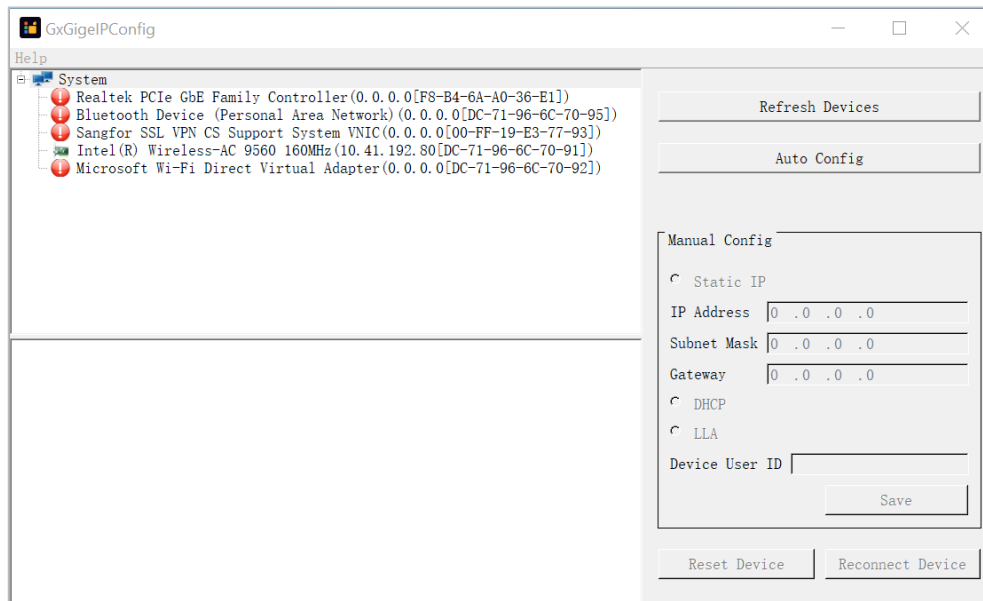
5. On the displayed window, select **Use the following IP address**, enter the IP address, subnet mask and default gateway, and click **OK**.



9.2 How to use the auxiliary tool for C3200 camera?

You can use the IP configuration tool that is installed together with the calibration software to manage the camera.

In the **System** list in the upper-left corner, you can see all the network adapters of the computer directly connected to the C3200 and which adapter the C3200 is connected to.



- Refresh Devices: Click to view the latest connection status of the devices.
- Reset Device: Click to power off the C3200 and restart it.
- Reconnect Device: Click to disconnect and reconnect the C3200.

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