AX IQ Tool User Manual

Version: V1.2

Release Date: 2024/06/06

Contents

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Introduction

Applied for

AX620E series (AX630C and AX620Q)

Intended Readers

- Software Developers
- Technical Support

Description of Symbols and Formats

Symbol/Format	Description
`xx`	Stands for command lines that you can execute.
Italic	Stands for variables. For example, the installation directory in "*installation directory*/AX620E_SDK_Vx.x.x/build" is a variable which depends on your actual environment.
☞ **Notes:**	Provides additional information to emphasize or supplement important points of the main text.
! **Notes:**	Provides additional information that needs to pay attention to.

Revision History

Version	Release Date	Description
V1.0	08/30/2023	Initial release.
V1.1	01/26/2024	Updated the platform description.
V1.2	2024/06/06	Updated the flowchart in Section 1.2.

1 Overview

1.1 Tool Overview

AXIQ is a tool specifically designed for debugging image quality effects. It consists of offline calibration, online parameter debugging, real-time preview, and image quality analysis tools.

- Offline Calibration: Automatically generates algorithm parameters for each supported ISP module.
- Online Parameter Debugging: Fine-tunes parameters distinctively; adjustments can be observed in real-time through the preview window.
- Real-Time Preview: A window for real-time observation of image effects, effectively assisting online debugging.
- Image Quality Analysis Tools: Provides a range of image analysis and debugging tools to assist in debugging.

Environment Preparation

- Tool Release Package

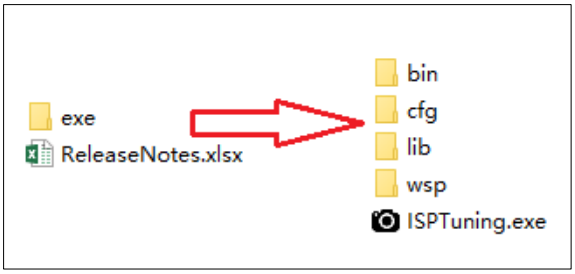

Figure 1-1 Tool Release Package

  - bin/lib: Dependency files needed for the tool to execute.

- cfg: Configuration files needed for the tool to execute.
- wsp: Some sample images and parameter files.

➢ Hardware: Recommended to have more than 8GB of memory and a CPU frequency above 2GHz.

➢ Software: Windows 10 operating system / Matlab runtime 8.1

For downloading Matlab runtime 8.1, refer to the following link and download and install the R2013a (8.1) 64-bit version:

https://www.mathworks.com/products/compiler/matlab-runtime.html

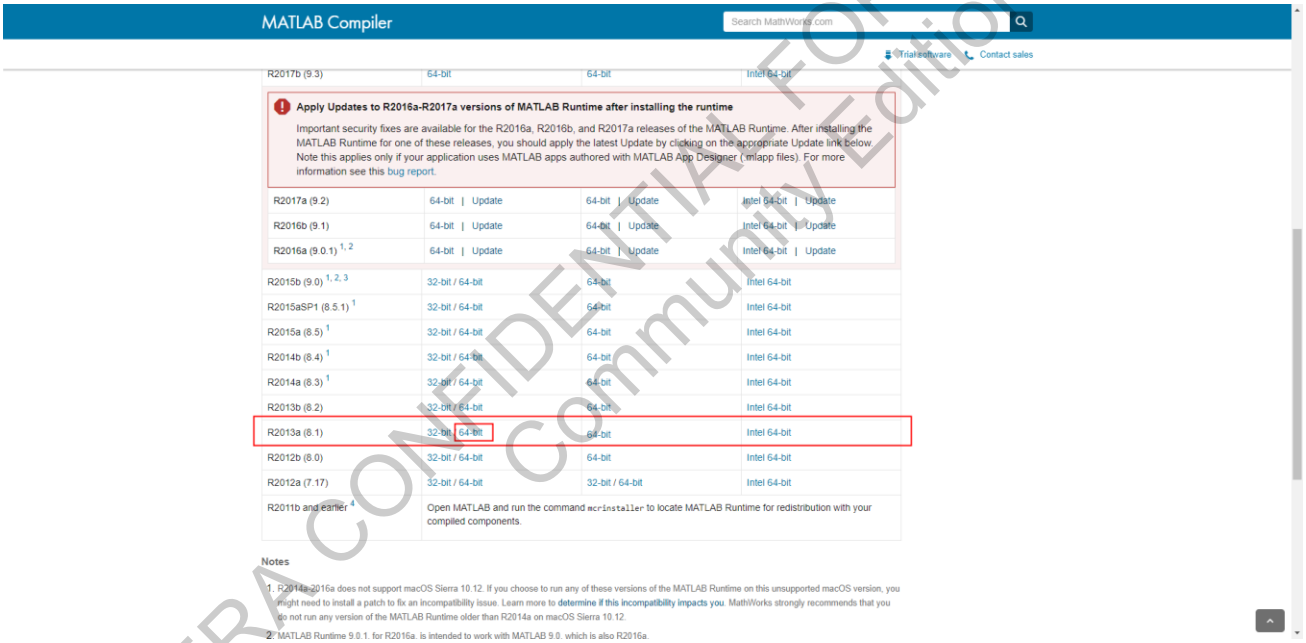

Figure 1-2 Downloading

1.2 Debugging Flowchart

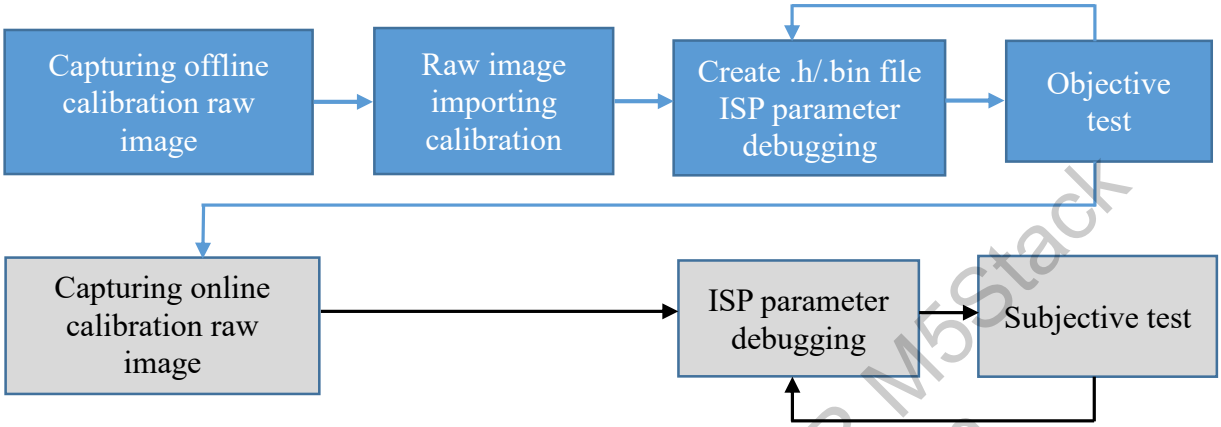

Figure 1-3 Debugging Flowchart

Flowchart

1. Capture raw images under different color temperatures.
2. Import the corresponding raw images into offline calibration tools for debugging.
3. Generate XML parameter files and import them into online Tuning Tools for objective testing.
4. Based on the test results, recapture raw images to optimize parameters.
5. Conduct repeated subjective tests.

1.3 Interface of Tool

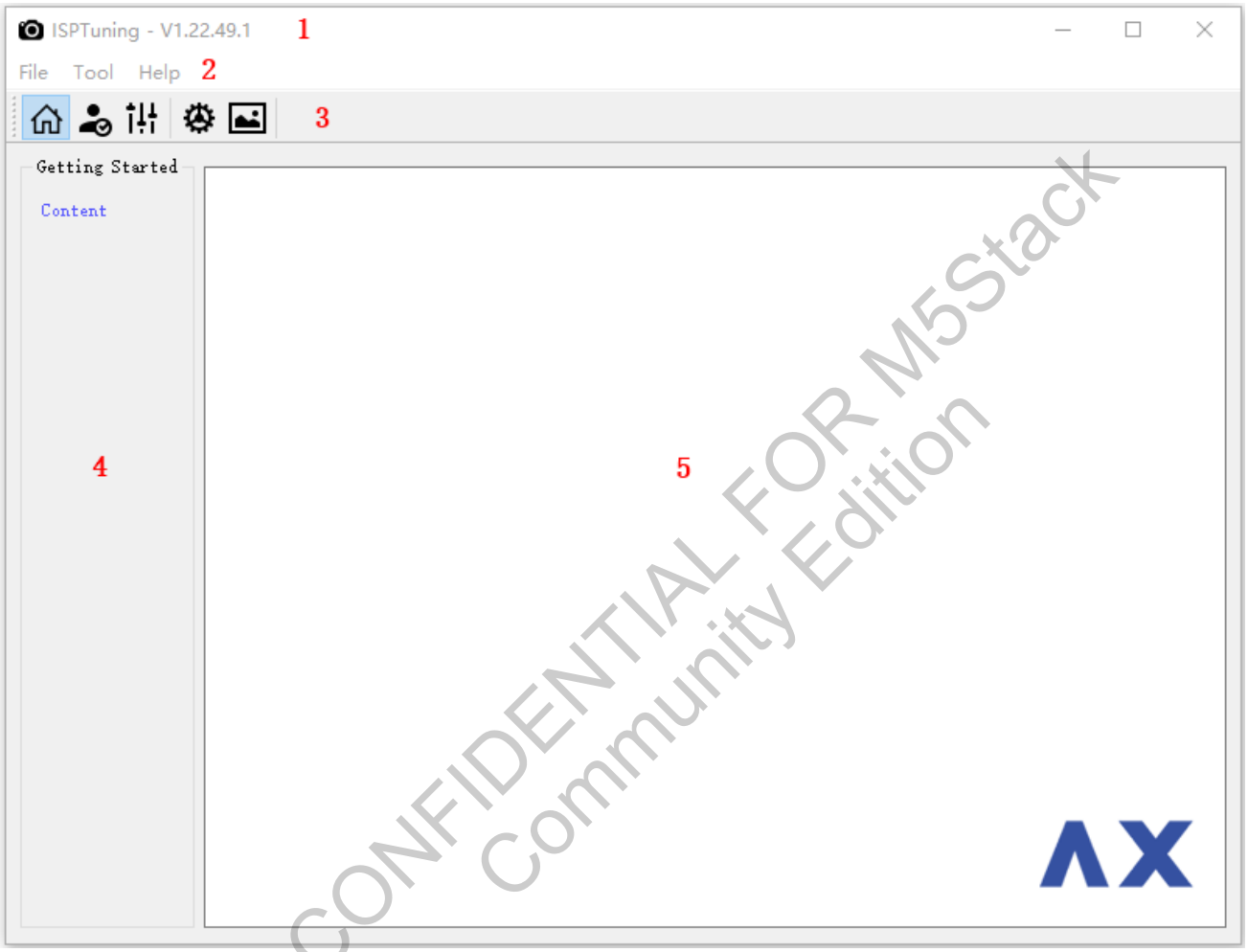

Figure 1-4 ISPTuning Tool

- 1. Title Bar: Mainly displays the version information of the tool.
- 2. Menu Bar: Provides some advanced operations.

Table 1-1 Description of Menu Bar

Menu Item	Description
File	File operations
Tool	Some auxiliary analysis tools

Menu Item	Description
Help	Information about the version

➢ 3. Menu Bar: Provides some common operations.

Table 1-2 Description of Toolbar Icon

Toolbar Icon	Description
	Create debugging projects and display tool-related information
	Offline calibration mode
	Online calibration mode
	Connection and related configuration
	Image quality statistical toolset

➢ 4. Module Panel Area: Displays the currently adjustable modules.

➢ 5. Parameter Debugging Area: Displays the adjustable parameters under the current module and provides means for adjustment.

1.4 Quick Start

1. Run exe/ISPTuning.exe to start the tool and enter the homepage.

2. Click on the toolbar icon  to open the connection configuration page, make the necessary

configurations, then click OK to complete the setup.

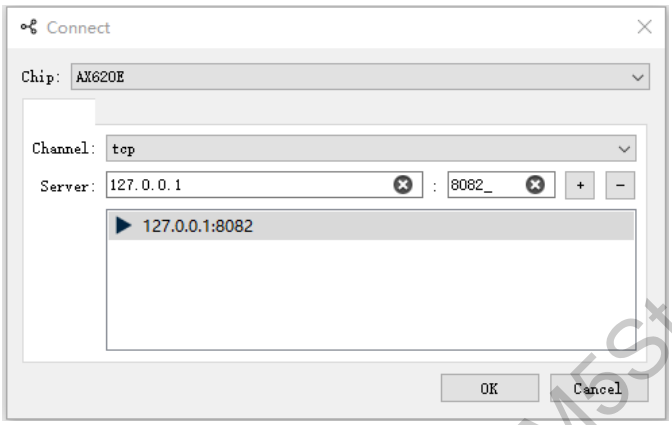

Figure 1-5 Connection Configuration

3. Once connected successfully, the tool enters the Sensor page. Click ▶ to open the preview window, and then start online debugging.

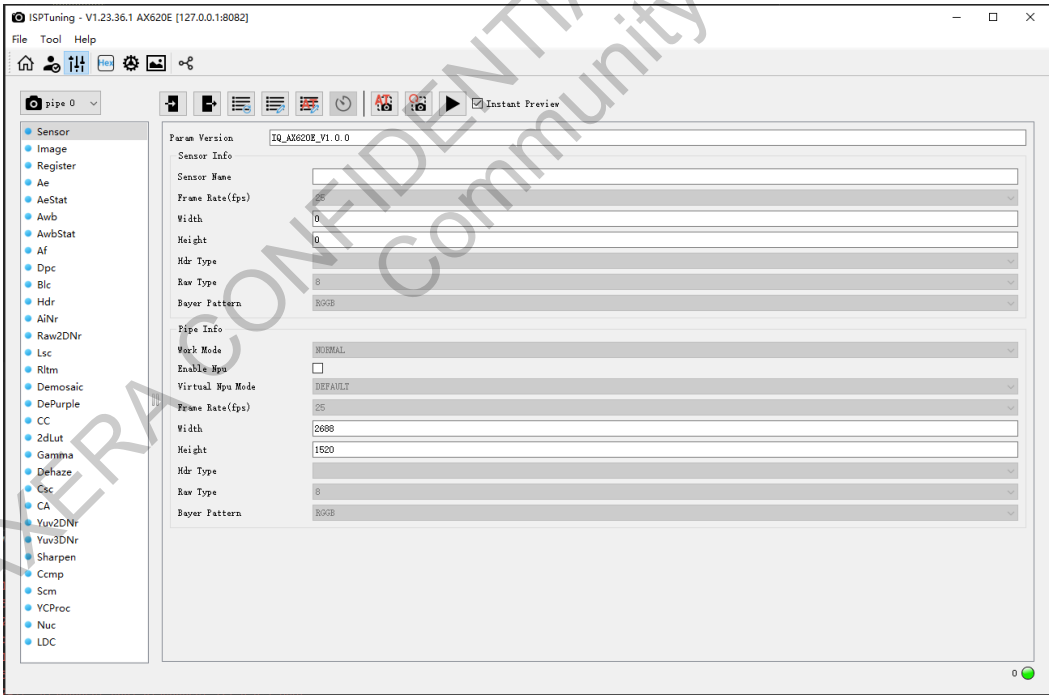

Figure 1-6 Sensor Control

2 Interface and Function Description

2.1 Basic Functions

2.1.1 Calibration Mode Selection and Settings

Click on the toolbar  to choose Calibration mode. Before entering, the following configurations need to be set:

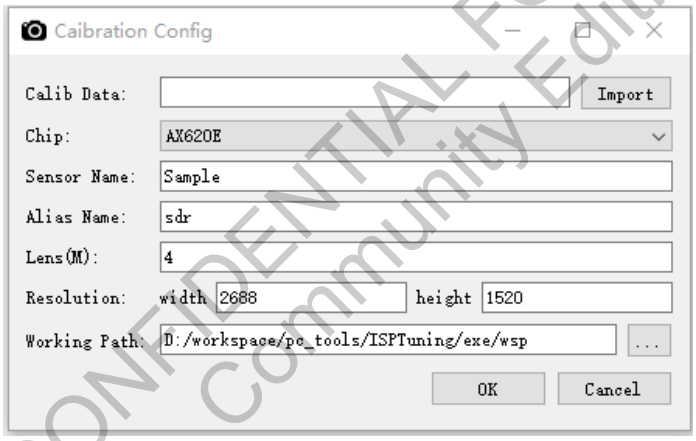

Figure 2-1 Calibration Configuration

- Calib Data: The path where Calibration data is saved. The directory depth should reach the Offline___* directory.

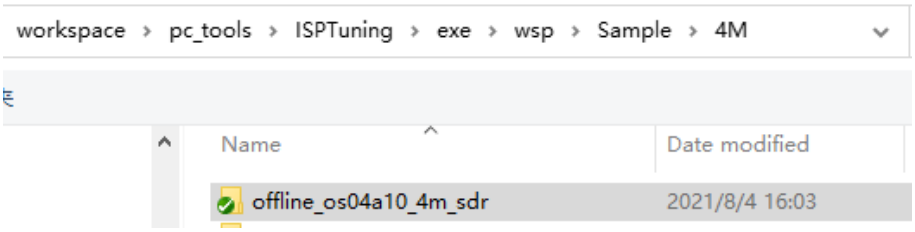

Figure 2-2 Calib Data Selection Directory

After the correct directory is selected, it will automatically parse information such as Chip/Sensor Name/Alias Name/Lens(M)/Resolution/Working Path.

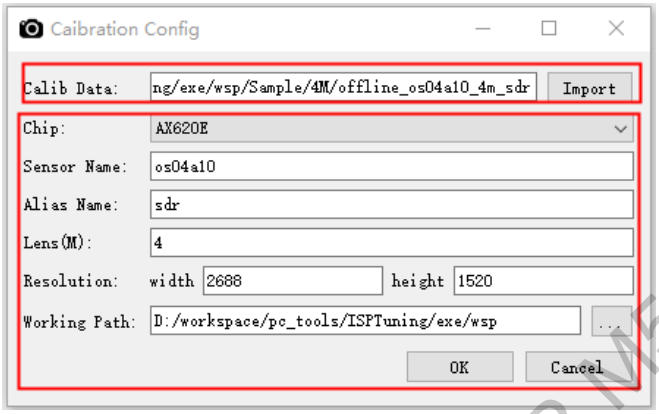

Figure 2-3 Calibration Configuration

- Chip: Select the chip type, here choose AX620E
- Sensor Name
- Alias Name: Alias type
- Lens: Size
- Resolution
- Working Path: The path where the results of the Calibration offline calibration are saved

! Notes:

If you want to modify the settings again under Calibration mode or switch to another chip, you can complete this by clicking on the menu bar  .

Figure 2-4 Toolbar

2.1.2 Online Tuning Mode Selection and Settings

Click on the toolbar  to choose Online Tuning mode. Before entering, the following configurations need to be set:

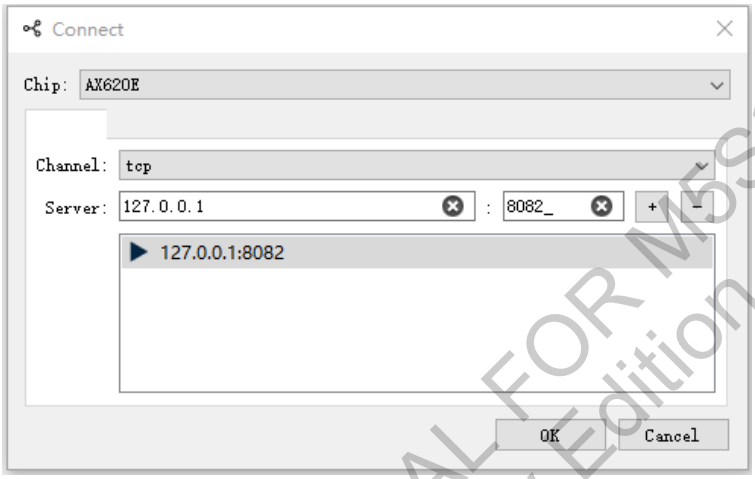

Figure 2-5 Online Tuning Configuration

- Chip: Select the chip type, here choose AX620E
- Channel: Choose the connection type, for AX620E products select tcp.
- Server: The IP address and port number (8082 by default) of the Tuning Server on the board side.

! Notes:

If you want to modify the settings again under Tuning mode or switch to another chip, you can complete this by clicking on the menu bar  .

Figure 2-6 Toolbar

2.1.3 Connection Configuration

Click on the menu bar  to open the connection configuration page.

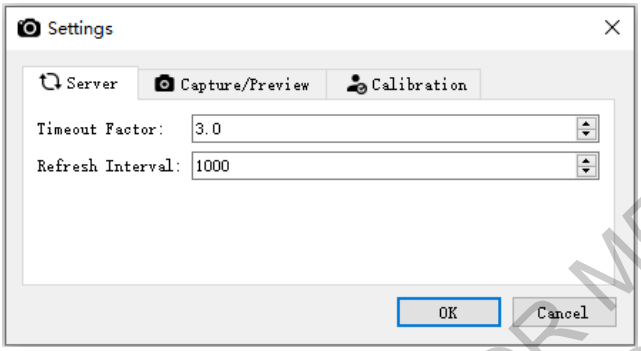

Figure 2-7 Settings

- Timeout Factor: The timeout factor when communicating with the Tuning Server, default is 3.0.
- Refresh Interval: Setting for the auto-refresh interval.

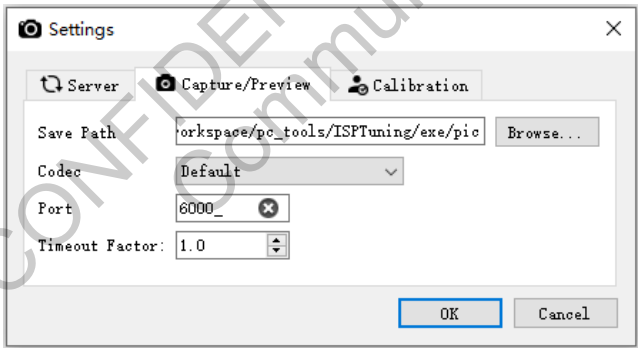

Figure 2-8 Settings

- Save Path: The local save path for images captured in the Preview window.

  Click on Browse to select the directory path for saving output image files.

- Codec: Codec settings for Preview, options include Default, QSV (INTEL), or CUIVD (NVIDIA).
- Port: The port used for capturing images in preview.
- Timeout Factor: The timeout factor for communicating with the server during capture/preview,

by default.

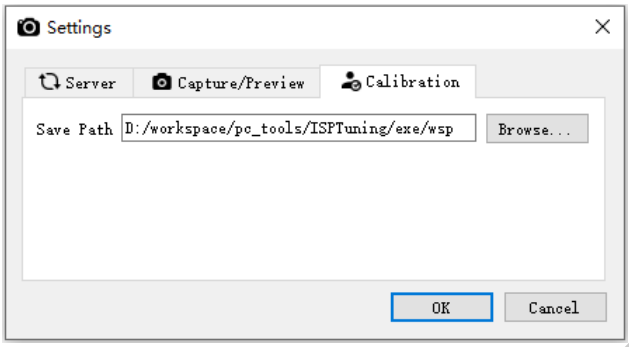

Figure 2-9 Settings

- Save Path: The local save path for Calibration calibration files.

Click on Browse to select the directory path for saving calibration files.

2.2 Real-Time Preview Feature

After entering Online Tuning mode, click on the menu bar ▶ in the pipeline page to open the real-time preview window. After closing the preview window, you can reopen it by checking “Install Preview” on the menu bar.

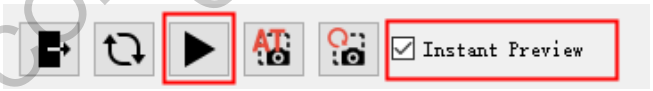

Figure 2-10 Pipeline Menu Bar

The preview window includes the following features:

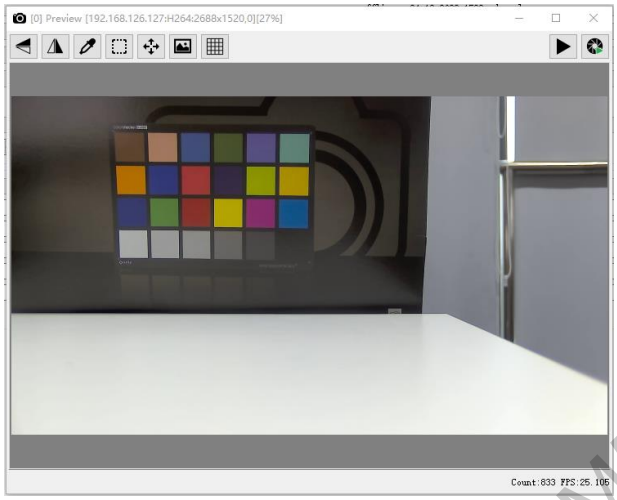

Figure 2-11 Preview Window

-  : Flip the window image vertically.

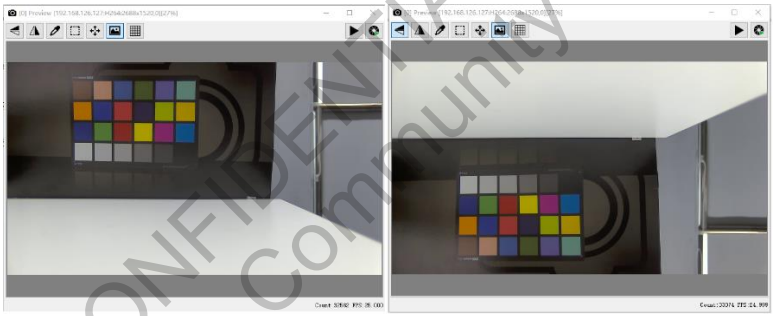

Figure 2-12 Flip

-  : Mirror the window image horizontally.

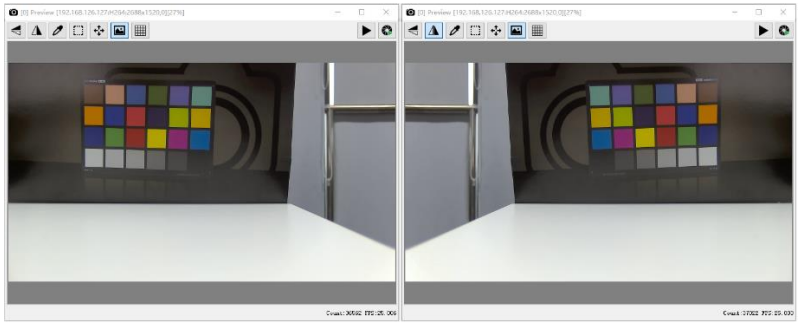

Figure 2-13 Mirror

- : Click a point within the window with the mouse retrieves the position information and RGBY statistics of that point, which are then displayed in the status bar.

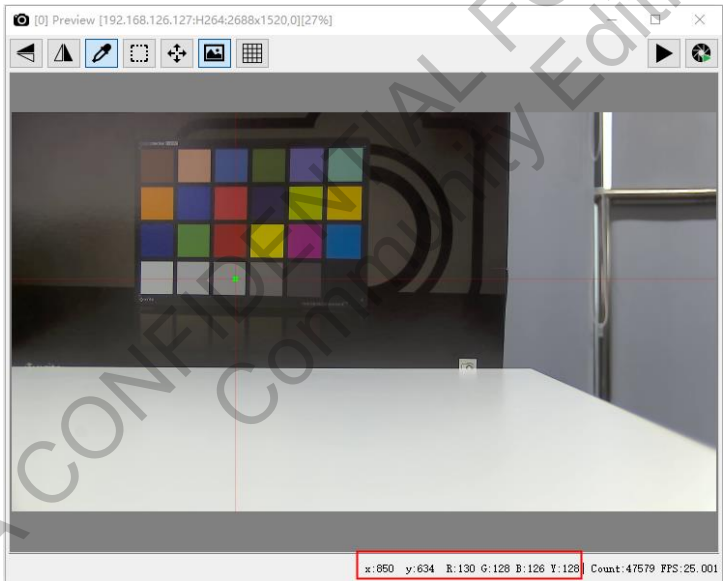

Figure 2-14 Select Color

- : Select an ROI, and the information about the ROI is displayed in the status bar.

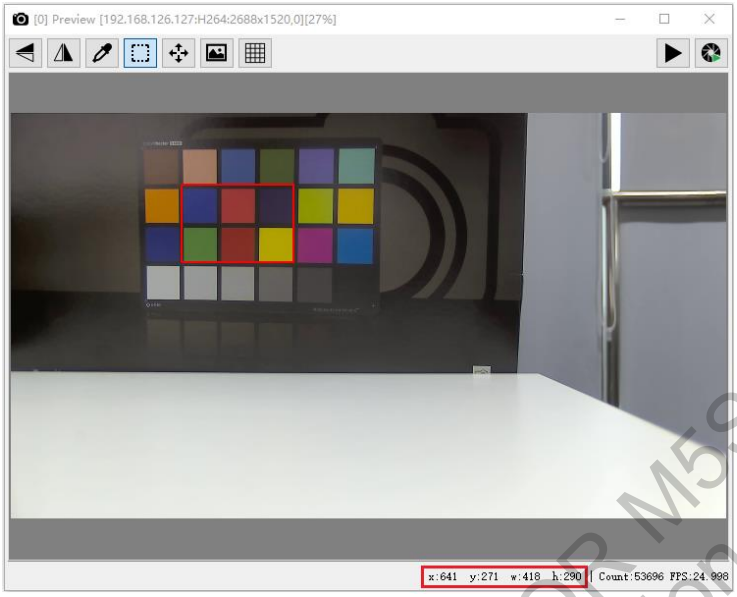

Figure 2-15 ROI

- : Zoom in or out of the window by scrolling the mouse wheel. After enlarging the window, click this button, then right-click and move the mouse to view the entire contents of the window.

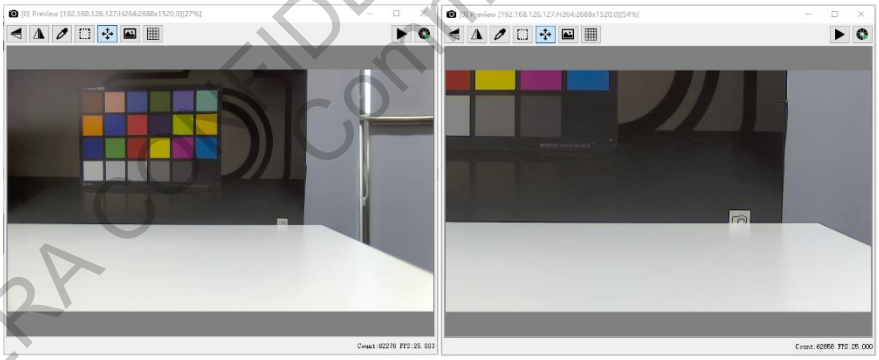

Figure 2-16 Zoom In/Out and Move

- : This function must be used in conjunction with the AWB page. Clicking this button divides the window into an MxN grid. Selecting some grids in the window will correspondingly select the white points on the AWB page. Double right-clicking will cancel all selections. For detailed operations, refer to the AWB section of the Online Tuning debugging.

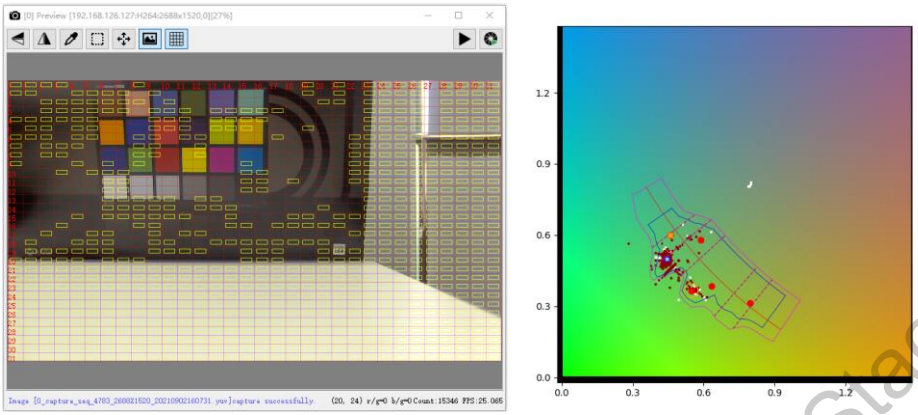

Figure 2-17 Grid

- ▶: Click this icon to start recording video; click ■ again to stop recording. The recorded content is saved under the exe/pic folder.

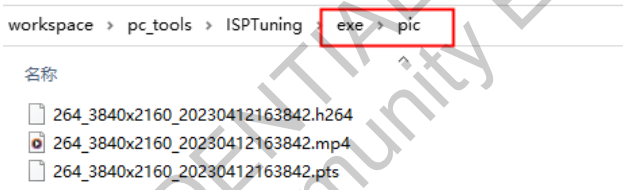

Figure 2-18 Recorded Video

- : Capture a single image.

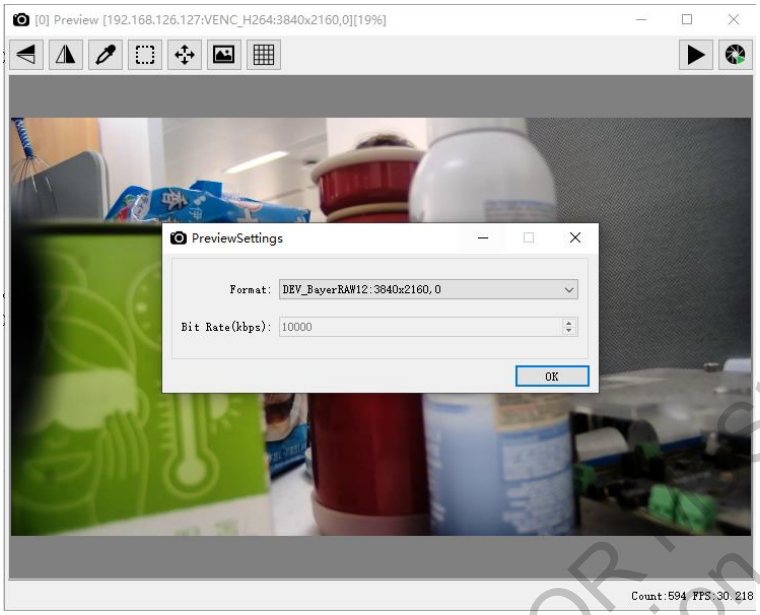

Figure 2-19 Capture Images

- Format: Image type, with the following options available:

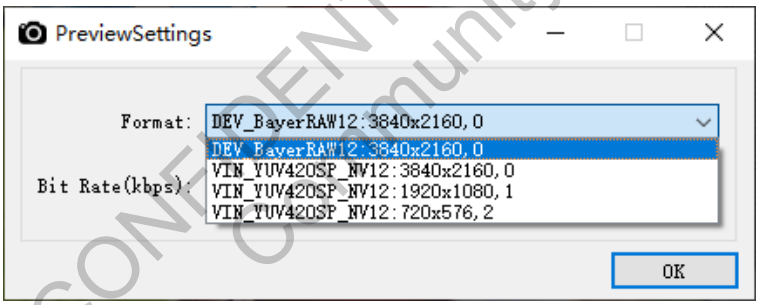

Figure 2-20 Image Type

- Bit Rate (kbps): Rate.

After a successful capture, the image is saved in the exe/pic folder:

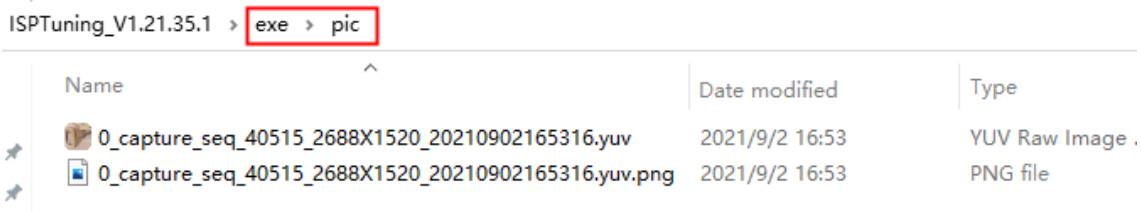

Figure 2-21 Capture Images

-  : This button must be used in conjunction with the capture  function. If pressed during image capture, the previously captured images will automatically open in the Image Tools when it is launched.

2.3 Capture Function

In addition to capturing single images in the preview window, the tool also provides a more convenient method to capture multiple images.

2.3.1 Capturing Multiple Images

After entering Online Tuning mode, click in the menu bar  on the pipeline page.

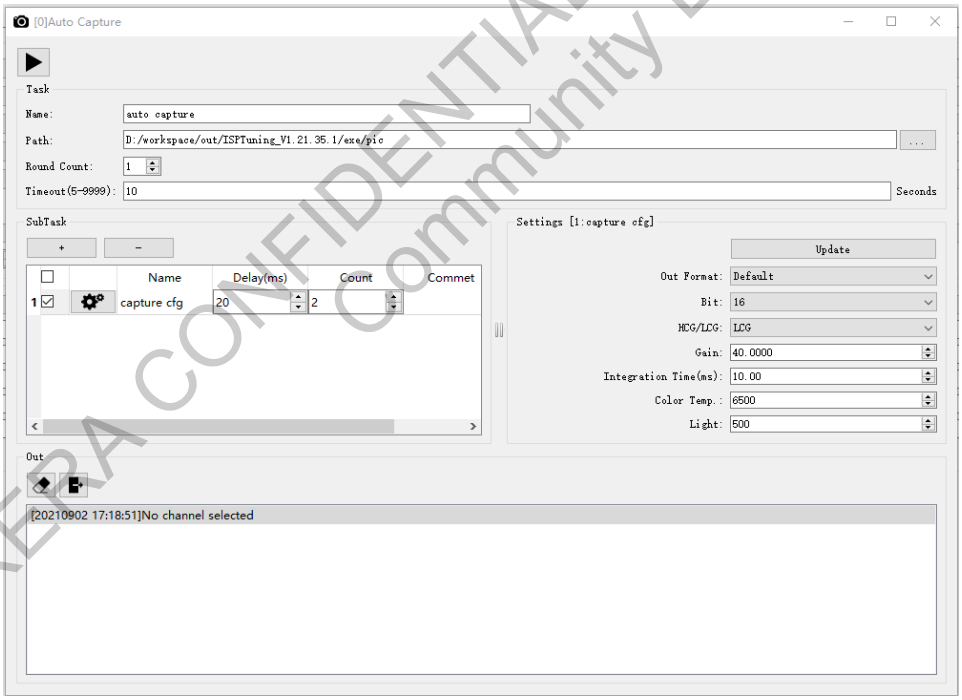

Figure 2-22 Capturing Multiple Images

- Name: The folder name where the images are saved, named as Name + timestamp.

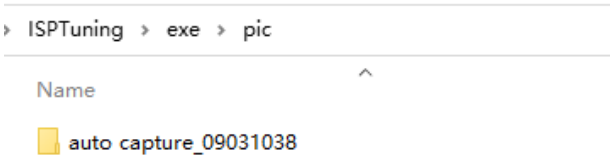

Figure 2-23 Image Saving Folder

- Task:
  - Path: The path where images are saved. For example, if Path = D:/workspace/pc_tools/ISPTuning/exe/pic and Name = auto capture, then the captured images will be saved in the following path: D:/workspace/pc_tools/ISPTuning/exe/pic/auto capture_09031038/.
  - Round Count: The number of cycles for image capturing.
  - Timeout: The timeout waiting period for capturing images, 5s by default.
- SubTask:
  - +: Add a configuration set.
  - -: Remove a configuration set.
  - Name: Configuration name.
  - Delay(ms): The interval between capturing two images, 20ms by default.
  - Count: The number of images captured in one go.
- Settings: This section mainly sets the fields for the captured image names.
  - Out Format: Choose the format for the captured images, options include Default/Blc/Dpc/Npise Profile.

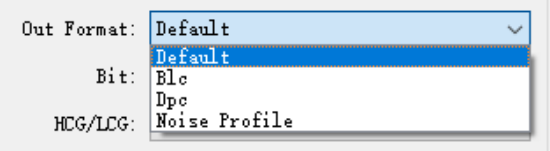

Figure 2-24 Out Format

- Bit: Bit width.
- HCG/LCG: Choose HCG/LCG.
- Gain: Enter the Gain value used during image capture.
- Integration Time: The integration time for capturing images, in ms.
- Color Temp: The color temperature during image capture.
- Light: The brightness during image capture.

For example, after setting the configuration items as above, the format of the captured image names might look like this:

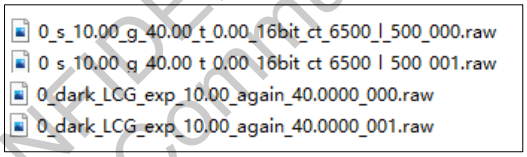

Figure 2-25 Image Name

➢ ▶: After completing the configuration, click this button to start capturing. Before capturing, first set the image type:

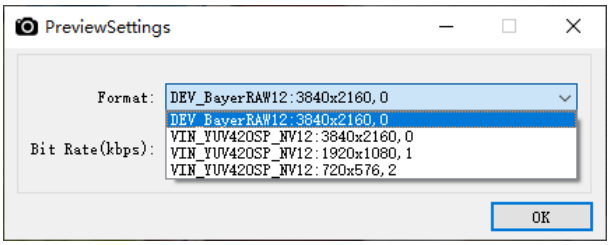

Figure 2-26 Image Type

2.3.2 Continuously Capturing Multiple Images

Refer to *02 - AX Raw Image Capture and Simulation Guide*.

2.4 Online Debugging

Refer to *03 - AX Image Online Debugging Guide*.

2.5 Offline Calibration

The reference document is to be determined.

2.6 Image Tools Function Description

2.6.1 Operational Description

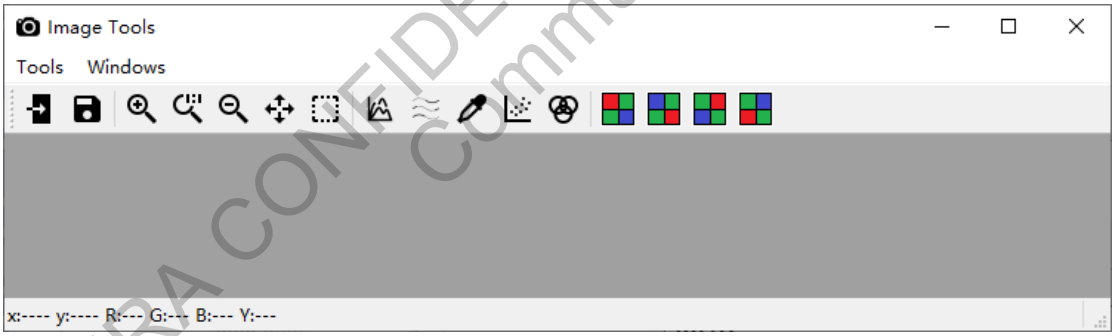

Figure 2-27 Image Tools

Below is the description of the icons on the Image Tools.

Table 2-1 Description of Image Tools Icons

Image Tools Icons	Description
	Open/Save image. ☞ **Notes**

Image Tools Icons	Description
	Supports *.png, *.jpg, *.jpeg, *.bmp, *.Raw, *.mipi_Raw, *.pgm, *.tif, *.tiff, and *.yuv formats.
	Zoom Ratio: Image enlargement and reduction
	Drag Image: Drag the current position of the image
	Select ROI
	Histogram: Displays image RGBY values/histogram
	Lens shading
	Gamma: Grayscale card test
	24 Color Card: Test
	Bayer Pattern Selection

2.6.2 Histograms

1. Import a Raw image as shown, enable the feature  , select an ROI (yellow box), and gather statistical data (Count/Mean/Max/Min) for R/RG/B/BG of the selected area.

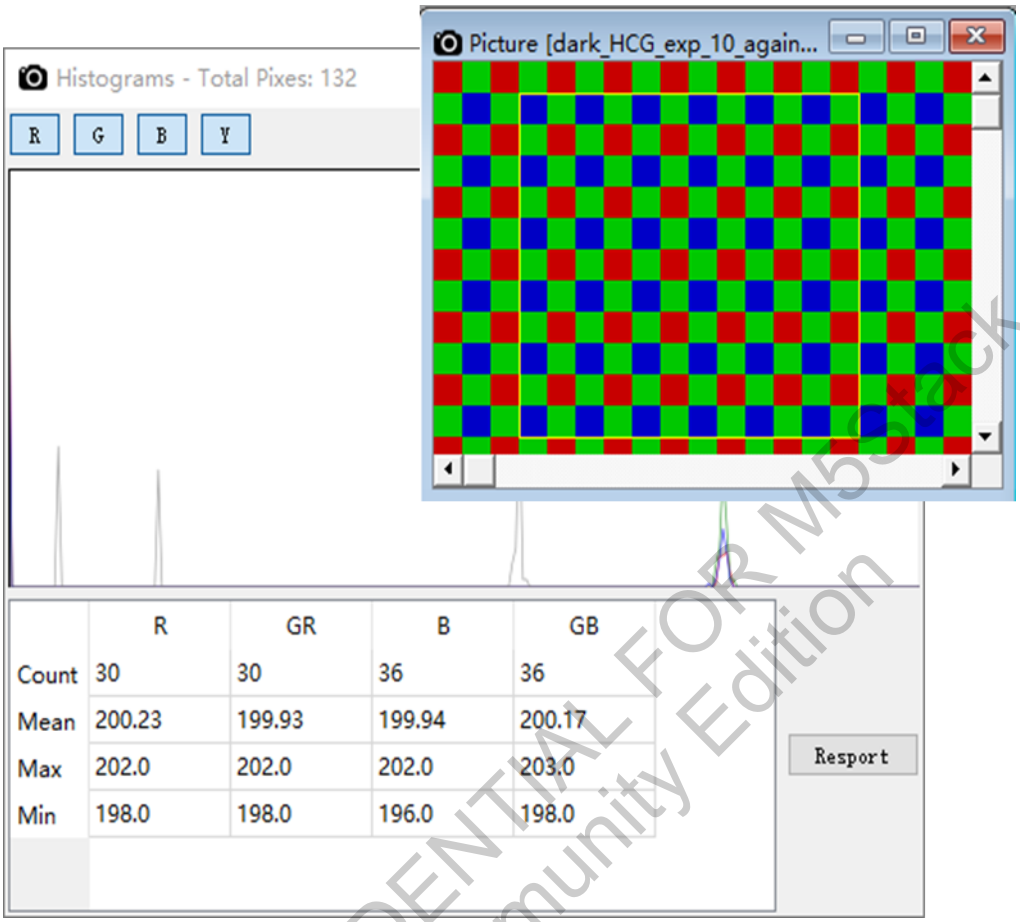

Figure 2-28 Statistical Data

2. Import other types of images, select an ROI (yellow box), and collect statistical data (Mean/STD/Max/Min/SNR) for R/G/B/Y of the selected area.

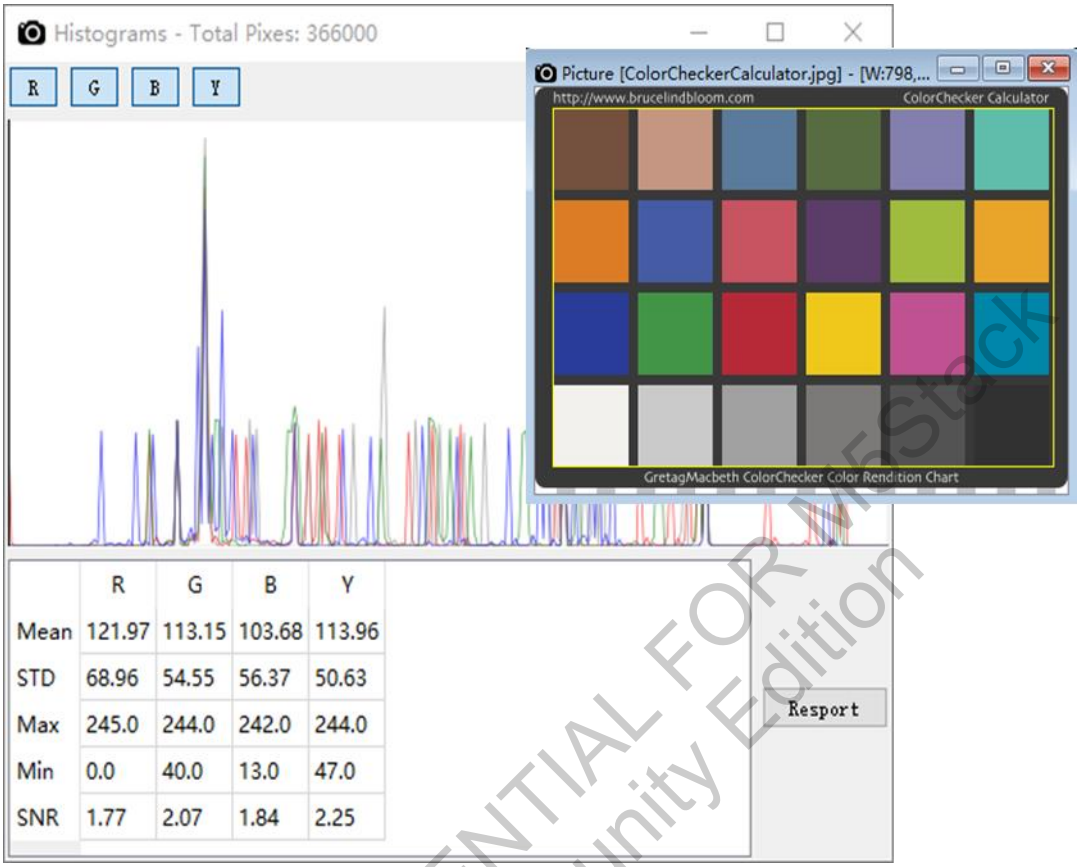

Figure 2-29 Statistical Data

3. Click “Report” to save and display the content of the exported statistical data file.

2.6.3 Wave

Import a photo, display the R, G, B, Y component waveforms. By moving the Row/Col Slider bar, show the Horizontal/Vertical corresponding coordinate position’s R, G, B, Y component waveforms to observe lens shading effects through waveform changes.

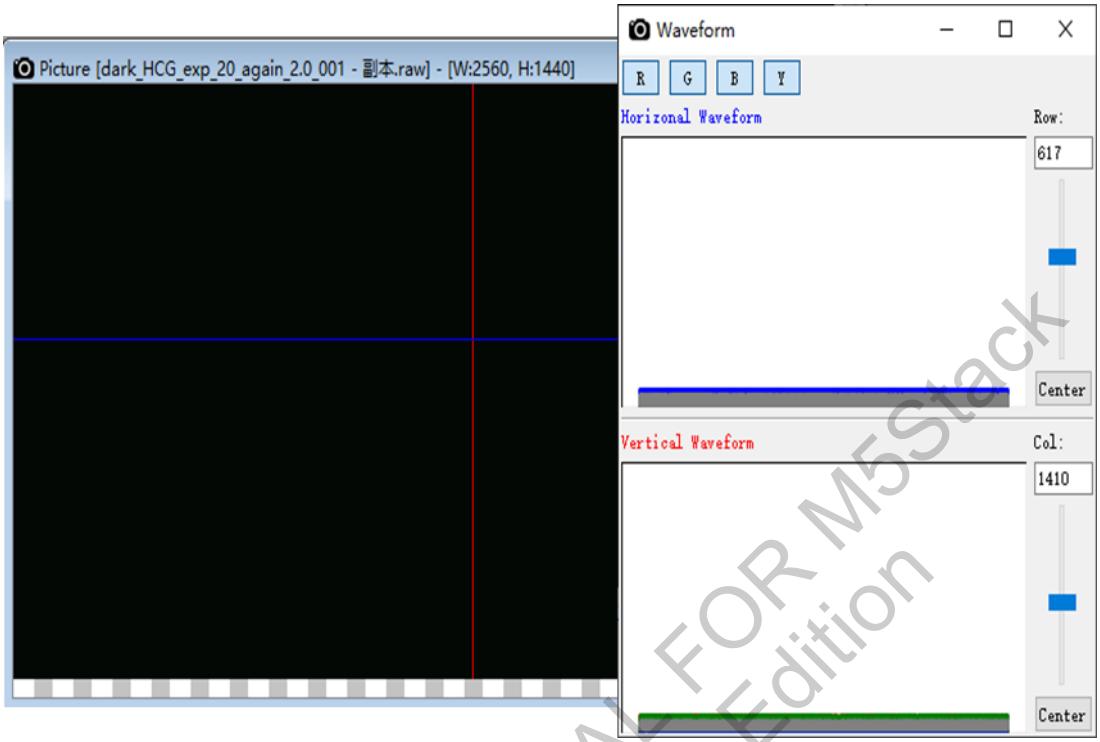

Figure 2-30 Observe Lens Shading Effects Through Waveform Changes

2.6.4 Color Channel

Import a photo, display the R, G, B, Y component waveforms. By moving the Row/Col Slider bar, show the Horizontal/Vertical corresponding coordinate position's R, G, B, Y component waveforms to observe lens shading effects through waveform changes.

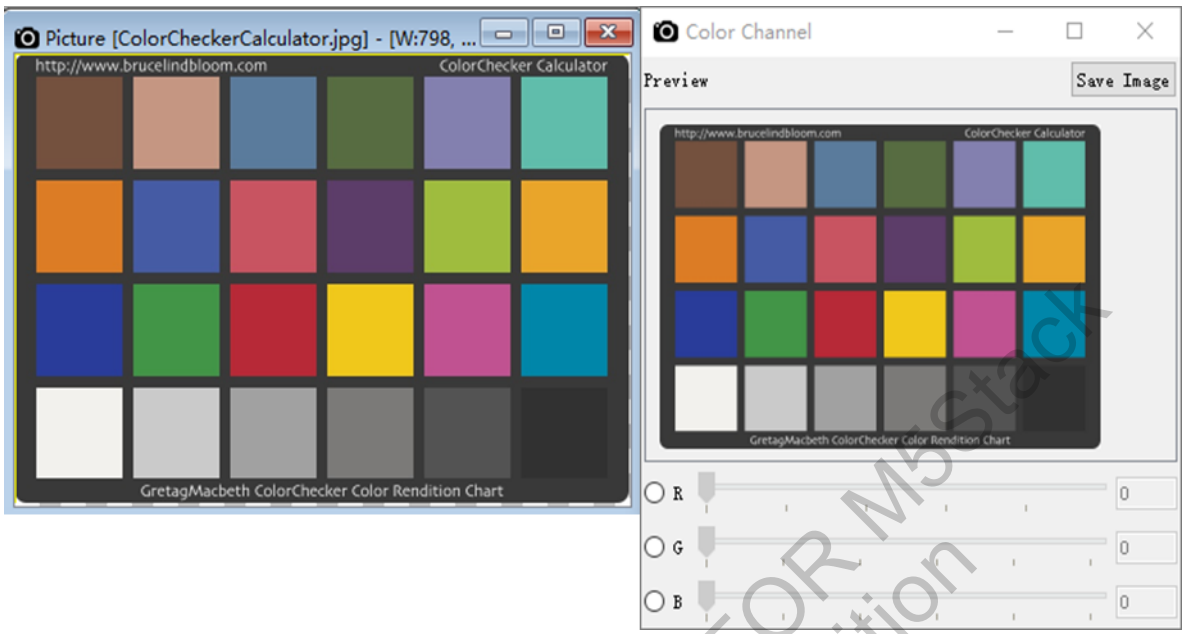

Figure 2-31 Color Channel

2.6.5 Gamma

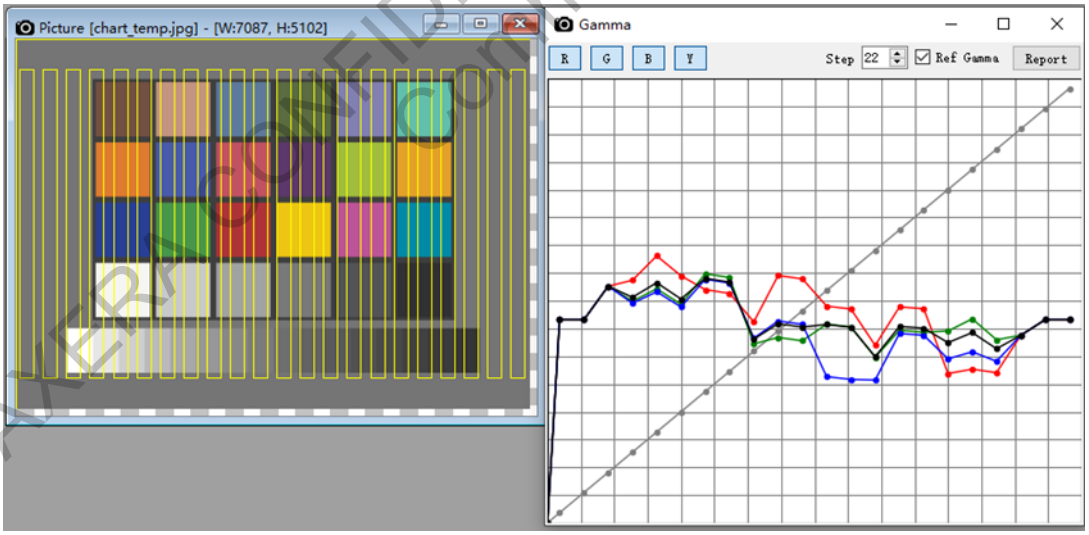

Figure 2-32 Gamma

2.6.6 Color Difference

Import an image file, enable the feature , and select an ROI (yellow box) to pick 24 areas (6*4 distribution) as shown below. Gather and generate AWB color statistics for 24 color blocks of R, G, B, Y, SNR values. Output a TXT file based on the order of color blocks and display specific results in the LAB coordinate system. By observing the lines connecting the camera values to the ideal values in the color difference chart, as well as the color difference data, determine if the color correction matrix for calibration is reasonable.

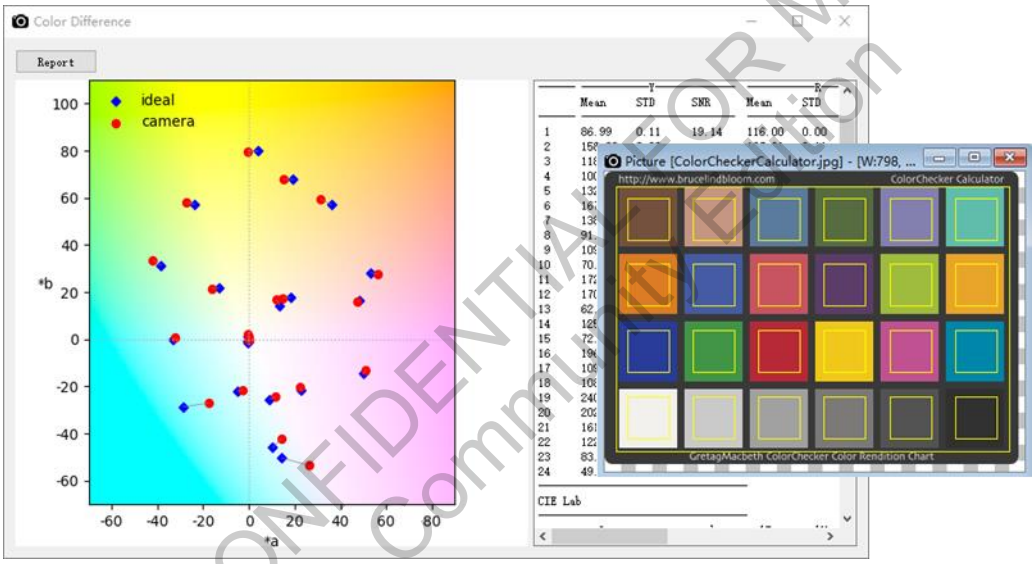

Figure 2-33 Color Difference

2.7 Other Auxiliary Tools

2.7.1 Raw Image Conversion Tool

Implements the conversion of 16-bit stored Raw images from low to high bit as well as tightly packed format Raw conversion to 16-bit least significant Raw image function.
Under the menu bar Tool, click “Convert Raw” to open the Raw image conversion tool. The interface is as follows:

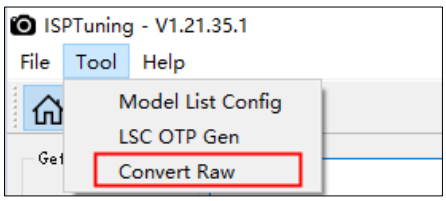

Figure 2-34 Menu Item

Interface of the tool is shown as follows.

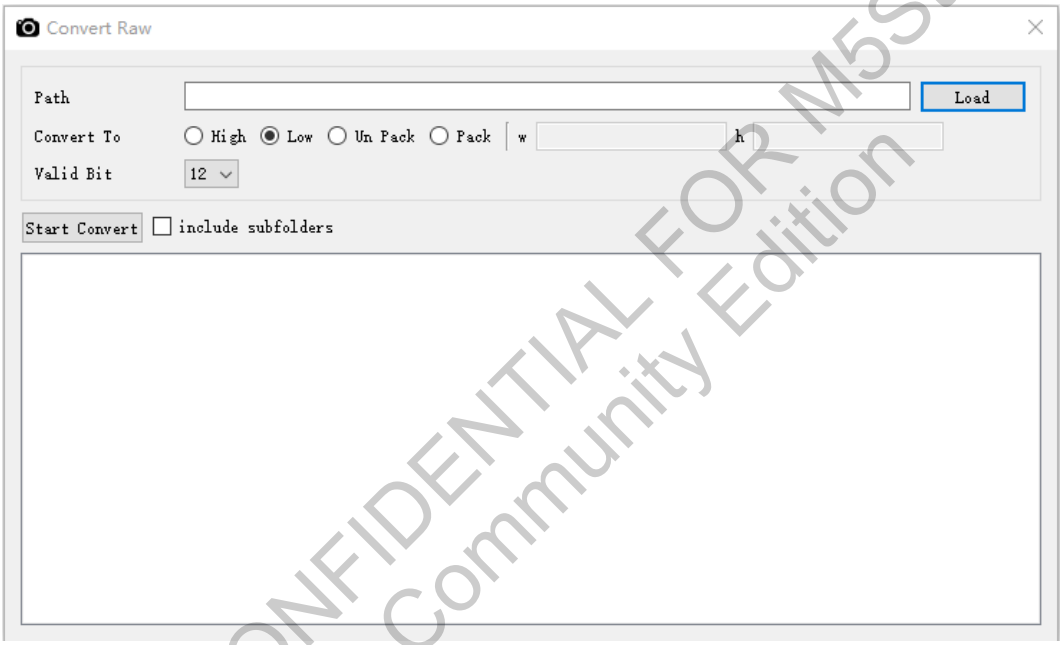

Figure 2-35 Raw Image Conversion Tool

- Path: The storage path for Raw images.
- Convert to:
  - High: 16bit least significant Raw (input) → 16bit most significant Raw (output).
  - Low: 16bit most significant Raw (input) → 16bit least significant Raw (output).
  - Un Pack & w & h: Non-tightly packed Raw & Raw width & Raw height (input) → 16bit least significant Raw (output).
  - Pack & w & h: Tightly packed Raw & Raw width & Raw height (input) → 16bit least significant Raw (output).

- Start Convert: Click to start the conversion.
- Include Subfolders: If checked, Raws in the subfolders of the selected folder will also be converted.

  A new folder will be created in the selected path to store the converted raw data.