RKIQTool User Manual

V1.5

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	Author：	Emily Chi, Yu Chen, Li Chen
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	Auditor：	Sandy Yang, George Deng
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Fuzhou Rockchip Electronics Co., Ltd

Version History

Version no.	Author	Revision date	Revision description	Corresponding tool version	Remark
V 1.0	Chi Xiaofang, Chen Yu, Chen Li	2016-11-30	Initial version release	v1.1.3	
V 1.1	Chi Xiaofang	2016-12-25	Supplement	v1.1.3	
V 1.2	Chi Xiaofang, Chen Yu	2017-01-11	Supplement	v1.1.4a	Add tool update log
V 1.3	Chi Xiaofang	2017-06-26	1.Add AWB white point debugging tool instruction 2.Add ROI function instruction in capture tool 3.Add the instruction of PC preview and quick acquisition of YUV data on capture tool interface 4.Add tool update log	v1.1.6a	
V1.4	Chen Yu	2018-8-28	Add section 4.4: Method to capture Raw picture on RK3288, RK3399 Linux platforms	v1.1.6a	
V1.5	Chen Yu	2019-5-16	Modify section 4.4 to add the method instruction for capturing raw picture on RK1808	v1.1.8.1	

Contents

1 Overview

RKIQTOOL supports below RockChip platforms:

RK3288、RK3326、RK3368、RK3399：Android 8.x or earlier

RV1108、RK1808、RK3288、RK3399、RK3326：Linux

Camera Module tuning process is shown as below:

（1） Use Capture Tool of RKIQTOOL to capture the raw picture required for tuning.

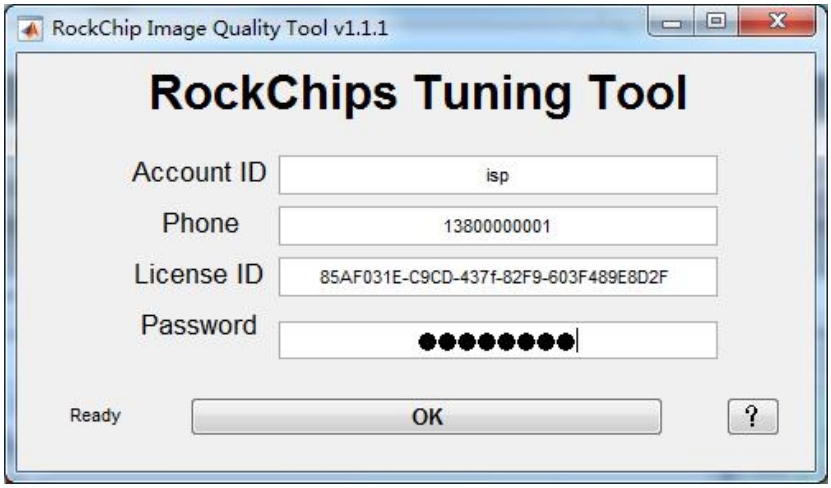
（2） Use Tuning Tool of RKIQTOOL to calibrate the parameters of the corresponding modules based on the raw picture obtained from Step 1.

（3） Use Analysis Tool of RKIQTOOL to fine tune or modify the calibrated parameter obtained from Step 2.

Installation steps:

1. Click MCRInstaller.exe to install MCR.
2. Click RKIQTOOL.exe to run RKIQTOOL.
3. If it is the first time to use RKIQTOOL, it requires users to register account and serial number. One SN can only register one computer and need to make sure the network unobstructed during registration.

Example：

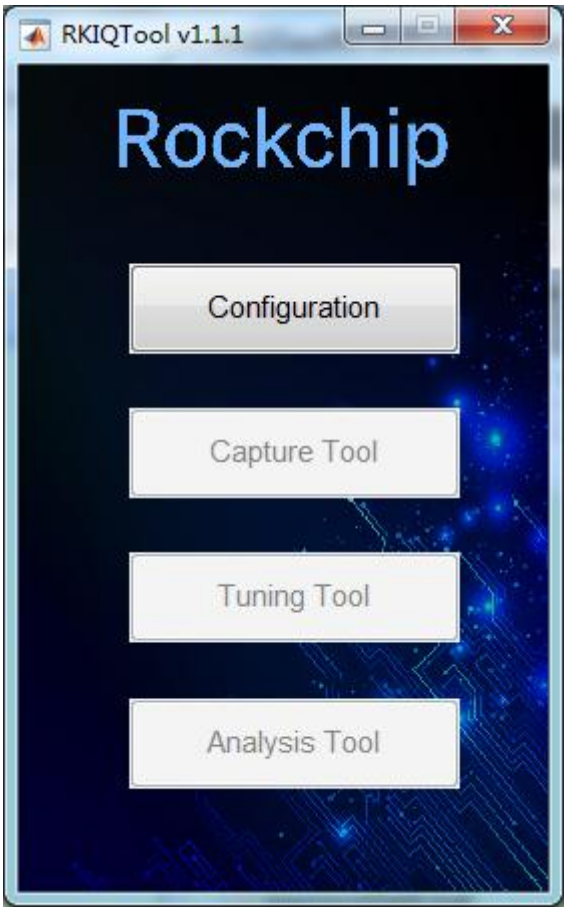


Picture 1- 1

Picture 1- 2

If there is any problem or suggestion, please contact with us through redmine or e-mail.

2 Main Interface

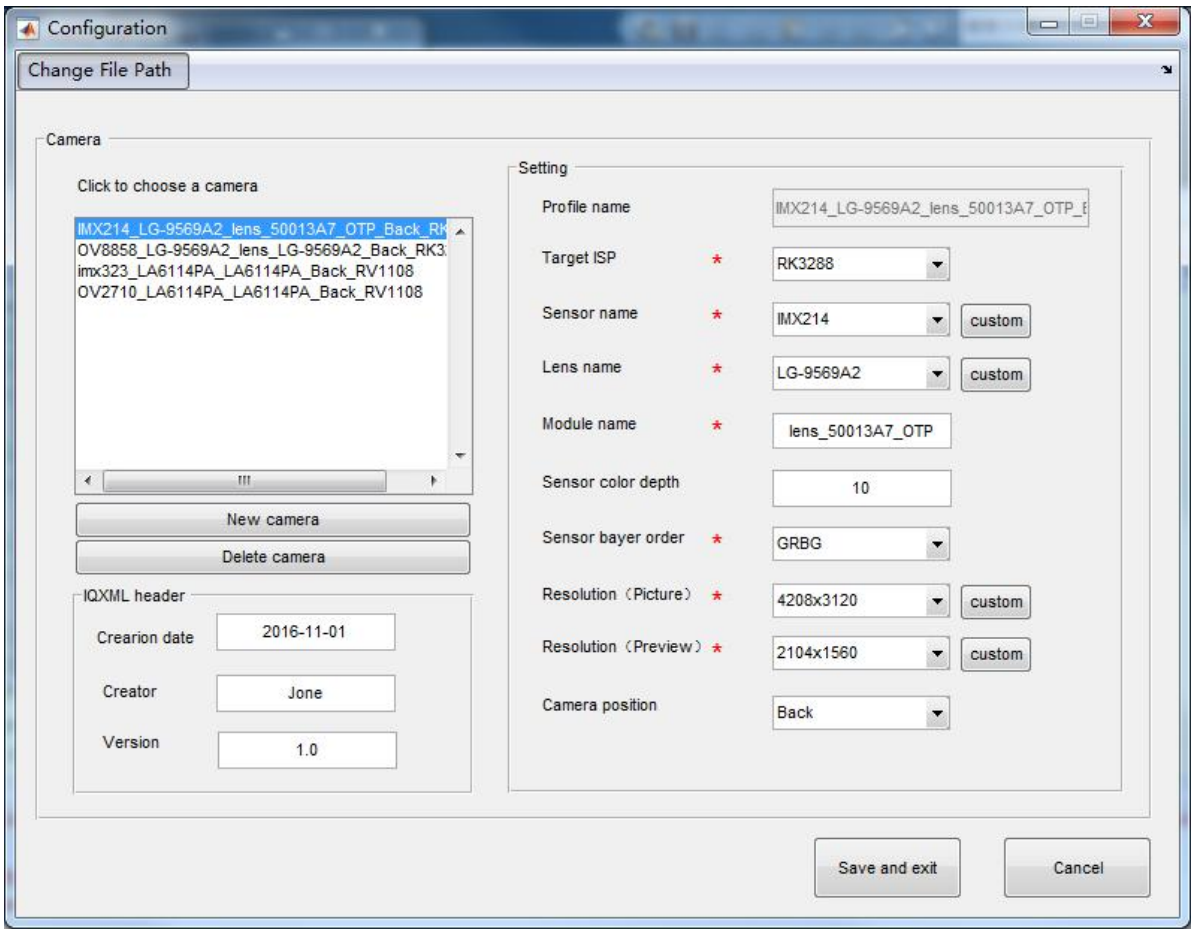


Picture 2- 1

This Tool has four modules. *Capture Tool, Tuning Tool* and *Analysis Tool* can be used only after *Configuration* module is configured.

3 Configuration

Click *Configuration* in Picture 2-1, and then below interface will pop up:



Picture 3- 1

3.1 Select configuration of a camera

Single click profile name in the left list box of Picture 3-1 to select configuration of its camera. You can also add or delete camera's configuration information through *New camera* or *Delete Camera* button, Click *save and exit* button to save the configuration.

The option can be added by clicking *custom* button ,then input the option through keyboard if it is not in the right drop-down menu. Note: the options marked with red star must be filled correctly.

Currently supported platforms include:

RK3288、RK3326、RK3368、RK3399：Android 8.x or earlier

RV1108、RK1808、RK3288、RK3399、RK3326：Linux

The tool will use SensorName, LensName and MoudleName configured in Configuration module according to the naming rule of IQXML to search the file matching with SensorName_LensName or

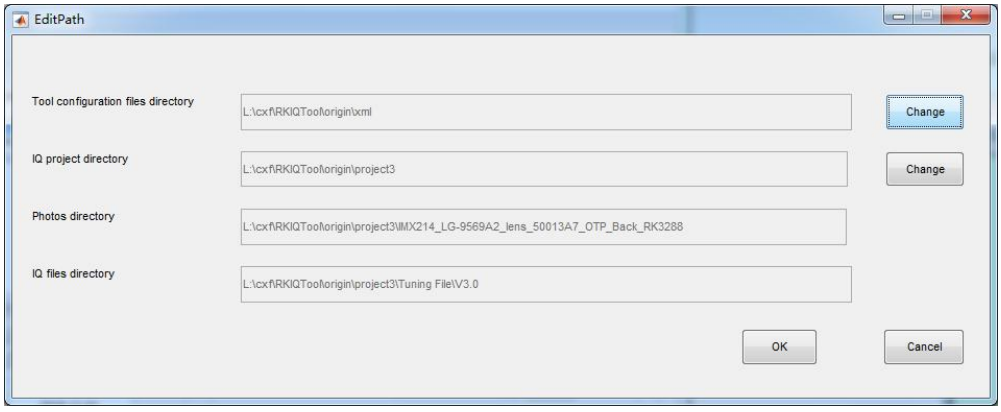
SensorName_ModuleName format in the device as the basic version for tuning.

Some content of the IQXML file generated based on the configuration is shown as below:

Picture 3- 2

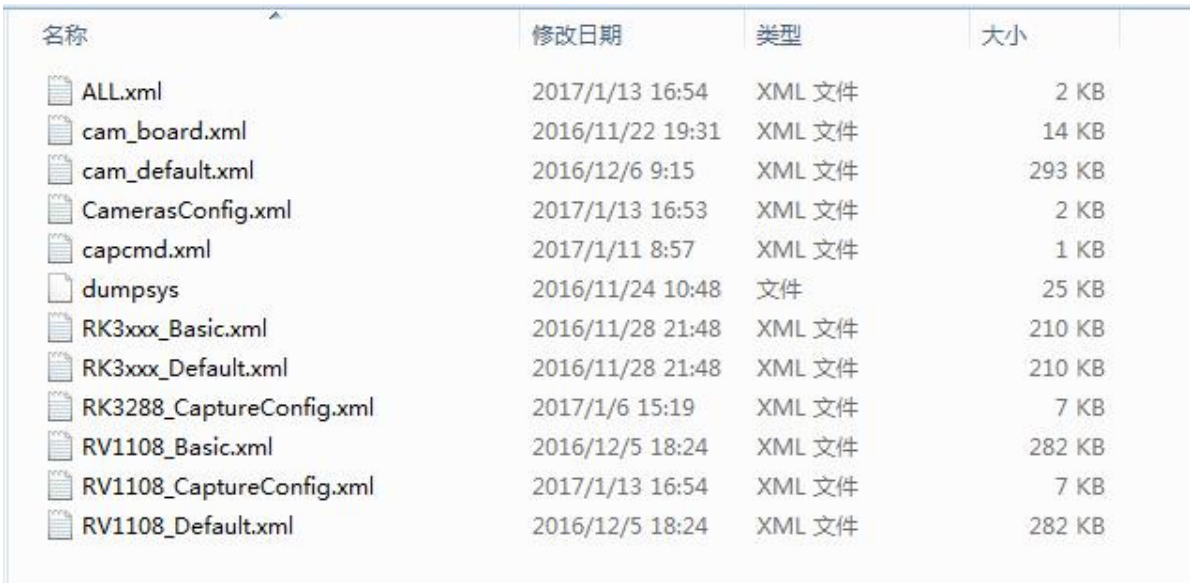
3.3 Configure Project Path

Click *Change file path* in Picture 3-1, and then below interface will pop up:



Picture 3- 3

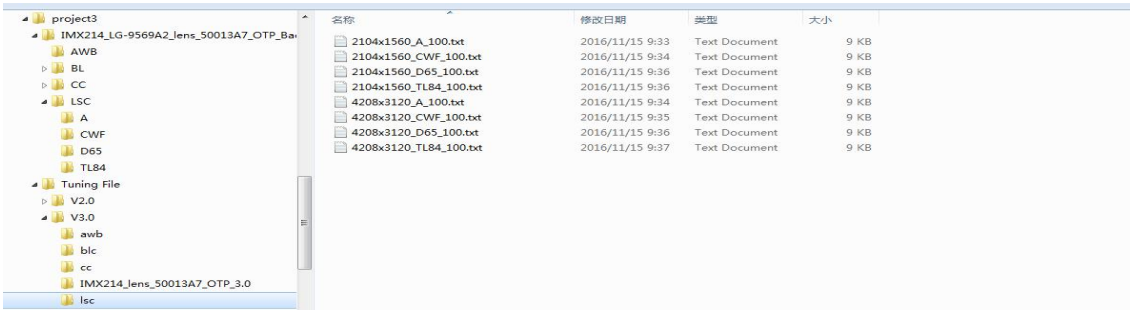
Tool configuration files directory means the configuration files required for tool running, including CamerasConfig.xml file recording camera information, CaptureConfig.xml file recording capture setting information, and so on. If the path is modified, these files should be in new path.



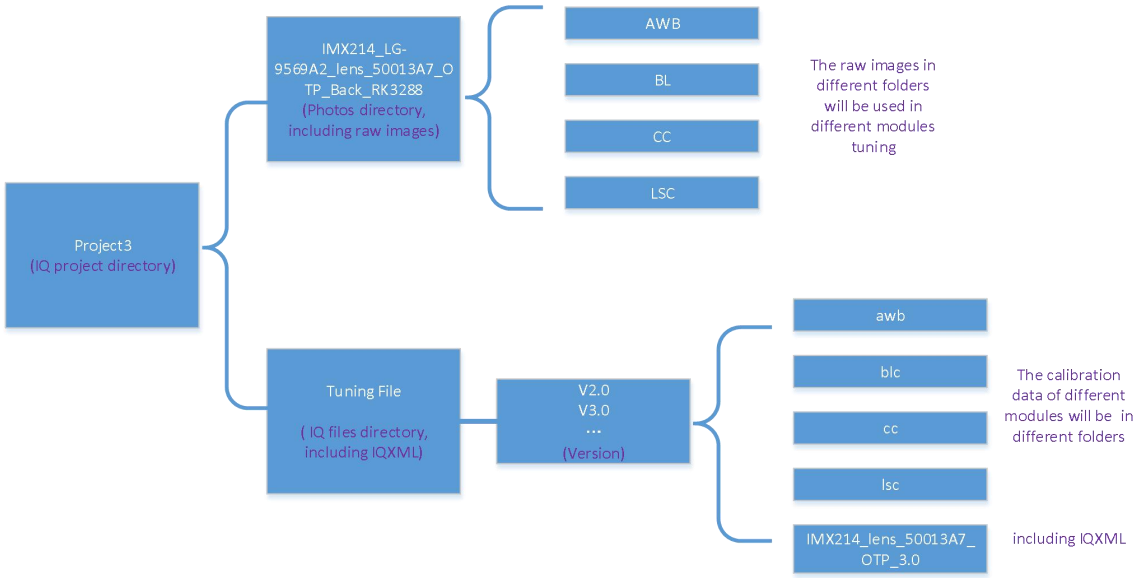
名称	修改日期	类型	大小
ALL.xml	2017/1/13 16:54	XML 文件	2 KB
cam_board.xml	2016/11/22 19:31	XML 文件	14 KB
cam_default.xml	2016/12/6 9:15	XML 文件	293 KB
CamerasConfig.xml	2017/1/13 16:53	XML 文件	2 KB
capcmd.xml	2017/1/11 8:57	XML 文件	1 KB
dumpsys	2016/11/24 10:48	文件	25 KB
RK3xxx_Basic.xml	2016/11/28 21:48	XML 文件	210 KB
RK3xxx_Default.xml	2016/11/28 21:48	XML 文件	210 KB
RK3288_CaptureConfig.xml	2017/1/6 15:19	XML 文件	7 KB
RV1108_Basic.xml	2016/12/5 18:24	XML 文件	282 KB
RV1108_CaptureConfig.xml	2017/1/13 16:54	XML 文件	7 KB
RV1108_Default.xml	2016/12/5 18:24	XML 文件	282 KB

Picture 3- 4

IQ project directory means the project route which can be specified by clicking *change* button. After IQ project directory is selected, Photos directory of capture tool and IQ files directory of tuning tool are also confirmed as shown below:



Picture 3- 5



Picture 3-6

4 Capture Tool

This section mainly describes the usage of auto capture software. You can refer to the raw pictures requirements of each module in section 5 first and then come back to this part for the detailed description. Please pay attention to below points for using capture tool:

1、**Choose the right platform,** each platform has different capture instruction, so it must be chosen correctly.

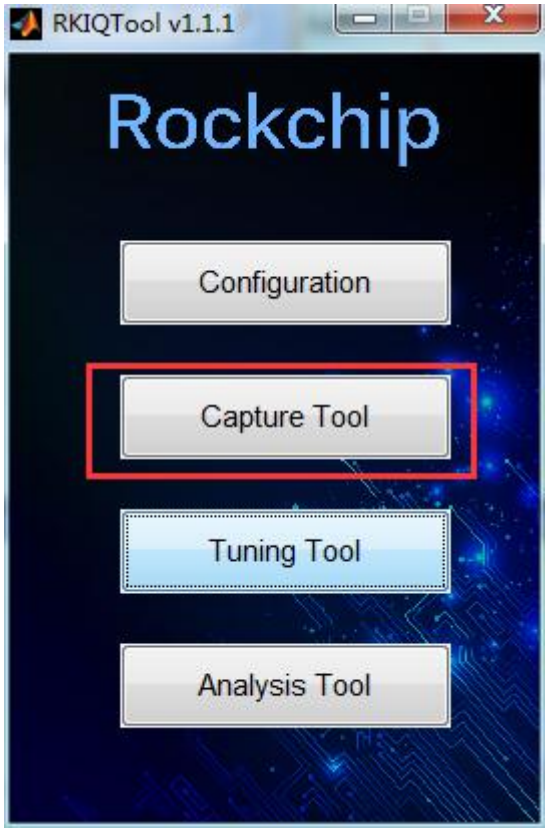
2、Choose the right **resolution**, otherwise capture raw picture will fail.

3、Please confirm the device is connected with PC before entering Capture Tool, and **confirm ADB connection is normal**.

4、**The camera must be opened** when using capture tool on RK3288/RK3368/RK3399 Android platforms.

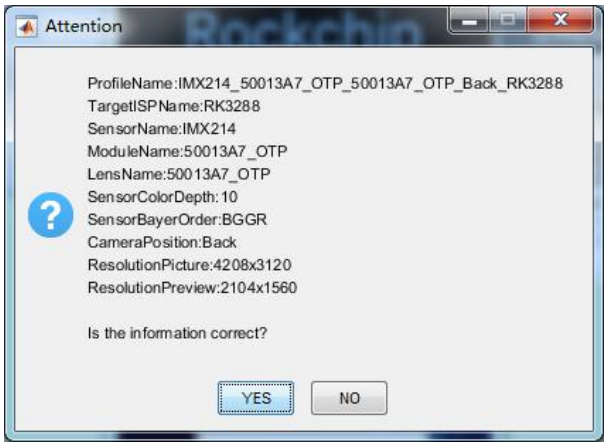
5、Currently RK1808 doesn't support to capture raw picture using auto exposure, and capture yuv picture.

4.1 Capture Tool Main Interface



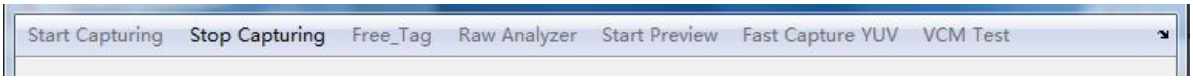
Picture 4- 1

Click *Capture Tool*, and it will pop up below interface:

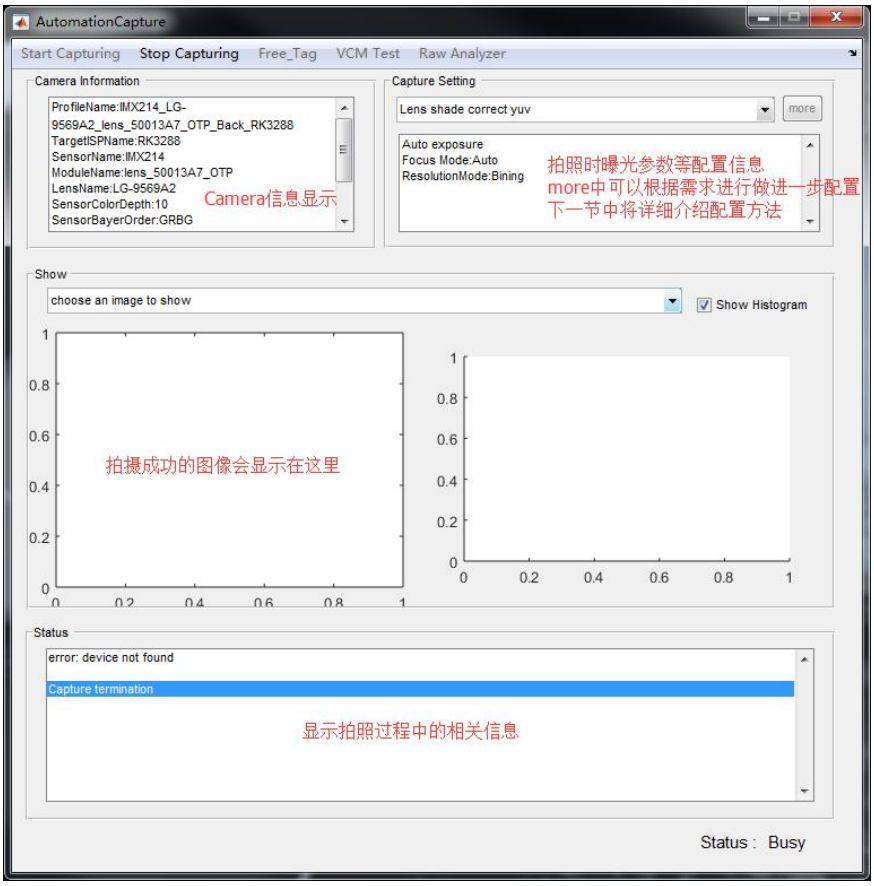


Picture 4- 2

Click *YES* after confirm the information is correct, and then it will pop up capture main interface. The detailed description of main interface is as below:

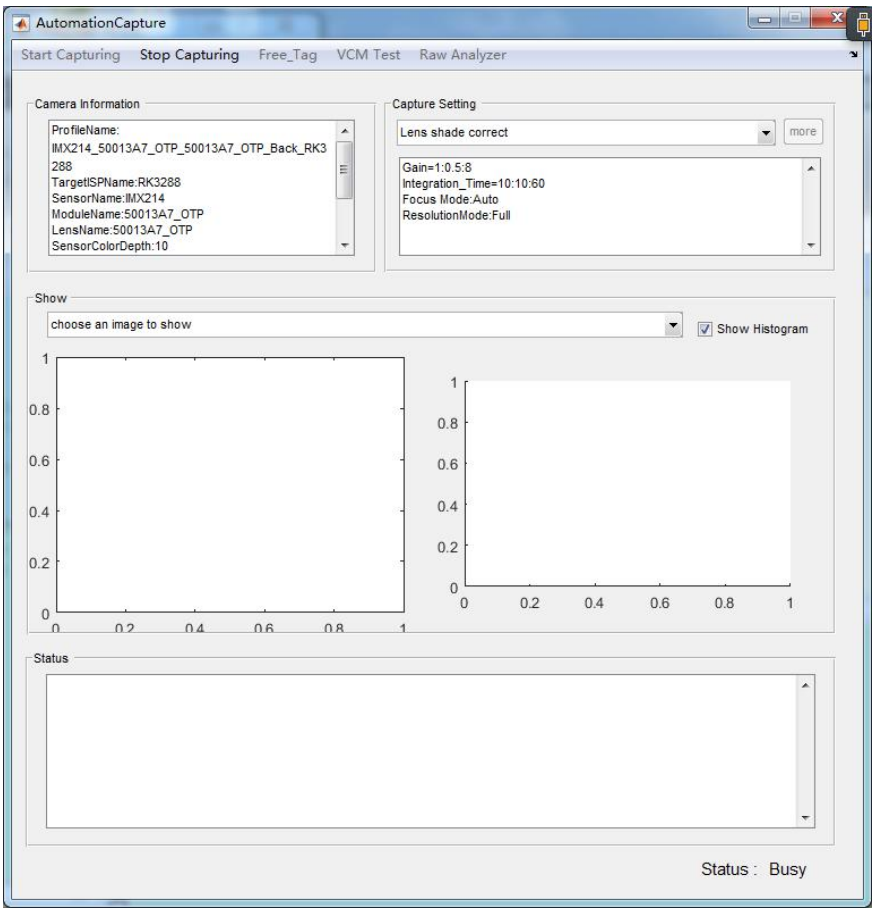


From left to right, they are Start Capturing, Stop Capturing (there is latency), add tag to picture name (such as lux of capture environment), Raw picture analyzer, Start PC Preview (only support for UVC of RV1XXX) and Fast Capture YUV data of ISP (only support for new version of RV1XXX).



Picture 4- 3

Then click *Start Capturing*, and it will show below interface:



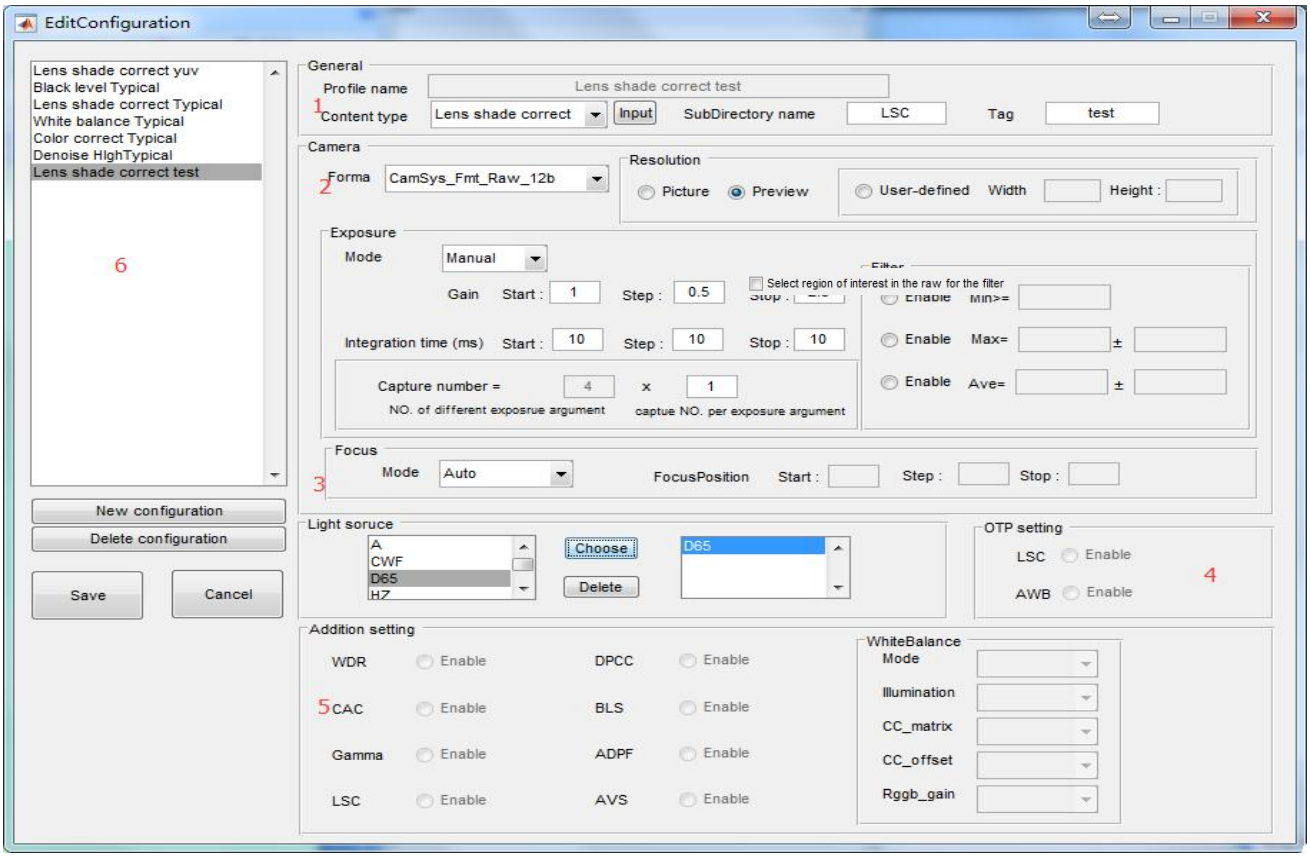
Picture 4- 4

Click *Stop Capturing* if need to stop during capturing.

Click the drop-down menu of *Capture setting* to select the capture task before capturing. Click *more* you can configure more capture tasks.

4.2 Edit configuration interface

Click *more* in main interface will pop up below interface:



Picture 4- 5

There are 6 parts in the interface, including *General*, *Camera, Light source, OTP setting, Addition setting,* and Configuration list. And They are marked with number 1~6 on the Picture 4- 5.

(1) *General*

Content type is the name of module. There are options including Lens shade correct, White balance, Color correct, Black level, Denoise, or you can also click *input* to add.

After Content type is selected, the abbreviation of the module name will be displayed in the corresponding txt box of *SubDirectoryname*. The captured raw pictures under this configuration will be saved in the folder named *SubDirectoryname*.

The corresponding txt box of *Tag* is used to add label for this configuration's name.

Content type and tag constitute the configuration name, which is updated and displayed in the corresponding txt box of *Profile name*. And it will also be updated and displayed in module 6 as shown in Picture 4-5.

（2）*Camera*

Capture information configuration includes exposure, focus, resolution, capture quantity, and capture image requirements.

Format is the captured image format, and there are two options, to capture raw picture or yuv picture.

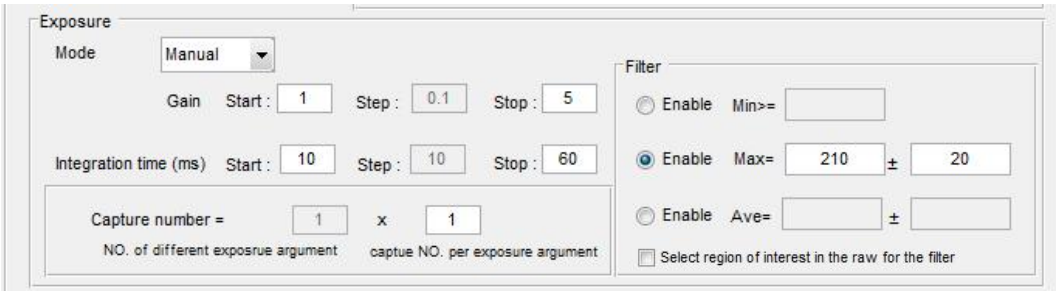
Resolution is to set the resolution for capture image, support to capture binning or full, and also support self-defined input resolution , which will be captured successfully only when driver supports the resolution.

Exposure is used to set the exposure parameter required by capturing image, when *Mode* is A*uto*, exposure parameter is controlled by AE algorithm of ISP, and the average brightness is determined by setpoint value in IQXML. When it is *Manual* mode, exposure parameter is determined by the interface setting gain and time. Recommend to set time as integral multiple 10ms in order to avoid flicker.

When *Mode* is selected as *Manual*, the gain of exposure parameter of the captured image is smaller than the value of gain stop but bigger than value of gain start, and the time of exposure parameter is smaller than the value of time stop but bigger than the value of time start. Need to pay attention to that the set biggest gain and time should be supported by driver. If time is increasing, but the time1 of the captured picture's name is not increasing, then time1 is the biggest time supported by driver. The biggest gain can be confirmed in the same way.

Filter is used to quickly capture the picture with the appropriate brightness. When *Min* is *enabled*, the minimum pixel of the captured picture can be bigger than the value in the textbox behind Min. When *Max* is *enabled*, the maximum pixel of the captured picture is approximate to the value in the textbox behind Max. When *Ave* is *enabled*, the average pixel of the captured picture is approximate to the value in the textbox behind Ave. If it is able to get the image with target brightness or not relates to the scenario brightness and camera exposure range limitation. Note: Min generally is not used alone. When the configuration gain and time max value is equal to the max value supported by driver, Filter mode can be quicker to capture the pictures with appropriate brightness.

Configure as below will capture one picture with the max brightness among 200±20. Firstly it will capture one picture which gain and time are 1, 10ms, and then compare the max pixel of current image with the max value of the configuration to calculate the new exposure parameter for next capture, until capture the image with appropriate brightness.



Picture 4- 6

When the button of *Select region of interest in the raw for the filter* is selected, you can specify some area of image to do the statistics of image average value and max value. When use wide angle lens to capture raw pictures, usually uninterested part will be captured, such as over-exposed light box wall, and you can get the image with appropriate brightness by specifying the interested image area.

Capture number specifies the capture quantity, the first textbox specifies the time gain group number, and the second textbox specifies the capture quantity for each time gain group. When Max or Ave of Filter is enabled as Picture 4-7, the captured time gain group number can only be 1, otherwise the time gain group number can be self-defined.

As the configuration in Picture 4-5, it will capture 4 raw pictures, each group of gain and time capture 1 raw picture, there are total 4 groups of exposure parameters, respectively (gain, time) : (1,10),

(1.5,10), (2,10), (2.5,10).

Focus is used to configure the motor position for capturing, but whether it is effective depends on if the module supports to set the motor position. When focus *mode* is selected as *auto*, the camera will focus automatically. When focus *mode* is selected as *Manual*, the device will focus according to the configured parameter. Generally it is *auto* mode when capture raw pictures for tuning.

（3）*Light source*

The available light sources are:

```
<LightSourceS>
  <LightSource CT="" name="A"/>
  <LightSource CT="" name="CWF"/>
  <LightSource CT="" name="D65"/>
  <LightSource CT="" name="HZ"/>
  <LightSource CT="" name="TL84"/>
</LightSourceS>
```

You can add light source name such as D75, D50, etc. in *ALL.xml* file.

Picture 4- 7

Click *choose* can add the selected light source in the left box to the right box.

Click *delete* can delete the selected light source in the right box. The light source finally displayed in the right box is the light source used for capturing.

（4）*OTP setting*

Set to use the data in One Time Programmable (OTP) or OTP for lens shading correction（LSC） or white balance(AWB). For the module has OTP, when capture raw picture, LSC OTP should be enabled, and AWB must ensure the typical value of sensor driver is equal to current module.

（5）*Addition setting*

This module is used only when *Format* is selected as *yuv*.

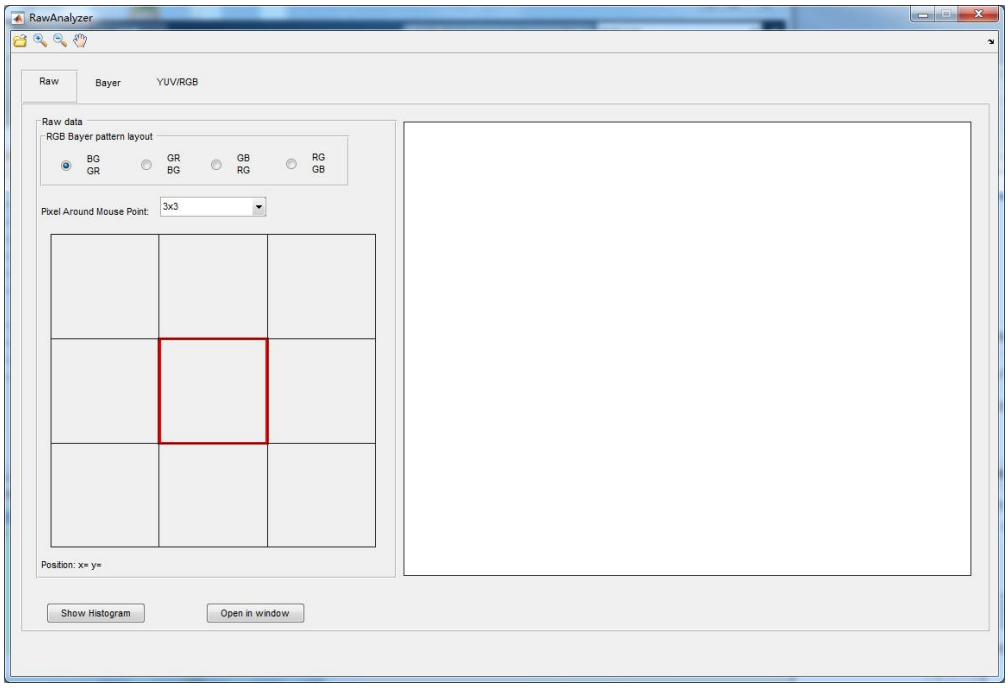
Configure AWB mode, and to support to run the modules such as LSC, gamma, BLC and so on.

（6）Configuration list

Clicking the configuration names , the configuration information will be updating. The setting with typical suffix is the recommended capture setting of each module.

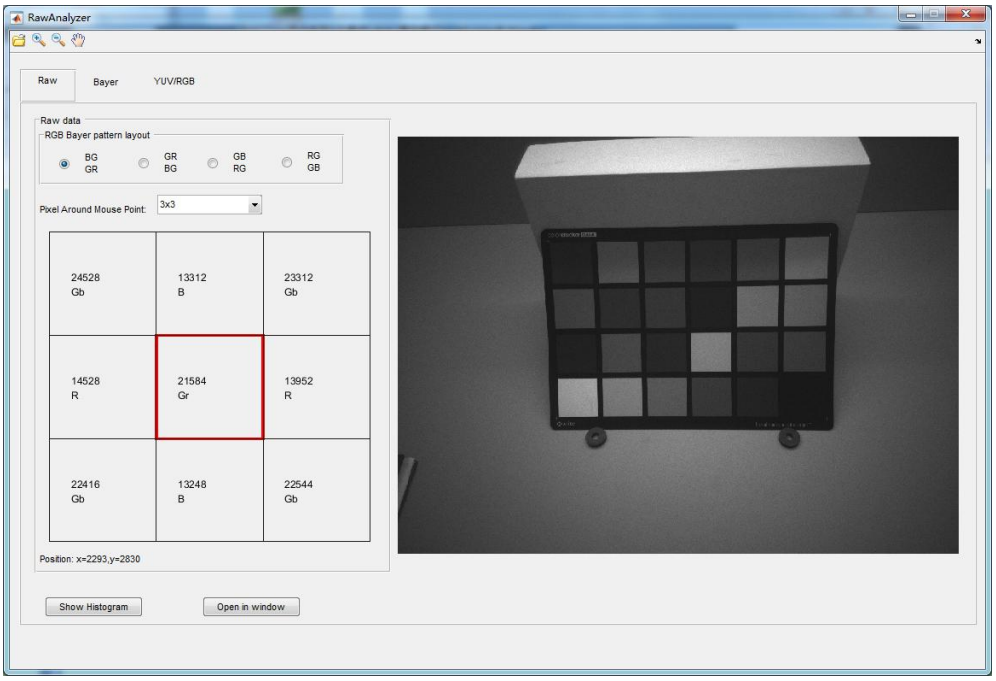
4.3 Raw analyzer

Click *Raw Analyzer* in the menu, and it will pop up below interface:



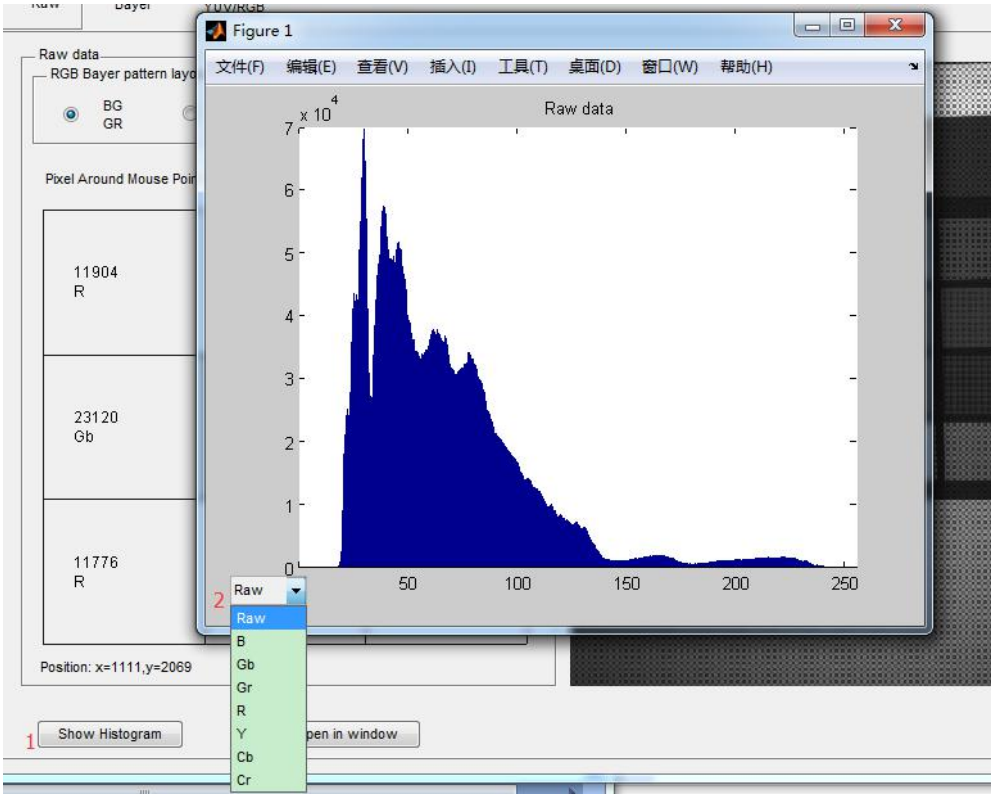
Picture 4- 8

Click *load image* icon to load the picture, and then move the mouse can get the pixel value in the neighborhood of 3x3, 5x5, 7x7, 9x9 as shown below:



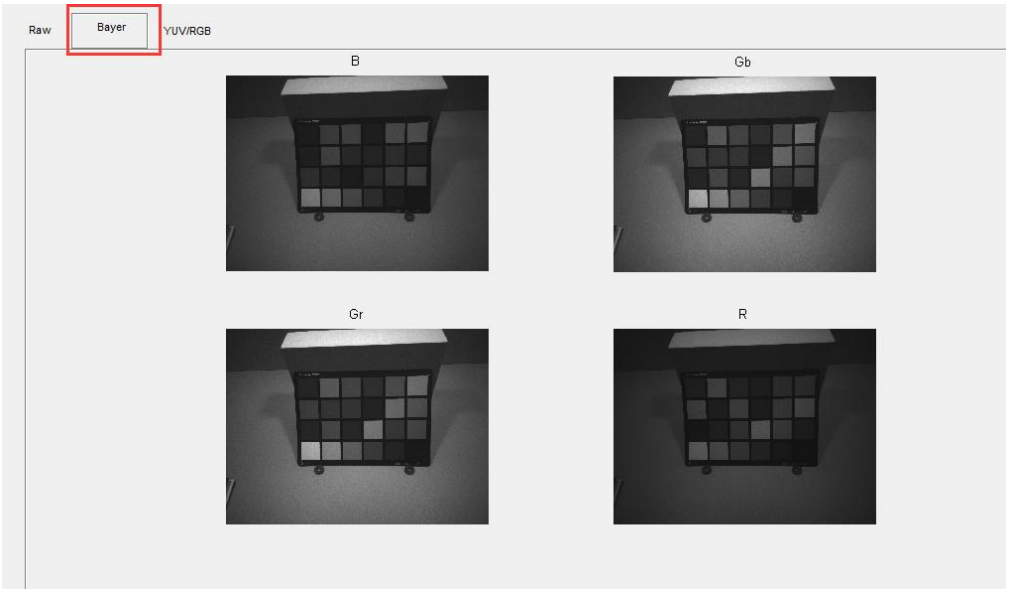
Picture 4- 9

Click *show histogram* can display the histogram of the different channels as shown below:



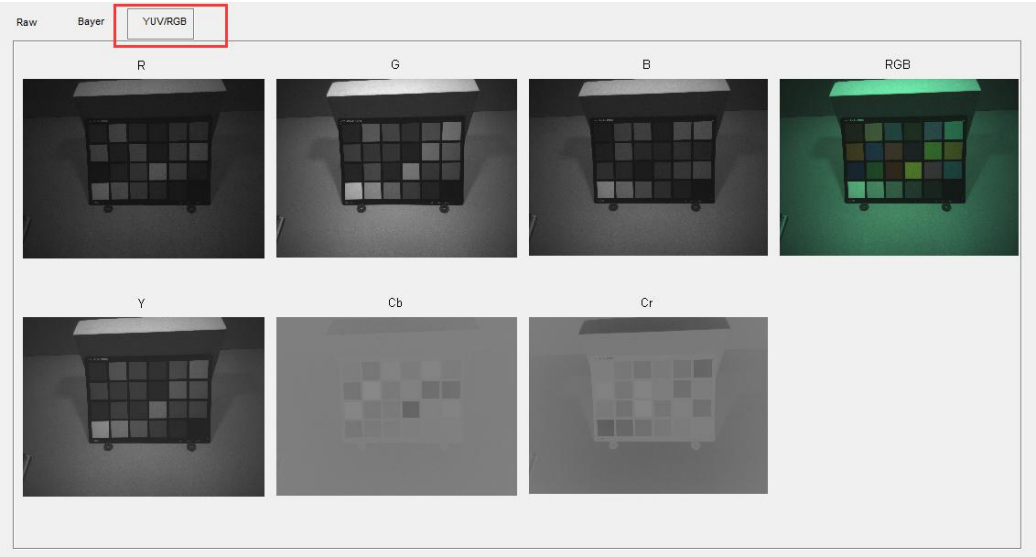
Picture 4- 10

Click *bayer* can display the pictures of four channels as shown below:



Picture 4- 11

Click *YUV/RGB* will display Y, Cb, Cr, R,G, B, RGB pictures as shown below:

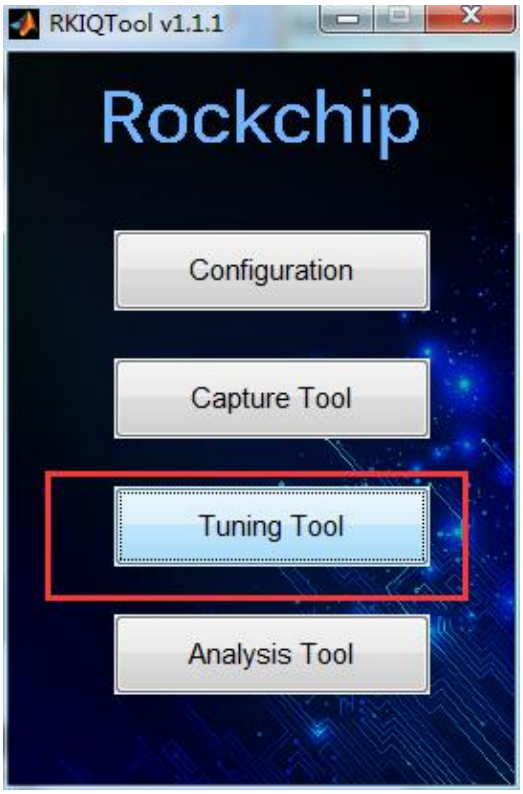


Picture 4- 12

4.4 The method to capture raw on RK1808

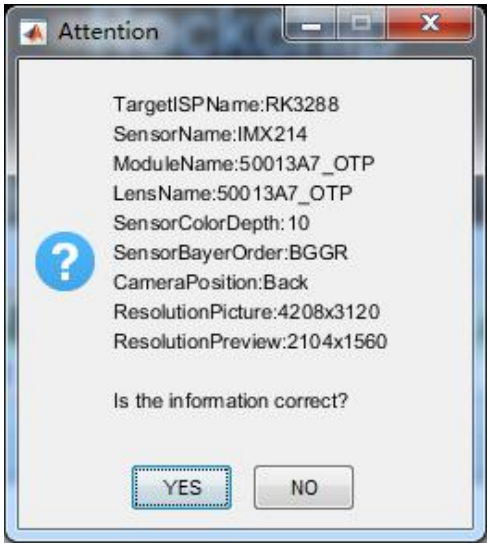
Currently the tool cannot accurately acquire the coefficient of the formula which is used to convert sensor exposure and gain to registers on RK1808. So it requires users to manually modify rawCapture.sh script in xml folder. There is detailed description about how to configure the exposure conversion format in the script.

5 Tuning Tool



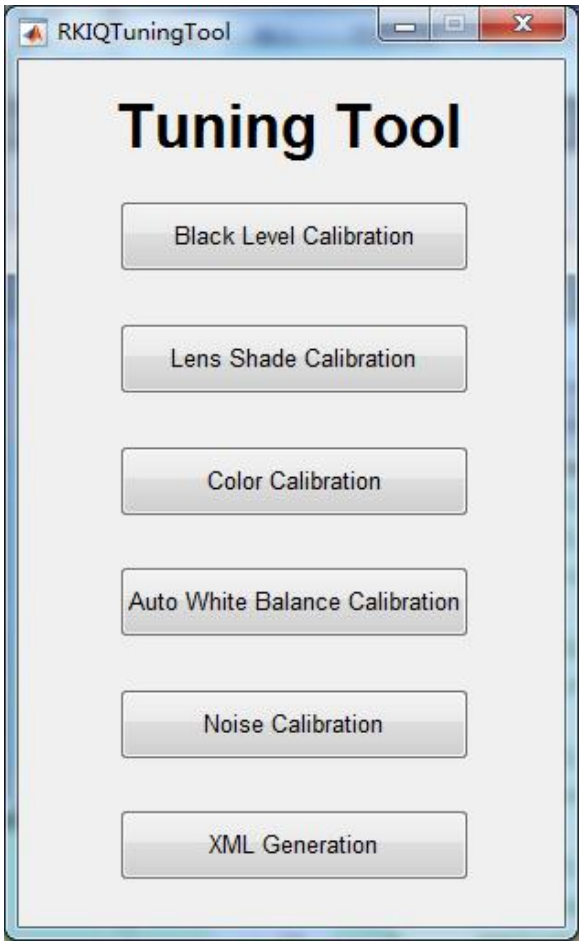
Picture 5- 1

Click *Tuning Tool* , the dialog box shows:



Picture 5- 2

Click *YES* if the information is correct, and sub interface will pop up. The tuning order is the same as the order on the interface, from *Black Level Calibration* to *XML Generation.*



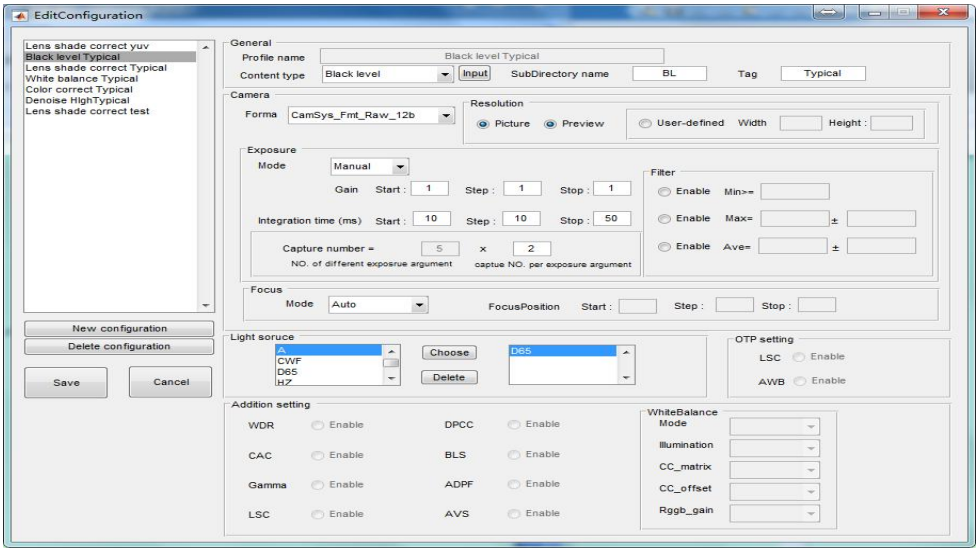
Picture 5- 3

5.1 Black Level Calibration

5.1.1 Capture pictures

（1）Use black box to cover sensor completely to avoid from the light.

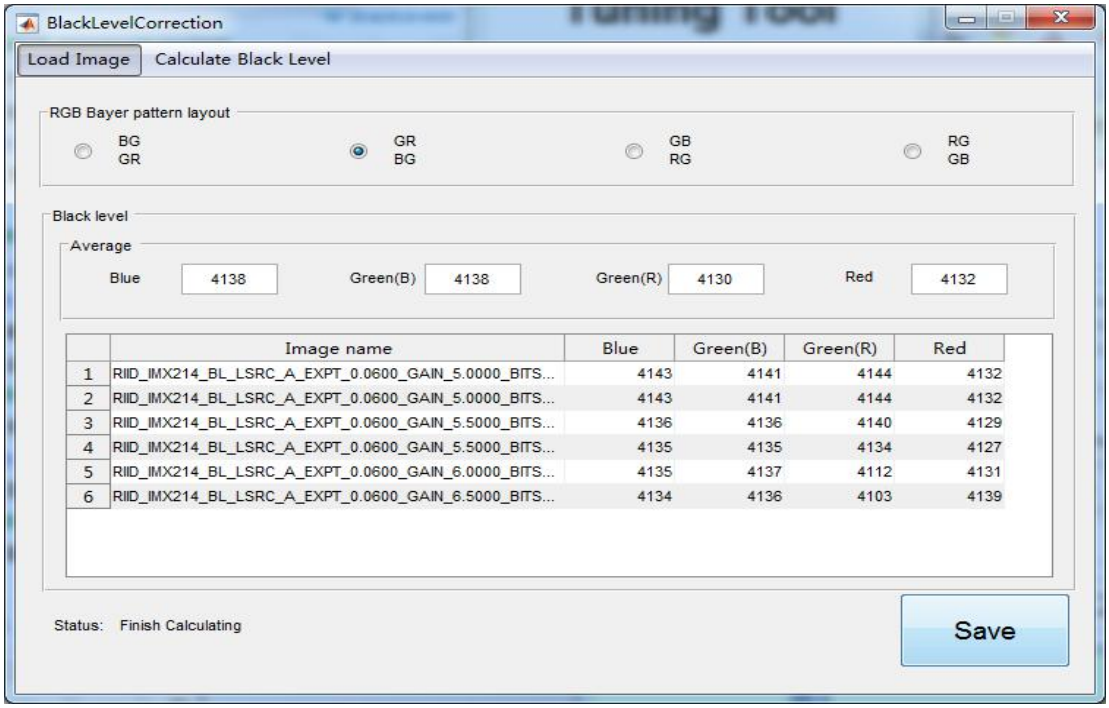
（2）Use Capture tool to capture. Capture configuration is Black Level Typical, as shown in Picture 5-4, capture 5 exposure groups of raw picture, each group captures two pictures.



Picture 5- 4

5.1.2 Calibration

Click *Black level Calibration* in the main interface and the interface of *BlackLevelCalibration* is shown as fellow:



Picture 5- 5

Click *Load Image* to load raw pictures.

Click *Calculate Black Level* to calculate BLC parameters.

Click *Save* to save the parameters.

5.2 Lens Shade Calibration

5.2.1 Capture pictures

（1）Equipment requirement

Light box (as shown below, SpectralightIII standard light box)

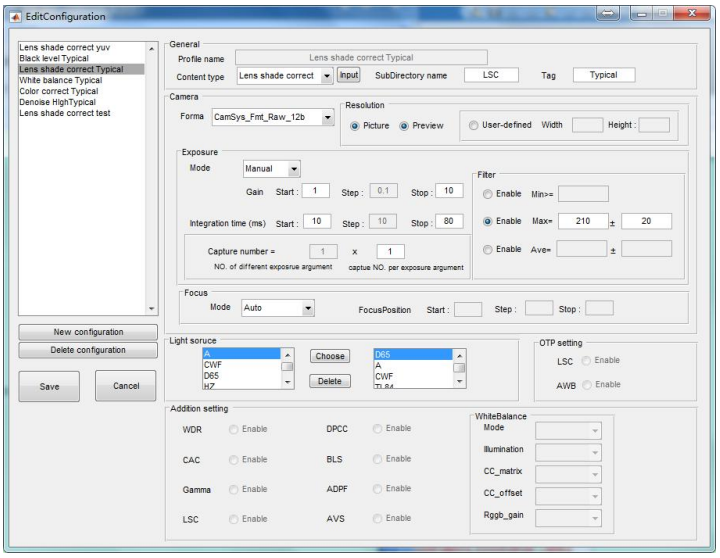
Picture 5- 6

Diffuser: white glass filter, one side is transparent, and the other is white coated.

Picture 5- 7

（2）Capture requirement

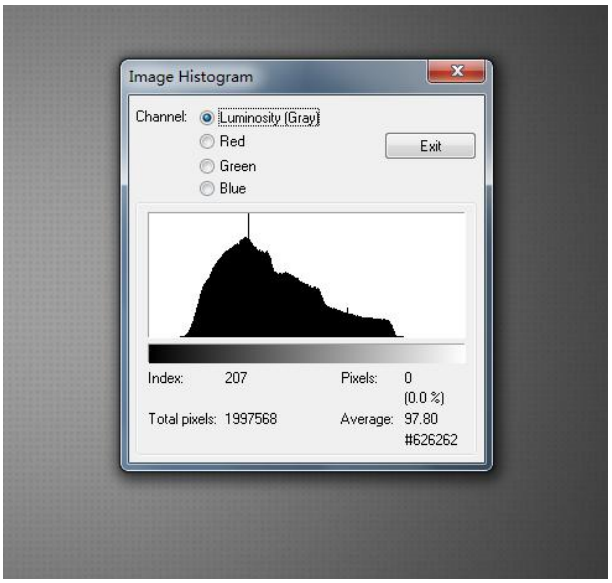
Use *Capture tool*, the recommend capture setting is *Lens shade correct Typical* to acquire the picture with appropriate brightness, as shown in Picture 5-8. Or disable *Max enable* to capture multiple pictures, then manually choose the picture with appropriate brightness. Need to capture under A, D65, TL84 (f11), and CWF (f2) four light sources, with preview and capture two resolutions. When capturing pictures, camera should face to the light source, and covered by diffuser (white coated side faces to camera).



Picture 5- 8

5.2.2 Select pictures

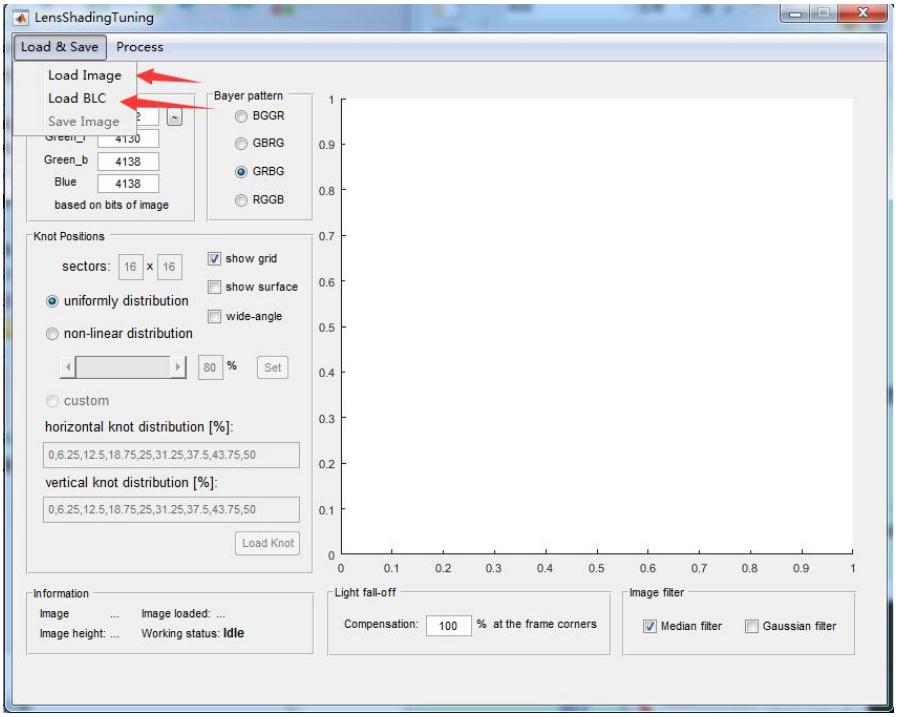
View the histogram of pictures, then select picture with the max brightness value near 210. The picture captured as Picture 5-9 meets the requirement. Each light source under each resolution only needs one appropriate raw picture. (The histogram shown in the picture is using Irfanview software which can be downloaded from internet. *Average* means the average value of image. *Index* means the luminance. *Pixels* means the pixel number of the current *Index*. Move the mouse on the histogram, then you can see the change of *Index* and *pixels*. *Index* at the right-most where *Pixels* is not 0 is the max brightness value of image.)



Picture 5- 9

5.2.3 calibration

Click *Lens Shading Calibration* in the main interface to enter sub interface:



Picture 5- 10

(1) Load raw picture and BLC parameter as marked by red arrow in above picture. BLC parameters will automatically update if black level value is calibrated, or you can manually fill in the box.

(2) *Bayer Pattern* will automatically update according to the setting of *Configuration* module.

(3) Select *uniformly distribution*, the sampling points in the raw image will distribute uniformly.

(4) Select *Process – Start* in the menu to start to calibrate LSC parameters.

After calculation, dialog box will be shown as fellow:

Picture 5- 11

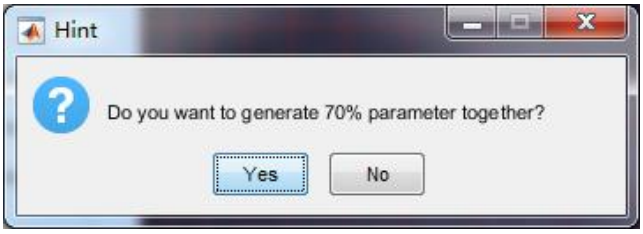
If the image is captured by *Capture Tool*, it'll automatically acquire the light source name from the image's name, e.g. if raw image's name is RIID_IMX214_LSC_LSRC_A_EXPT_0.0100_GAIN_3.5000_BITS_16_FMT_BGGR_SIZE_2104x1560_20160930_094206_num_0001.pgm , tool will know that picture was captured under A light source. Otherwise users should fill the light source name in the pop-up dialog box as Picture5-11. The light source name will be used to name the LSC parameter file(The light source name should use uppercase letters. Use TL84 and CWF instead of F11 and F2).

Picture 5- 12

The file's naming rule is resolution_compensation， and it is named automatically. *Compensation* corresponds to the value to compensate *Light fall-off* of lens.

(5) Select *Process –Apply* to check the image calibrated by LSC parameters.

(6) Set *Light fall-off* parameter to 70%, do step 4 again. If select *Yes* in Picture 5-13 during the previous step 4, this step can be skipped.



Picture 5- 13

By now, LSC parameter of Compensation 70 and 100 for one light source of one resolution is finished.

Note:

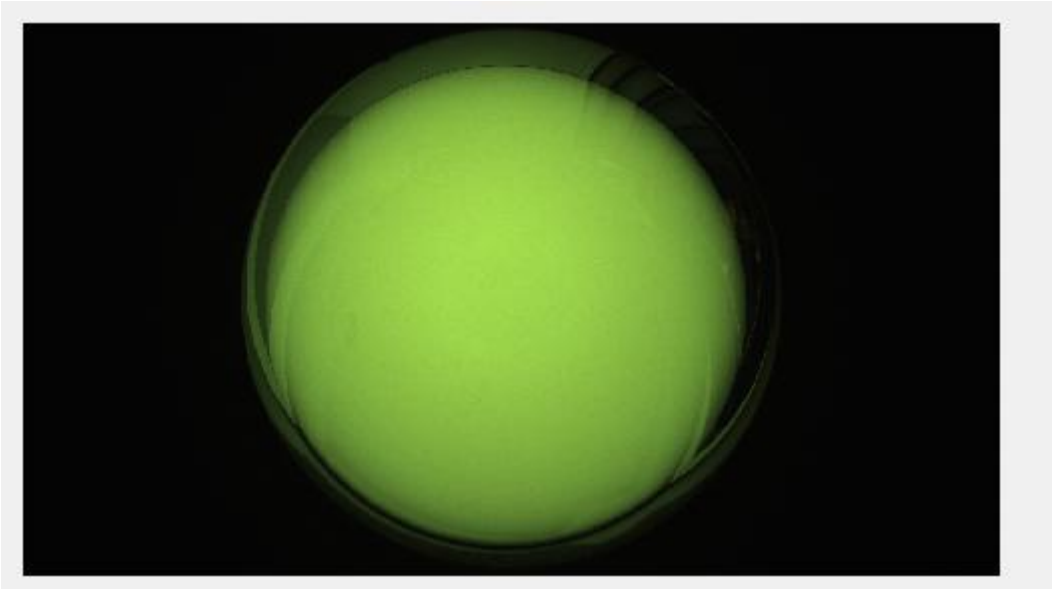
（1）Each light source of each resolution needs to calibrate LSC parameter of Compensation 70 and 100.

（2）Besides *uniformly distribution* option (recommended option), the sampling points mode can also be *non-linear* distribution mode. Adjust by moving the slider, and click *set* button to make it effective.

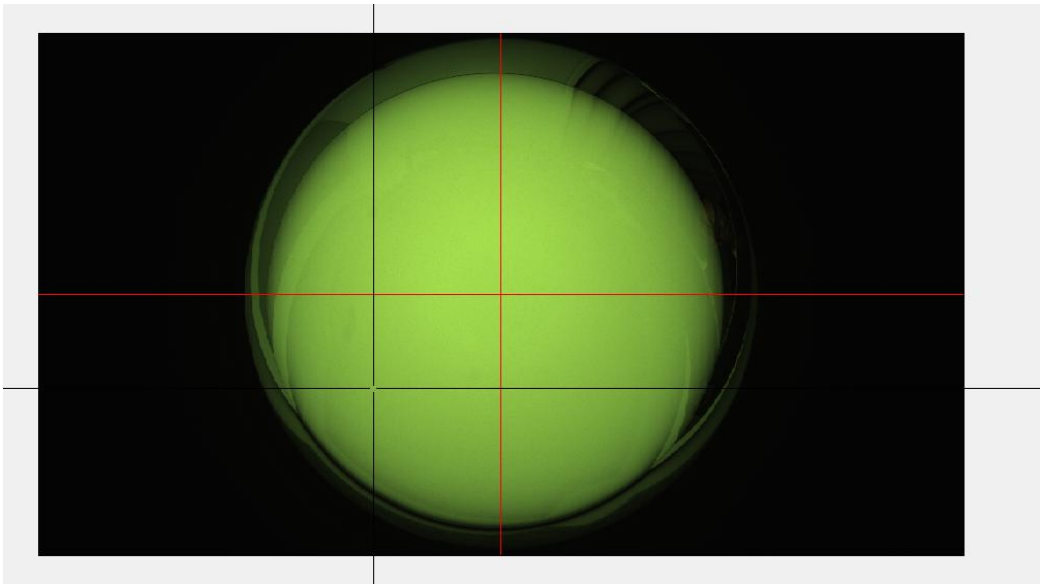
（3）The option of show grid is display/hide sampling auxiliary line, which does not affect the calculation result.

（4） The option of *show surface* is used to decide whether to show analysis result of LSC parameters , which does not affect the LSC parameters calibration.

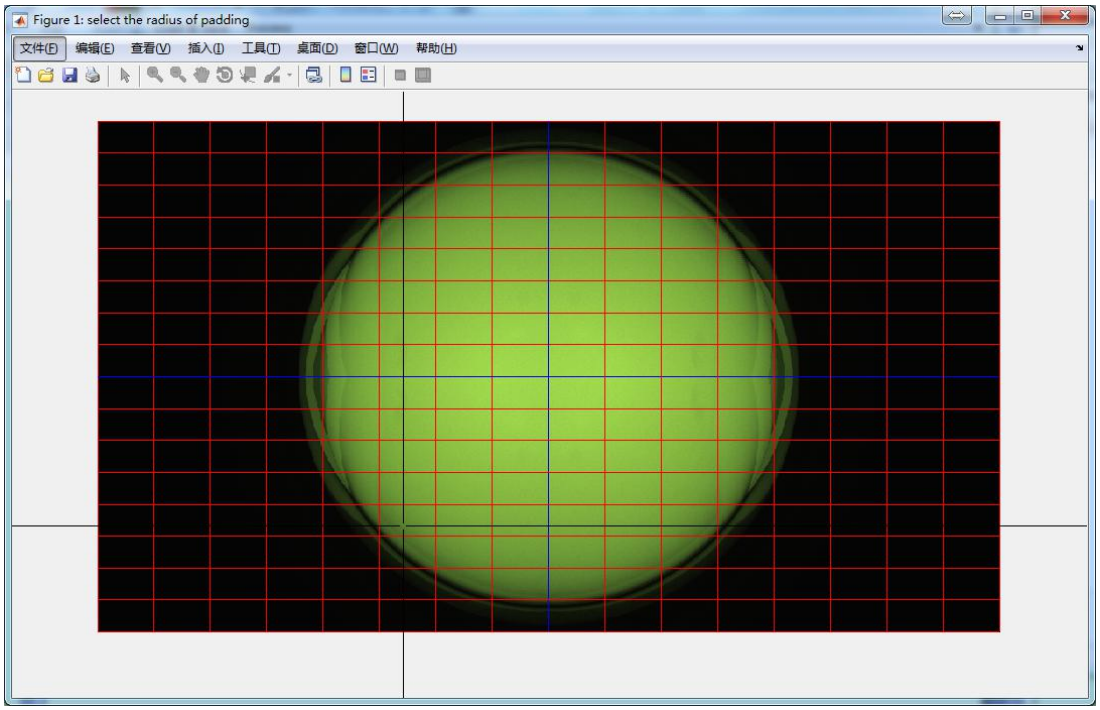
（5）The option of *wide-angle* is designed for the lens with large FOV (field of view). The lens with large FOV is very difficult to be covered by diffuser completely, as shown in Picture 5-14, the upper left corner is not covered. However it's better to find other method to solve the completely covered sensor problem than use this function. When *wide-angle* mode is selected, after clicking *start*, an completely covered area should be selected and then it will copy symmetrically to generate an image completely covered by diffuser. As shown in Picture 5-15, the lower left corner is selected, and the image filled symmetrically according to the selected area is shown as Picture 5-16. Click on Picture 5-16 to confirm the max radius of image used to generate lens shading parameter.



Picture 5- 14



Picture 5- 15



Picture 5- 16

5.3 Color Calibration

5.3.1 Capture picture

5.3.1.1 Equipment requirement

Light box, color chart, Eye-one (optional). Color chart can be x-rite standard 24 color chart or 140 color chart.

Picture 5- 17 Color chart

Eye-one is used to measure the color block of standard color chart line by line and data will be saved in SG_chart.cxf. The data can be used for next tuning, and no need to re-measure. If there is no Eye-one, the tool will use the default standard color chart measurement which has a little difference with the real color chart but doesn't affect tuning process.

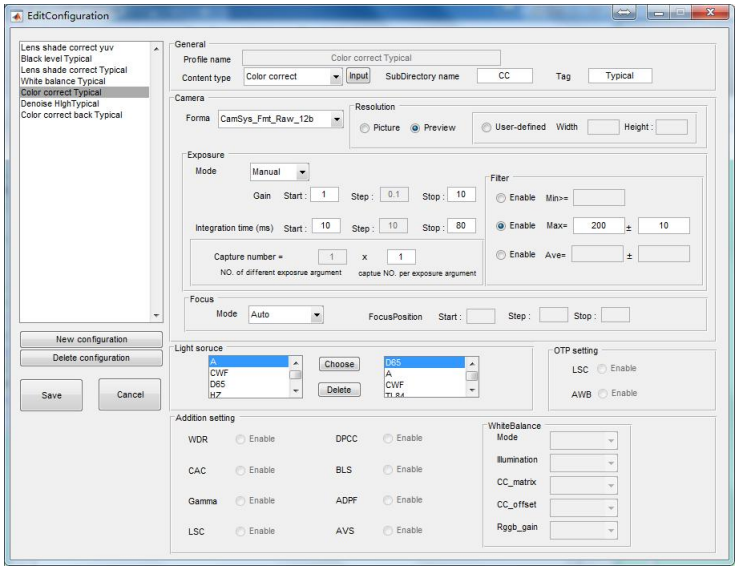
Picture 5- 18 Eye-one

5.3.1.2 Capture requirement

(1) Repeat step (2), (3), (4) to capture picture under the light source A, D65, TL84(f11), CWF(f2). Recommend to capture the image with preview resolution .

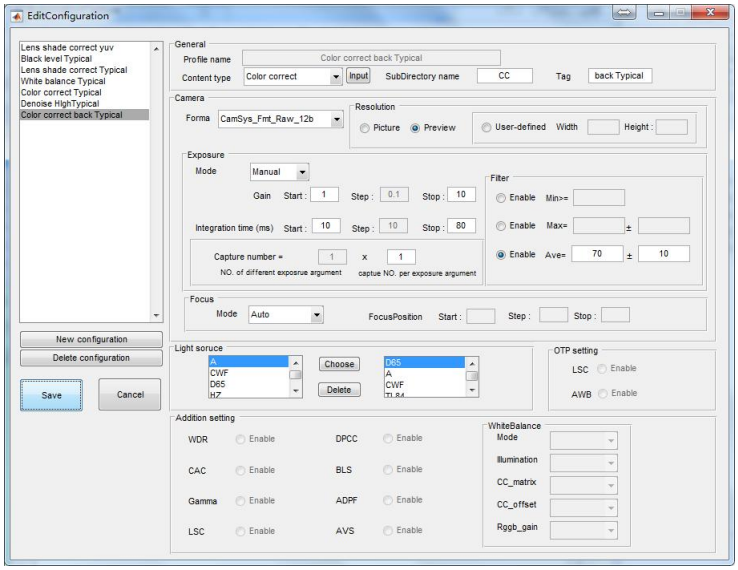
(2) The color chart should be directly illuminated by the light source .Camera will capture at 45 degree angle, and the color chart should be in the center of the image as possible. For normal lens the proportion of color chart in the picture is about 1/2. For the distorted lens with large field of view, the proportion of the color chart can be reduced to 1/4, so as to improve the recognition rate of each color block in the color chart.

(3) After focus the color chart, capture RAW of color chart, use *Capture tool*, configure referring to *Color correct Typical* to acquire the picture with appropriate brightness, as shown in Picture 5-19, or not select *Max enable*, capture raw pictures with multiple groups of exposure parameter, and then manually select the picture with appropriate brightness.



Picture 5- 19

(4) Then remove the color chart, capture raw image of the background and don't move camera and tripod. Use *Capture tool*, configure referring to *Color correct back Typical* to acquire the image with appropriate brightness, as shown in Picture 5-20, or not select *Ave enable*, capture multiple pictures, and then manually select the picture with appropriate brightness.



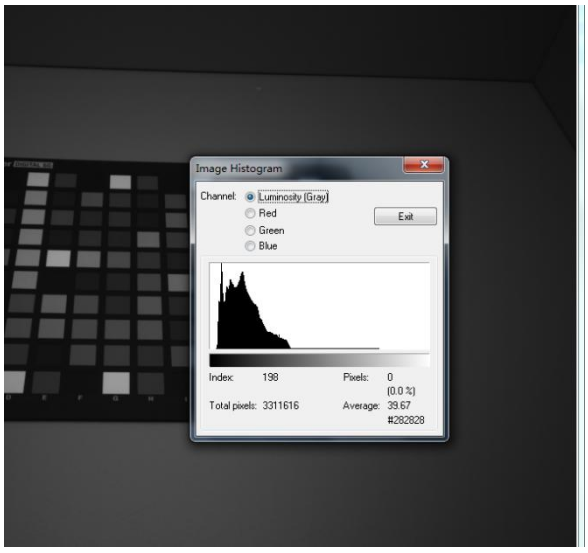
Picture 5- 20

5.3.2 Select picture

One light source needs a raw picture with color chart and appropriate brightness and a background raw picture without color chart.

The maximum brightness value of white block in the raw picture with color chart should be around 200, and the minimum brightness value of black block should be bigger than black level. The picture captured as Picture 5-21 is meet the requirement.

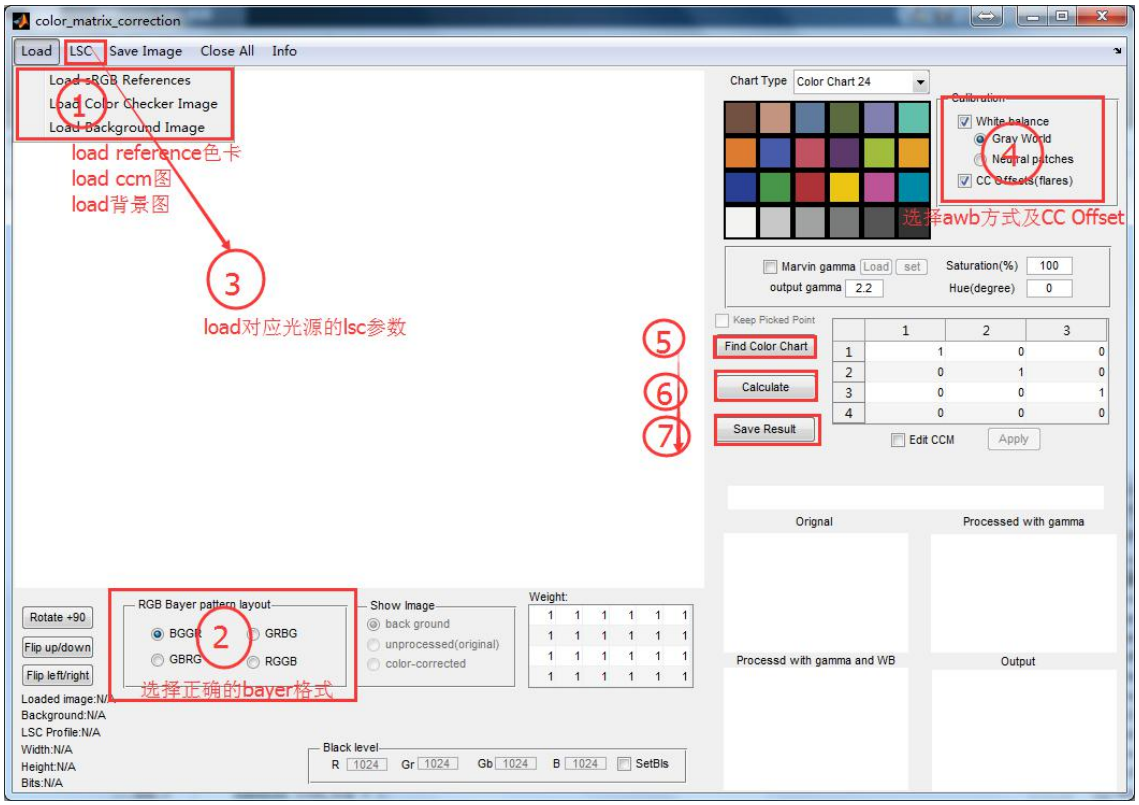
The average brightness value of background pictures without color chart is around 70



Picture 5- 21

5.3.3 calibration

Click *Color Calibration* in the main interface will enter below interface:



Picture 5- 22

(0)*Load sRGB References*

Click *Load sRGB References*, load sRGB value file of color chart (that is measured previous ,SG_chart.cxf). If not load, then use CIE sRGB value of standard color chart.

(1) *Load color checker Image*

Click *Load color checker Image* , load raw image with color chart.

(2) *Load background Image*

Click *Load background Image*, Load raw image of background.

(3) *RGB Bayer pattern*;

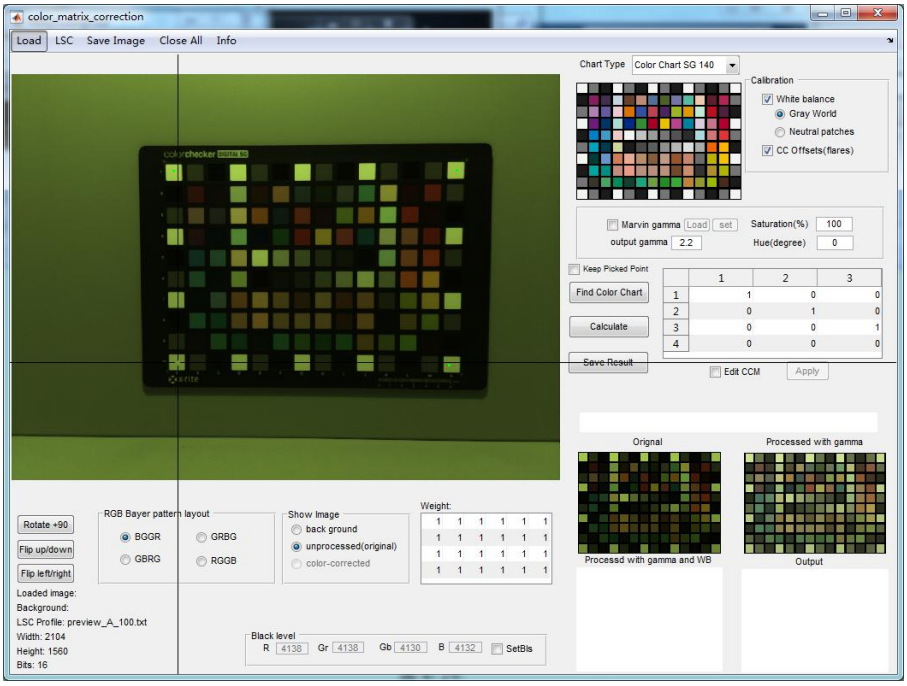
Bayer Pattern will automatically update according to the setting of *Configuration* module.

(4) *LSC*

Click *LSC-Apply LSC From .txt*, apply the LSC parameters with 100% compensation of the corresponding light source, which is generated in LSC module.

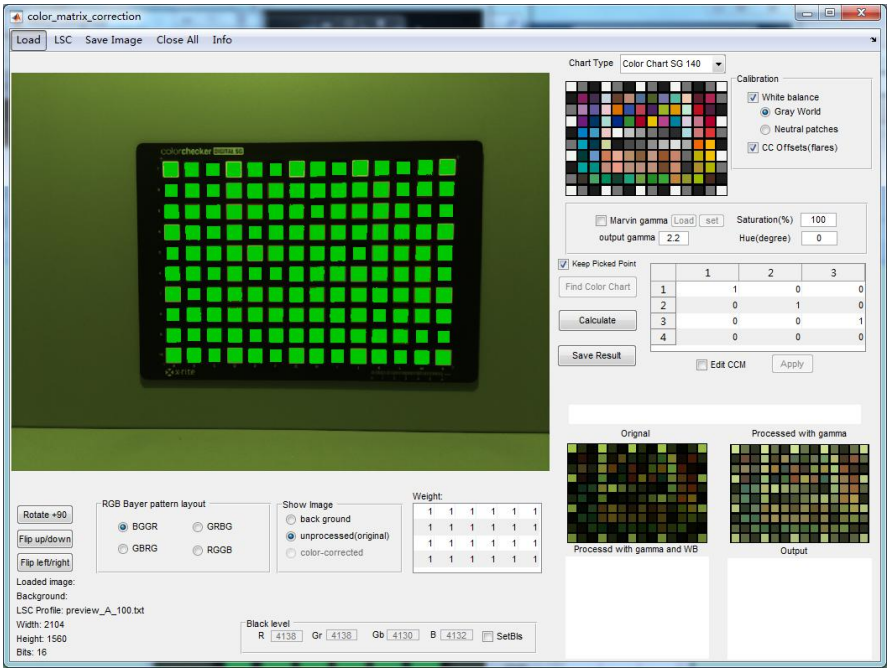
(5) *Find Color Chart*

Click *Find Color Chart*, select the center of the color block in the four corners of the color chart.



Picture 5- 23

Then the color blocks of the color chart are automatically recognized.

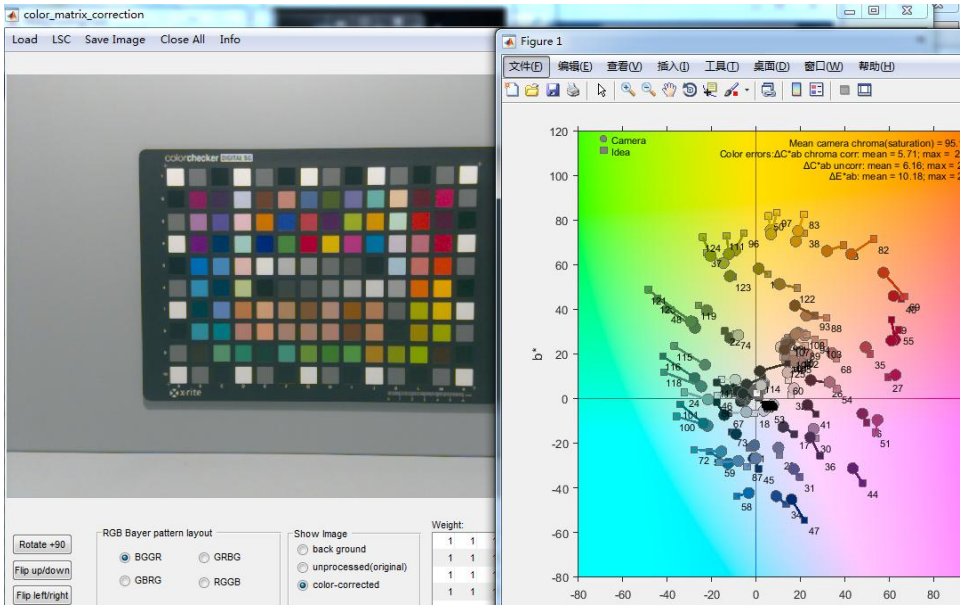


Picture 5- 24

(6)*Calculate*

Click *Calculate* to generate color correction matrix (CCM)parameter with 100% saturation.

Generate CCM parameter and display the color difference result. Need to ensure that the color difference in the report should be less than 7.



Picture 5- 25

(7)*Save Result*

Click *Save Result* to save the result in file, it will pop up below dialog box:

Picture 5- 26

If the image is captured by *Capture Tool*, it can automatically acquire the light source name from the image's name, e.g. if raw image's name is RIID_IMX214_CC_LSRC_A_EXPT_0.0100_GAIN_3.5000 _BITS_16_FMT_BGGR_SIZE_2104x1560_20160930_094206_num_0001.pgm , tool will acquire that it was captured under A light source. Otherwise users should fill the light source name in the pop-up dialog as Picture5-27. The light source name will be used to name the file saving LSC parameter(The light source name should use uppercase letters. Use TL84 and CWF instead of F11 and F2).

Picture 5- 27

(8) *Saturation*

Modify the saturation to 74%, it will automatically generate CCM parameter with 74% saturation.

(9) *Save Result*

Save result.

So far, CCM parameter calibration for one light source with saturation 74 and 100 is finished.

Notice:

（1）Each light source needs to calibrate two groups of parameters with saturation 74 and 100.

（2）If sRGB reference file of the actual color chart is not loaded, the program will use CIE standard value. The color difference with the sRGB value of the actual color chart is less than the standard value.

（3）If need to *rotate* the image, must apply *LSC* first and then *rotate*.

（4）Apply *LSC* has two options, and "*apply lsc based on background*" function is used only when the brightness of the background picture is very uneven.

（5）Manually modify black level requires to enable *setbls* checkbox first.

（6）After *Marvin gamma* checkbox is selected, "*output gamma*" function is closed, you can select gamma but it will influence the calculation result. This function is not stable currently, so not recommend to use for tuning gamma.

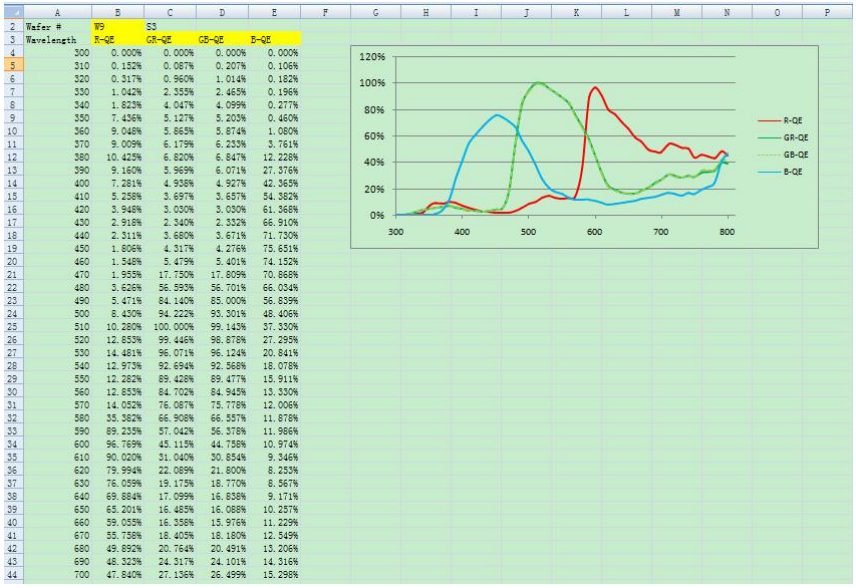
（7）*Calculate* can only calculate CCM parameter with100% saturation. After calculating the parameter with100% saturation, change saturation to 74 will automatically generate one group of parameter without requiring to click *Calculate* again.

（8)After "*Edit ccm*" checkbox is enabled, CCM parameter can be modified manually, and the effect of new parameter can be check after click *Apply*.

5.4 Auto White Balance Calibration

5.4.1 Generate sensor spectral sensitivities curve text file

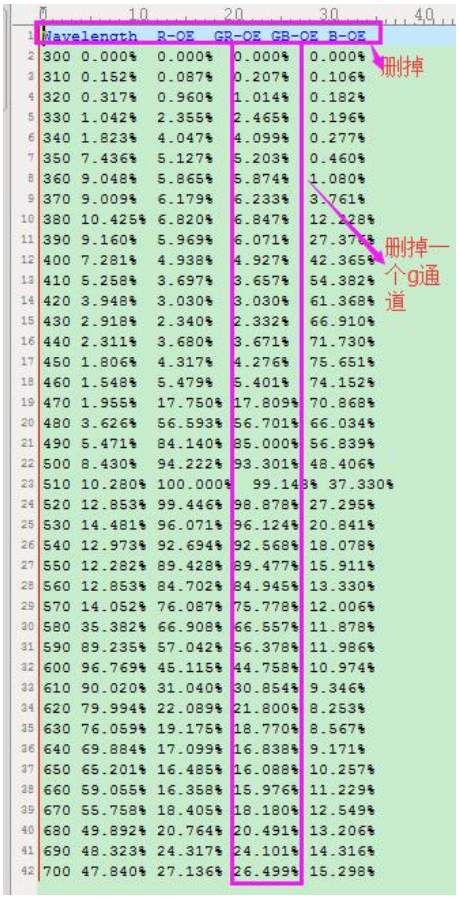
（1）Open the sensor spectral curve excel file of sensor (this file is provided by module vendor).



	A	B	C	D	E
2	Wafer #	W9	S3		
3	Wavelength	R-QE	GR-QE	GB-QE	B-QE
4	300	0.000%	0.000%	0.000%	0.000%
5	310	0.152%	0.087%	0.207%	0.106%
6	320	0.317%	0.960%	1.014%	0.182%
7	330	1.042%	2.355%	2.465%	0.196%
8	340	1.823%	4.047%	4.099%	0.277%
9	350	7.436%	5.127%	5.203%	0.460%
10	360	9.048%	5.865%	5.874%	1.080%
11	370	9.009%	6.179%	6.233%	3.761%
12	380	10.425%	6.820%	6.847%	12.228%
13	390	9.160%	5.969%	6.071%	27.376%
14	400	7.281%	4.938%	4.927%	42.365%
15	410	5.258%	3.697%	3.657%	54.382%
16	420	3.948%	3.030%	3.030%	61.368%
17	430	2.918%	2.340%	2.332%	66.910%
18	440	2.311%	3.680%	3.671%	71.730%
19	450	1.806%	4.317%	4.276%	75.651%
20	460	1.548%	5.479%	5.401%	74.152%
21	470	1.955%	17.750%	17.809%	70.868%
22	480	3.626%	56.593%	56.701%	66.034%
23	490	5.471%	84.140%	85.000%	56.839%
24	500	8.430%	94.222%	93.301%	48.406%
25	510	10.280%	100.000%	99.143%	37.330%
26	520	12.853%	99.446%	98.878%	27.295%
27	530	14.481%	96.071%	96.124%	20.841%
28	540	12.973%	92.694%	92.568%	18.078%
29	550	12.282%	89.428%	89.477%	15.911%
30	560	12.853%	84.702%	84.945%	13.330%
31	570	14.052%	76.087%	75.778%	12.006%
32	580	35.382%	66.908%	66.557%	11.878%
33	590	89.235%	57.042%	56.378%	11.986%
34	600	96.769%	45.115%	44.758%	10.974%
35	610	90.020%	31.040%	30.854%	9.346%
36	620	79.994%	22.089%	21.800%	8.253%
37	630	76.059%	19.175%	18.770%	8.567%
38	640	69.884%	17.099%	16.838%	9.171%
39	650	65.201%	16.485%	16.088%	10.257%
40	660	59.055%	16.356%	15.976%	11.229%
41	670	55.758%	18.405%	18.180%	12.549%
42	680	49.892%	20.764%	20.491%	13.206%
43	690	48.323%	24.317%	24.101%	14.316%
44	700	47.840%	27.136%	26.499%	15.298%

Picture 5- 28

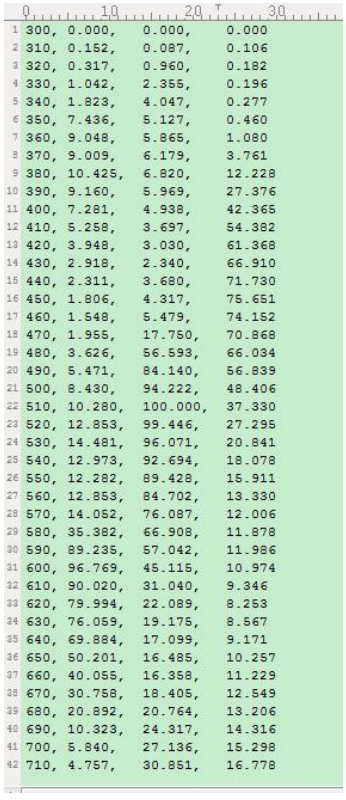
(2) Create txt file ovxxxx-spec.txt, and copy data in above picture to ovxxxx-spec.txt:



Wavelength	R-QE	GR-QE	GB-QE	B-QE
300	0.000%	0.000%	0.000%	0.000%
310	0.152%	0.087%	0.207%	0.106%
320	0.317%	0.960%	1.014%	0.182%
330	1.042%	2.355%	2.465%	0.196%
340	1.823%	4.047%	4.099%	0.277%
350	7.436%	5.127%	5.203%	0.460%
360	9.048%	5.865%	5.874%	1.080%
370	9.009%	6.179%	6.233%	3.761%
380	10.425%	6.820%	6.847%	12.228%
390	9.160%	5.969%	6.071%	27.376%
400	7.281%	4.938%	4.927%	42.365%
410	5.258%	3.697%	3.657%	54.382%
420	3.948%	3.030%	3.030%	61.368%
430	2.918%	2.340%	2.332%	66.910%
440	2.311%	3.680%	3.671%	71.730%
450	1.806%	4.317%	4.276%	75.651%
460	1.548%	5.479%	5.401%	74.152%
470	1.955%	17.750%	17.809%	70.868%
480	3.626%	56.593%	56.701%	66.034%
490	5.471%	84.140%	85.000%	56.839%
500	8.430%	94.222%	93.301%	48.406%
510	10.280%	100.000%	99.143%	37.330%
520	12.853%	99.446%	98.878%	27.295%
530	14.481%	96.071%	96.124%	20.841%
540	12.973%	92.694%	92.568%	18.078%
550	12.282%	89.428%	89.477%	15.911%
560	12.853%	84.702%	84.945%	13.330%
570	14.052%	76.087%	75.778%	12.006%
580	35.382%	66.908%	66.557%	11.878%
590	89.235%	57.042%	56.378%	11.986%
600	96.769%	45.115%	44.758%	10.974%
610	90.020%	31.040%	30.854%	9.346%
620	79.994%	22.089%	21.800%	8.253%
630	76.059%	19.175%	18.770%	8.567%
640	69.884%	17.099%	16.838%	9.171%
650	65.201%	16.485%	16.088%	10.257%
660	59.055%	16.358%	15.976%	11.229%
670	55.758%	18.405%	18.180%	12.549%
680	49.892%	20.764%	20.491%	13.206%
690	48.323%	24.317%	24.101%	14.316%
700	47.840%	27.136%	26.499%	15.298%

Picture 5- 29

Delete sensitivities of g channel, remove percent sign and add comma between columns as below:



```
300, 0.000,   0.000,   0.000
310, 0.152,   0.087,   0.106
320, 0.317,   0.960,   0.182
330, 1.042,   2.355,   0.196
340, 1.823,   4.047,   0.277
350, 7.436,   5.127,   0.460
360, 9.048,   5.865,   1.080
370, 9.009,   6.179,   3.761
380, 10.425,  6.820,   12.228
390, 9.160,   5.969,   27.376
400, 7.281,   4.938,   42.365
410, 5.258,   3.697,   54.382
420, 3.948,   3.030,   61.368
430, 2.918,   2.340,   66.910
440, 2.311,   3.680,   71.730
450, 1.806,   4.317,   75.651
460, 1.548,   5.479,   74.152
470, 1.955,   17.750,  70.868
480, 3.626,   56.593,  66.034
490, 5.471,   84.140,  56.839
500, 8.430,   94.222,  48.406
510, 10.280,  100.000, 37.330
520, 12.853,  99.446,  27.295
530, 14.481,  96.071,  20.841
540, 12.973,  92.694,  18.078
550, 12.282,  89.428,  15.911
560, 12.853,  84.702,  13.330
570, 14.052,  76.087,  12.006
580, 35.382,  66.908,  11.878
590, 89.235,  57.042,  11.986
600, 96.769,  45.115,  10.974
610, 90.020,  31.040,  9.346
620, 79.994,  22.089,  8.253
630, 76.059,  19.175,  8.567
640, 69.884,  17.099,  9.171
650, 50.201,  16.485,  10.257
660, 40.055,  16.358,  11.229
670, 30.758,  18.405,  12.549
680, 20.892,  20.764,  13.206
690, 10.323,  24.317,  14.316
700, 5.840,   27.136,  15.298
710, 4.757,   30.851,  16.778
```

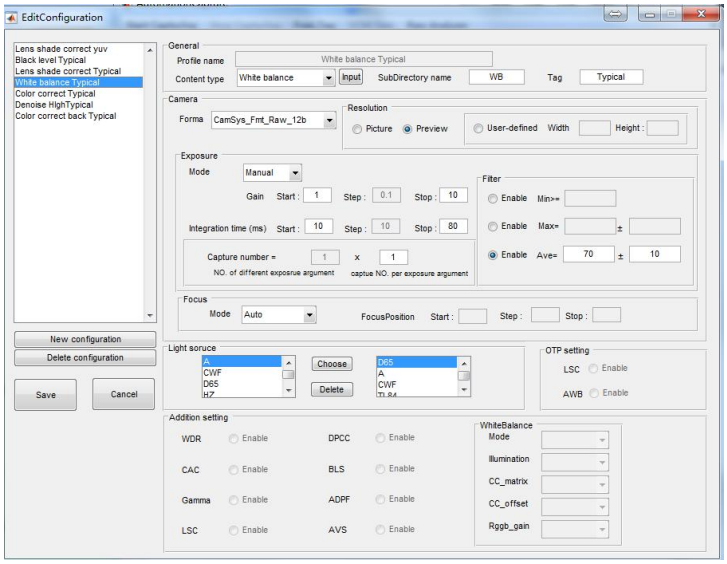
Picture 5- 30

5.4.2 Capture picture

Place the gray chart directly below the light source of light box, and make the gray chart occupy the whole preview picture of camera, capture raw pictures in different light sources (only capture with one resolution, usually capture with the resolution of preview).

Picture 5- 31

Use *Capture tool*, capture configuration refers to *White Balance Typical* to acquire the picture with appropriate brightness, as shown in Picture 5-32, or disable Ave enable, capture several pictures, and then manually select the picture with appropriate brightness.



Picture 5- 32

5.4.3 Select picture

Use Irfanview to view the pixel distribution. Select the picture which average brightness is close to the setpoint value of IQXM, generally it is 70.

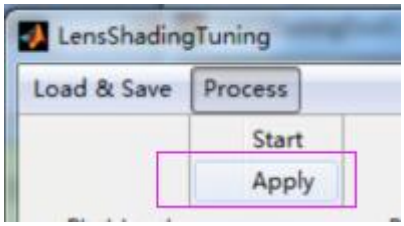
5.4.4 Apply lens shading correction to raw images

Click *Lens Shade Calibration* in the main interface and do follow steps to generate png image for raw images captured under each light source:

(1) Click *Load Image* to load one raw image

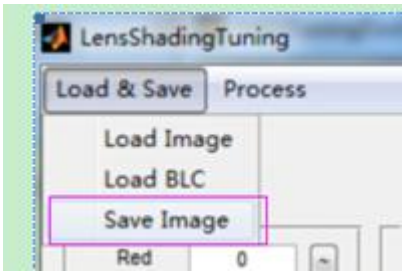
Picture 5- 33

(2) Click *Apply* to do the LSC on the raw image, Select LSC 100% parameter corresponding to the light source that the raw image is captured.



Picture 5- 34

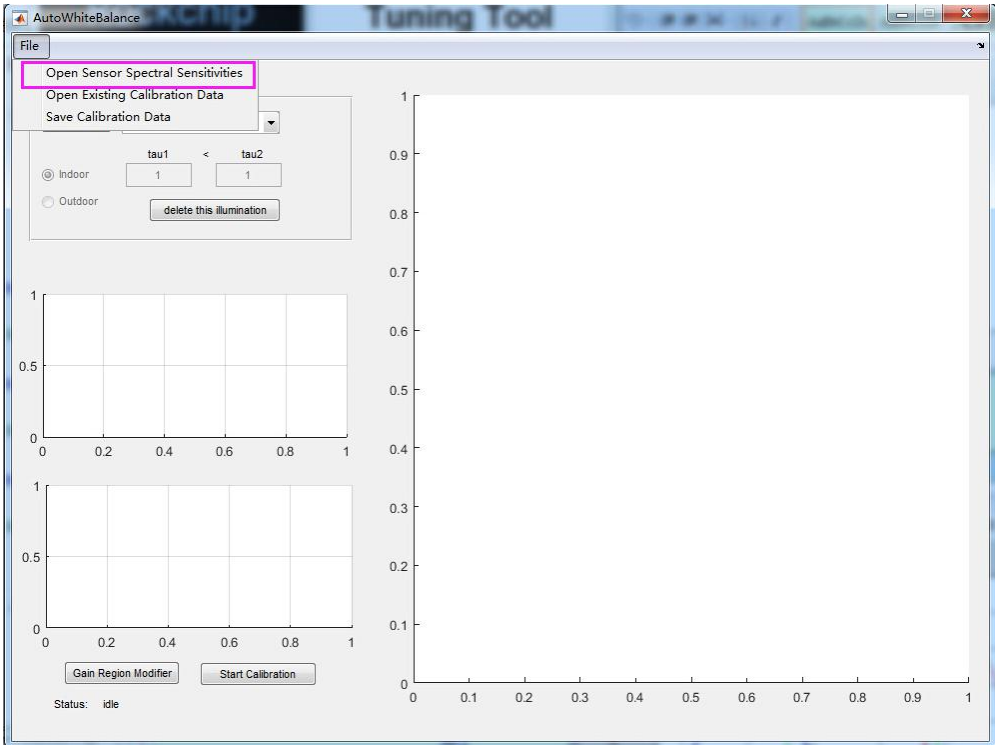
(3) Click *Save Image* to save the picture



Picture 5- 35

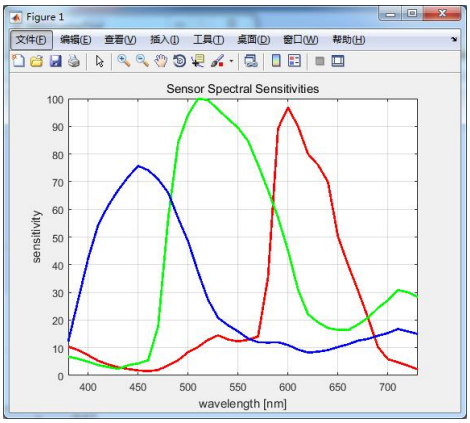
5.4.5 Calibrate AWB parameter

Click *Auto White Balance Calibration* in the main interface will enter below interface:



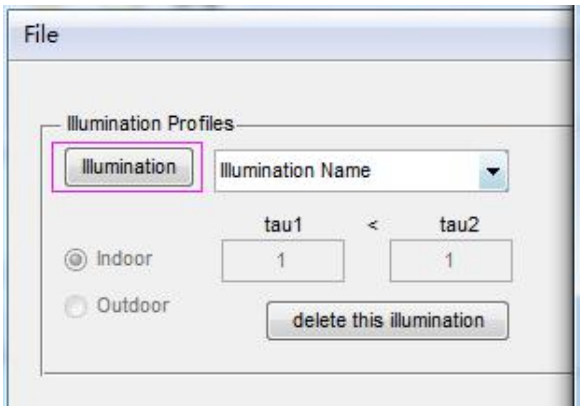
Picture 5- 36

(1) Click O*pen Sensor Spectral Sensitivities* to load spectral sensitivities curve

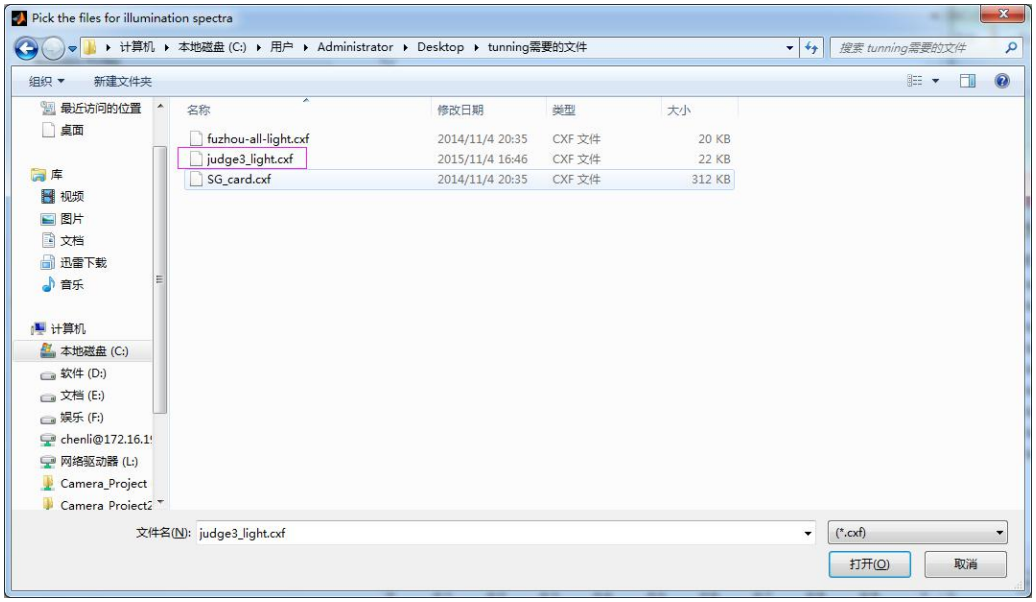


Picture 5- 37

(2)Click illumination to load the spectral power distribution of all used light source (this curve is measured by eye-one).

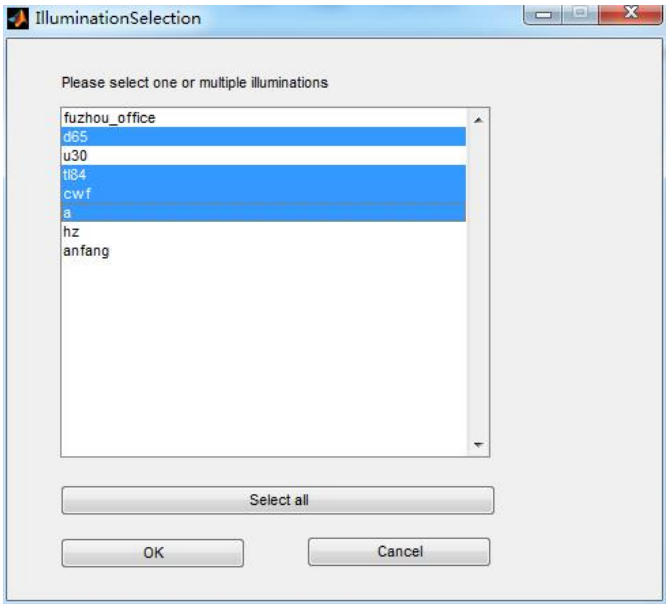


Picture 5- 38



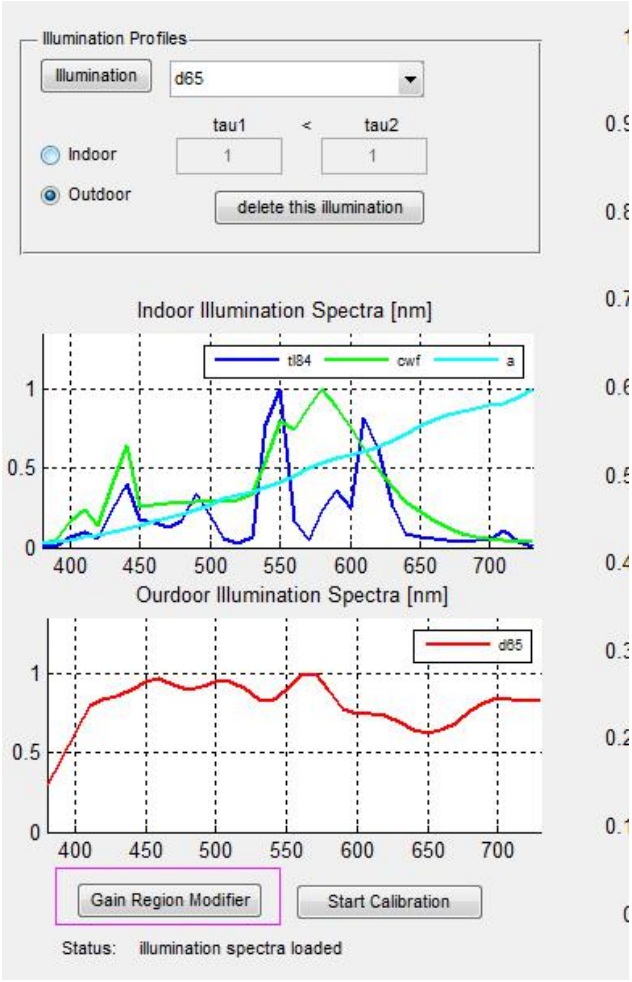
Picture 5- 39

Select A, CWF, TL84 and D65 four light sources. They are all indoor light sources except D65 light.



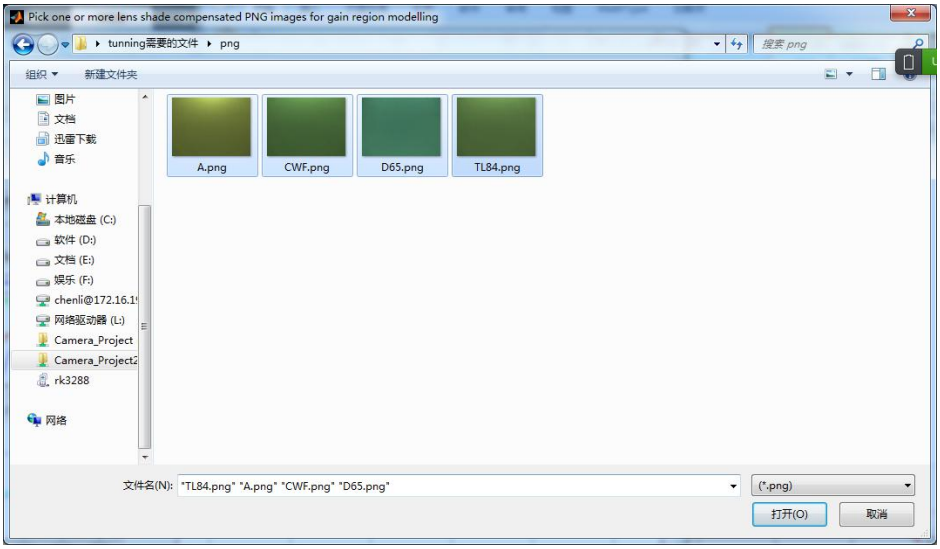
Picture 5- 40

(3) Generate white balance gain range



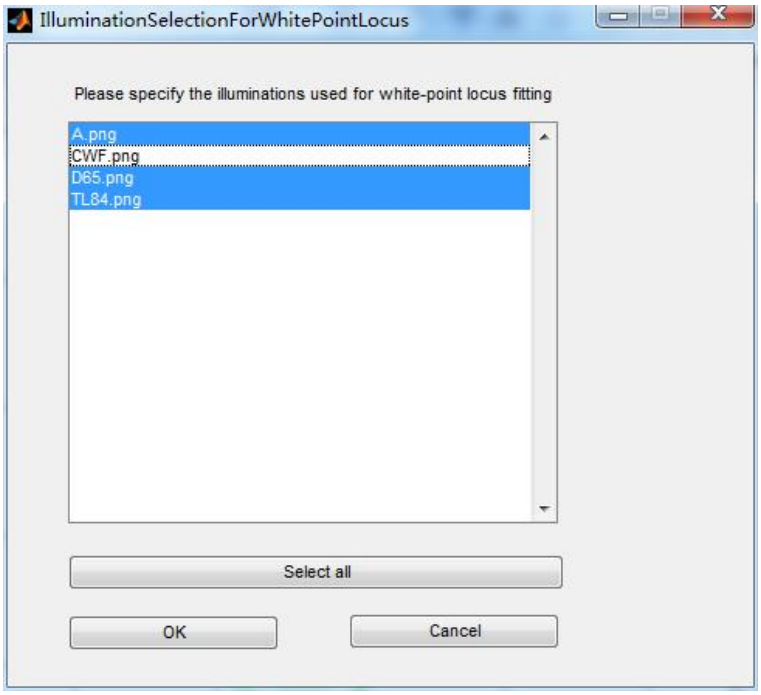
Picture 5- 41

Click *Gain Region Modifier*, then select the PNG pictures generated in 5.4.4. Here we can select all:


Pick one or more lens shade compensated PNG images for gain region modelling
tunning需要的文件 ▸ png
搜索 png
组织
新建文件夹
图片
文档
迅雷下载
音乐
计算机
本地磁盘 (C:)
软件 (D:)
文档 (E:)
娱乐 (F:)
chenli@172.16.1
网络驱动器 (L:)
Camera_Project
Camera_Project2
rk3288
网络
A.png
CWF.png
D65.png
TL84.png
文件名(N): "TL84.png" "A.png" "CWF.png" "D65.png"
(*.png)
打开(O)
取消

Picture 5- 42

Select the light source to fit white point gain curve. Generally do not select CWF.

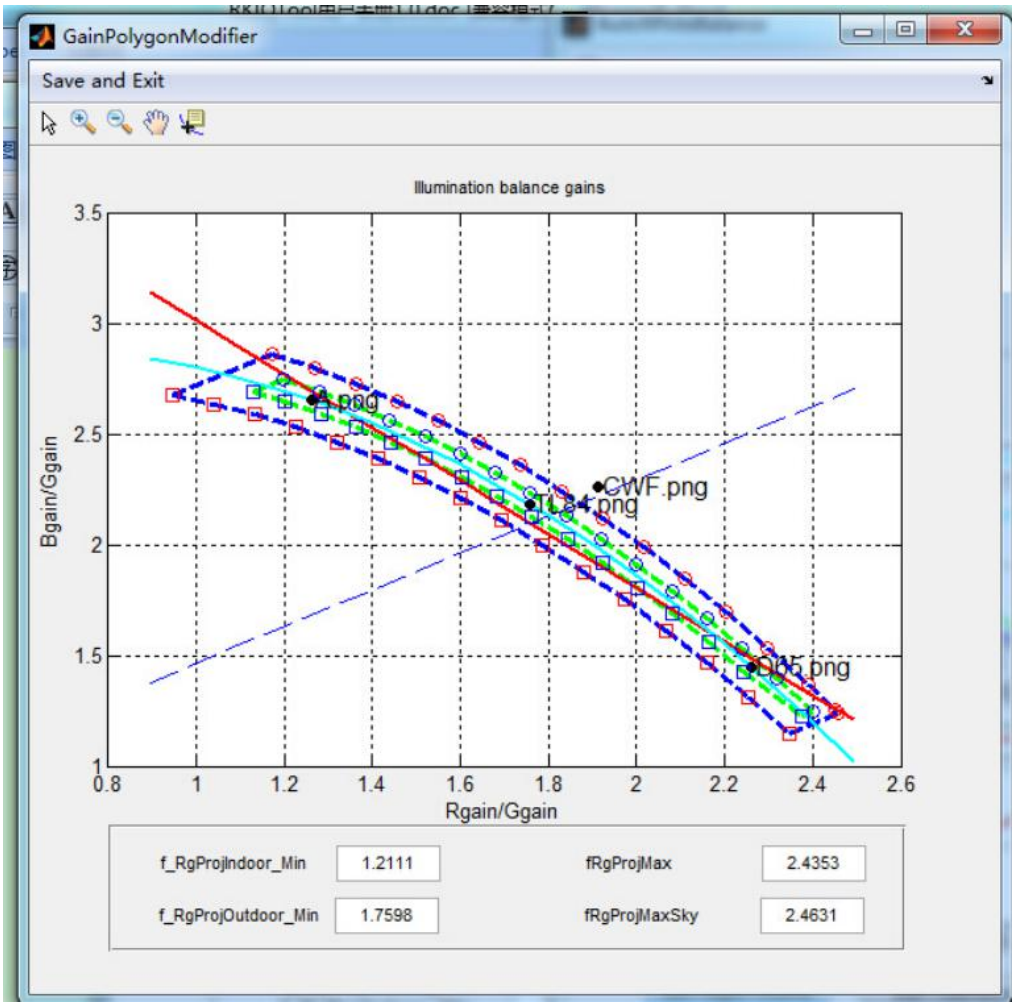


Picture 5- 43

Adjust the initial white balance gain range, recommend to use the default setting:

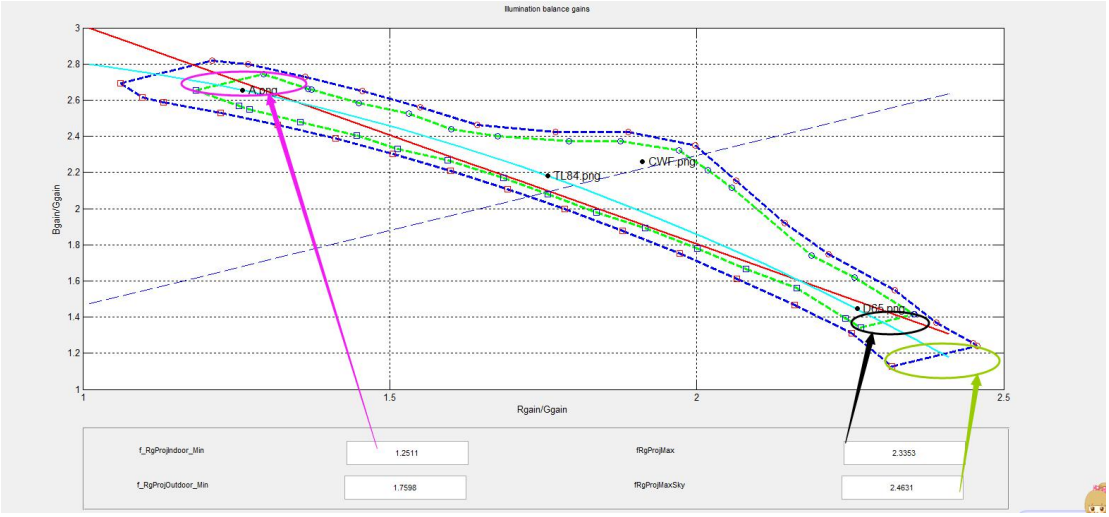
Picture 5- 44

The initial white balance gain range is shown as below:



Picture 5- 45

The modified balance gain range is shown as below:



Picture 5- 46

The blue and green curves are used to clip the white balance gain within the curve range, so it needs to calibrate white balance gain range.

Drag the points in blue and green curves to make the white balance gain of all light source within the curve range. The curve should be as smooth as possible.

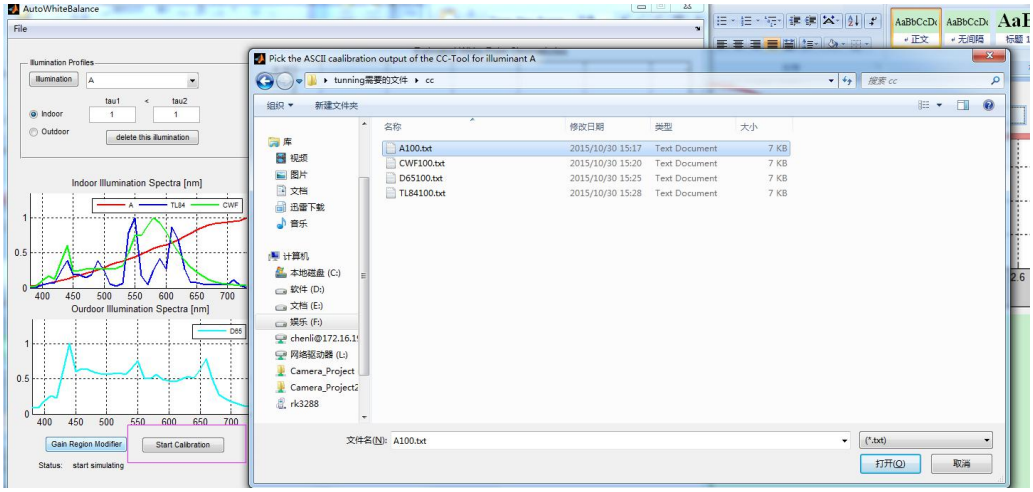
The Rgproj(projection Red channel white balance gain) value of the points circled by ellipse is determined by the value in text box, but that points can be dragged along the vertical direction of the red line.

Other points can be dragged, but Rgproj value from left to right increases monotonically, so the range of Rgproj of dragged point doesn't exceed two adjacent points. If a point is hard to drag, you can adjust the adjacent points first.

Click "*Save and exit*" to save and exit.

(4) Generate all light sources related parameters

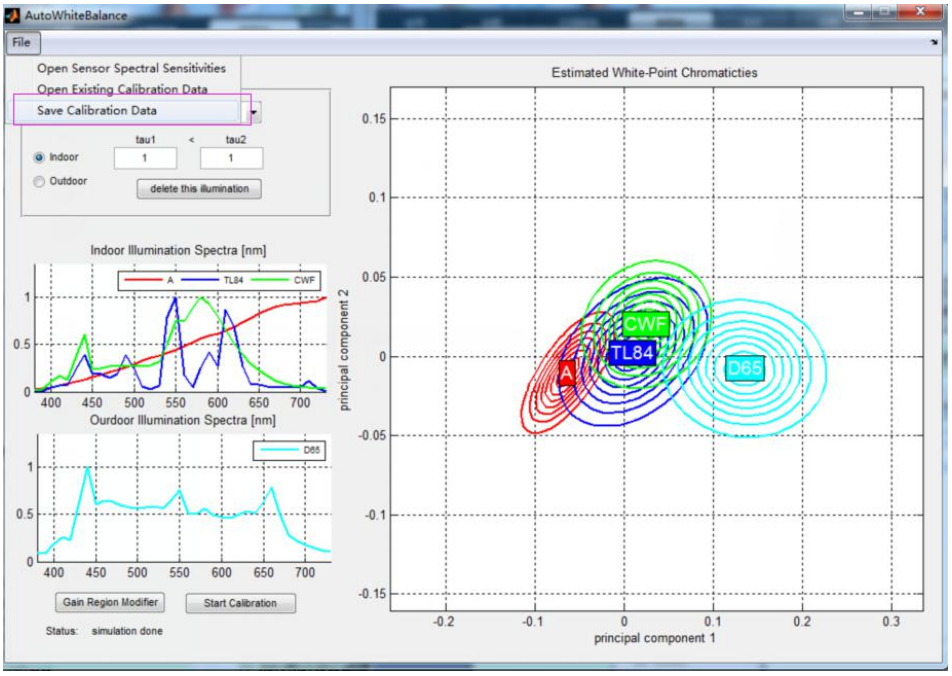
Single click "*Start Calibration*" to select the file of CCM parameters with 100% saturation one by one according to light source's name in the title of dialog. Those files are generated by CC in the previous step:



Picture 5- 47

(5) Save the data

Click *Save Calibration Data* to save the data



Picture 5- 48

So far, AWB parameter calibration is finished.

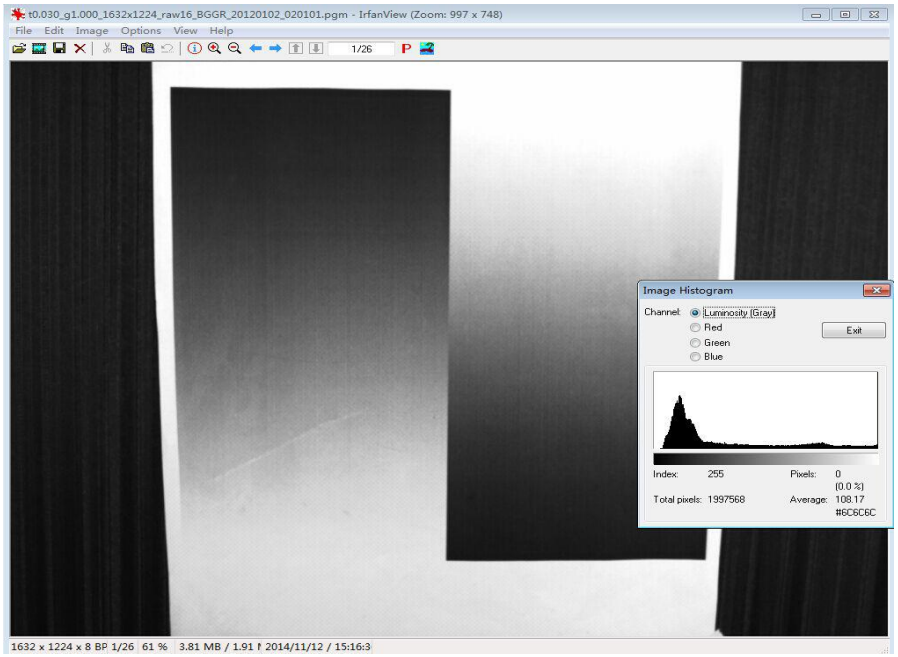
5.5 Noise Calibration

5.5.1 Capture picture

(1) Capture 20 raw images under high luminance conditions, and capture 20 raw images under low luminance conditions. The black and white gradient chart (Picture 5- 49) fills the entire image. And exposure gain (usually set 1) and integration time (30ms, usually set the max) are better to keep the same in two kinds of conditions (that is, gain and time should be the same in low light and high light conditions).

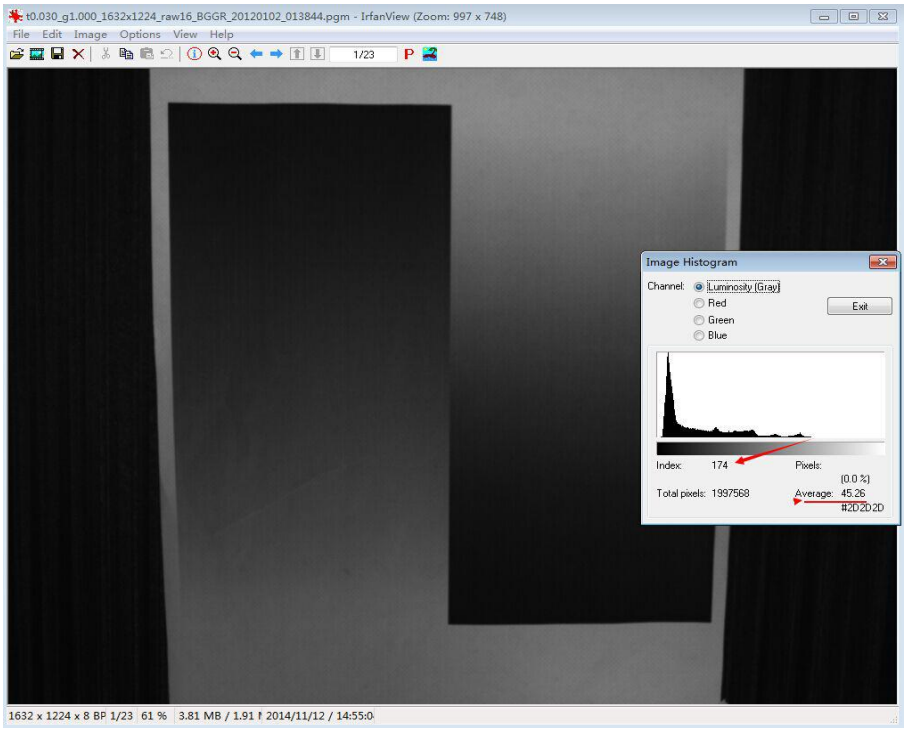
(2) Modify luminance condition or exposure parameters to make white part of gradient chart overexposure in high light condition.

The reference picture under high luminance conditions:



Picture 5- 49

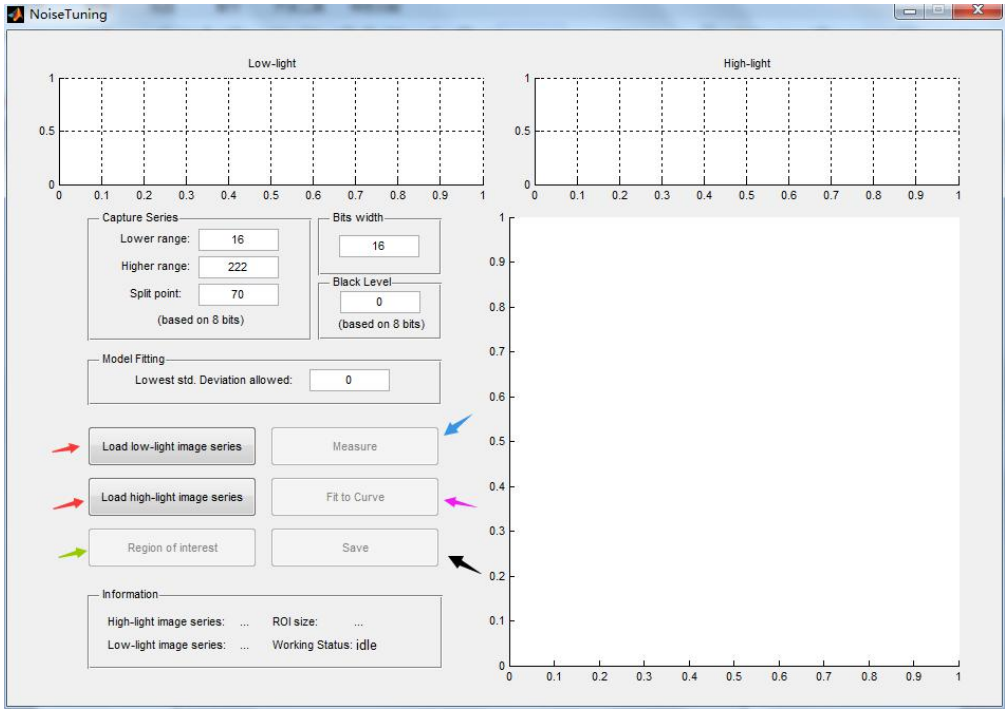
The reference picture under high luminance conditions:



Picture 5- 50

5.5.2 Calibrate

Click "*Noise Calibration*" in the main interface to enter below interface:



Picture 5- 51

Tuning respectively for binning and full two resolutions. The tuning steps are as below:

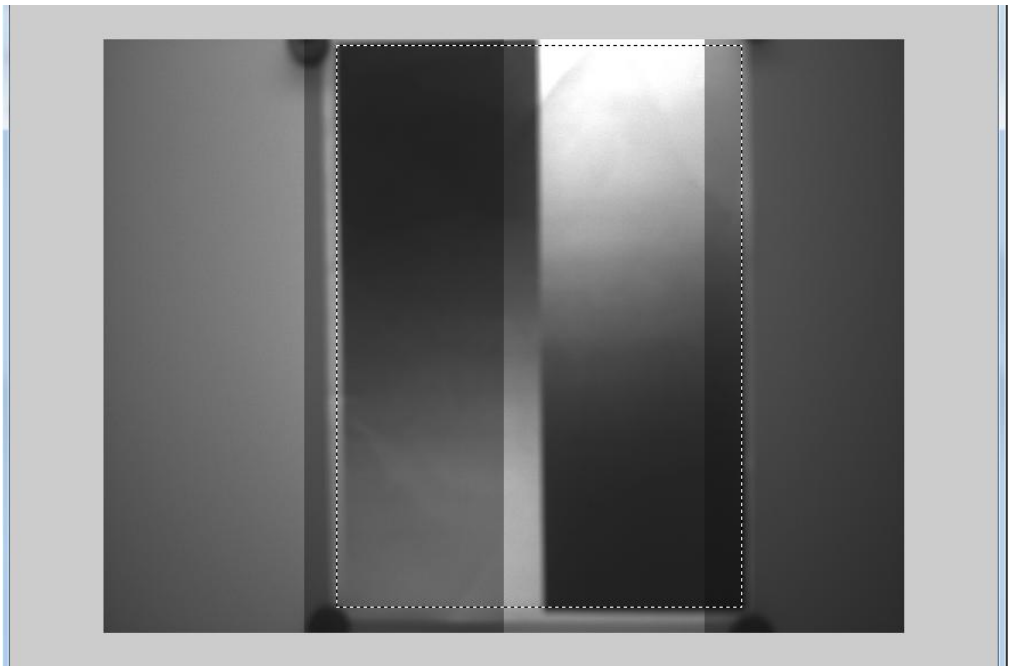
（1）Load image

Click *Load low-light image series* to load all images captured under low luminance condition.

Click *Load high-light image series* to load all images captured under high luminance condition.

（2）Select region of interest(ROI)

Use the button marked as green arrow to select ROI participating in calculation. Generally it is impossible to make the black and white gradient chart (Picture 5- 49) fills the entire image, so you must select the chart region.



Picture 5- 52

（3）Measure

Click the *Measure* button marked as blue arrow in above picture, the tool will start to analyze the data of the picture set.

（4）Fit curve

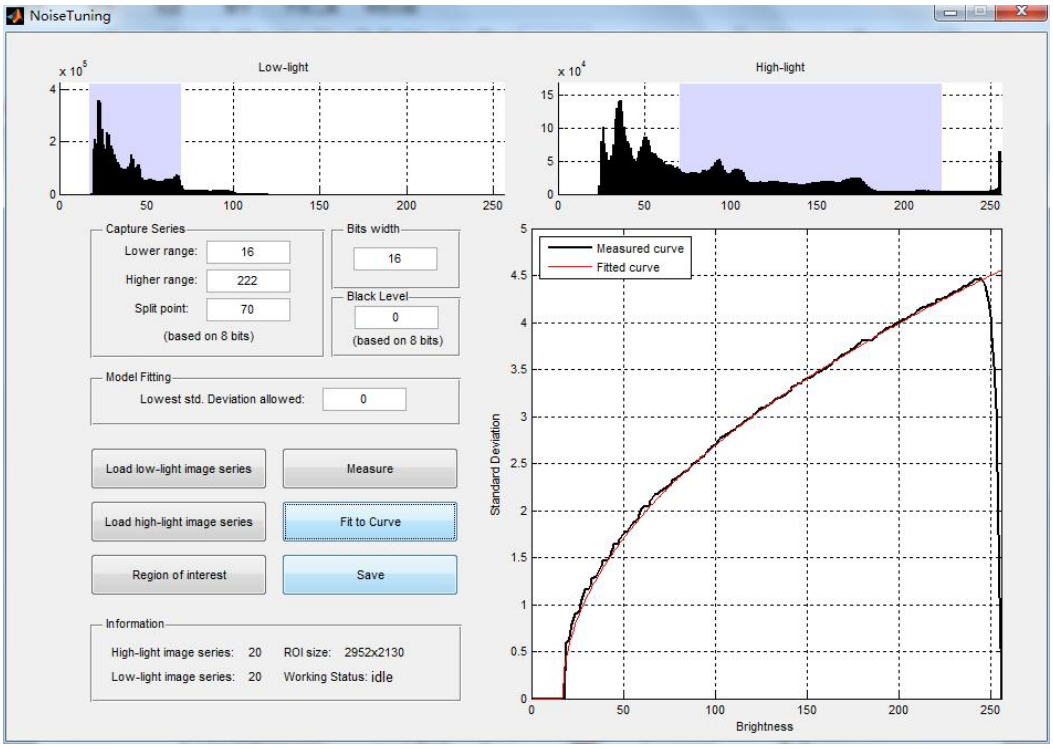
After measurement, click *Fit to Curve t*o fit Noise curve.

Capture Series parameter, *Black Level* parameter and *Model Fitting* parameter in the interface can change the fitting curve. After modifying these parameters, click *Fit to Curve* button again to generate new curve.

Capture Series parameters determine the histogram statistics distribution of *high-light* and *low-light*.

If *Black Level* parameter was tuned before, it will be loaded automatically, otherwise need to be filled manually. This parameter affects the start point of curve, and the curve will shift horizontally according to this parameter.

Model Fitting parameter is used to limit the minimum value of the curve. All the curve values lower than the set value will clip to the set value.



Picture 5- 53

（5）Save

Press *Save* button to save the parameters.

So far, Noise related parameters calibration is finished.

Note:

For images captured under the low luminance condition ,there should be as many pixels as possible fallen between *Lower range* and *Split point* of histogram. While for images captured under the high luminance condition ,there should be as many pixels as possible fallen between *Split point* and *Higher range* of histogram .

The responses of different sensors are different. So it is difficult to use one Typical configuration of *Capture Tool* to capture the images that meet the requirements. Actually, it is more difficult to capture high light picture than low light picture. The simplest selecting images' method is to capture a group of high light first (same or similar Picture 5-49) ,a group of low light images ,then fit the curve. If the smooth of the curve is similar to Picture 5-53, that means the curve is OK. Otherwise, if the curve is very irregular, that means it is too bright in high-light images or too dark in low-light images

5.6 XML Generation

5.6.1 TXT naming rule for all modules

The standard format is:

/root directory

/root directory/awb

awb.txt

awb.mat

//root directory/lsc

naming rule：resolution _illuName_vignetting.txt

1980x1080_A_70.txt

…

/ root directory/cc

naming rule：illuName _saturation.txt

A_70.txt

…

/ root directory/dpf

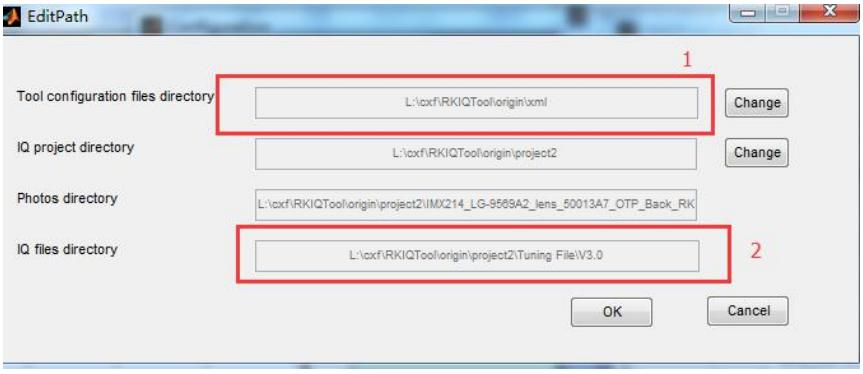
naming rule

dpf_resolution.txt

Where resolution represents the actual resolution, such as 1980x1020.

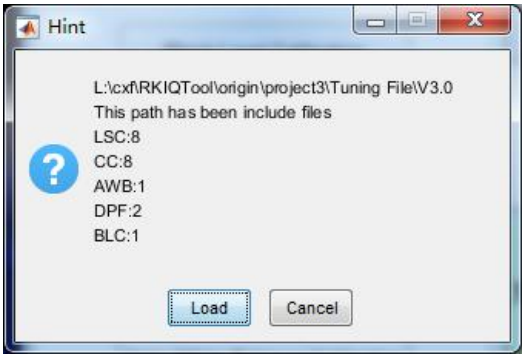
5.6.2 Automatically generate IQXML

Clicking *XML Generation*, then read the IQXML(named SensorName_MoudleName.xml) from device and read the files of AWB, LSC, CC, BLC and DPF modules in route 2, and generate new IQXML based on these files which is named SensorName_MoudleName.xml. If failing to read the IQXML from the device, it will automatically load RKxxxx_Basic.xml file in route 1.



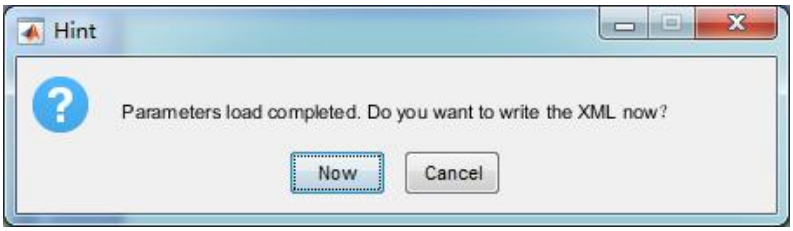
Picture 5- 54

（1） Click *XML Generation* in the main interface, and it will pop up dialog box similar as below:



Picture 5- 55

（2） Click *Load*, start to read parameter, and it will pop up below dialog box after read successfully:



Picture 5- 56

（3） Click now, start to generate IQXML file. It will pop up below dialog box after finishing and open the f IQXML ile directory at the same time.

Picture 5- 57

6 Analysis tool

Analysis tool is a tool used to fine tune or analysis . For the TXT documents of AWB LSC CCM DPF modules' calibration data, analysis tool supports to automatically fill the parameters from txt documents into XML. Moreover, support to use the tool to modify parameters in the IQXML. There are *LSC*, *CC*, *AWB*,*AE*, *DPF*, *GOC*, *WDR* modules in the interface. WDR only support for RV1108.

Click *Analysis tool* in the main interface, and it will pop up the following dialog. Must confirm that the platform and Bayer order are correct.

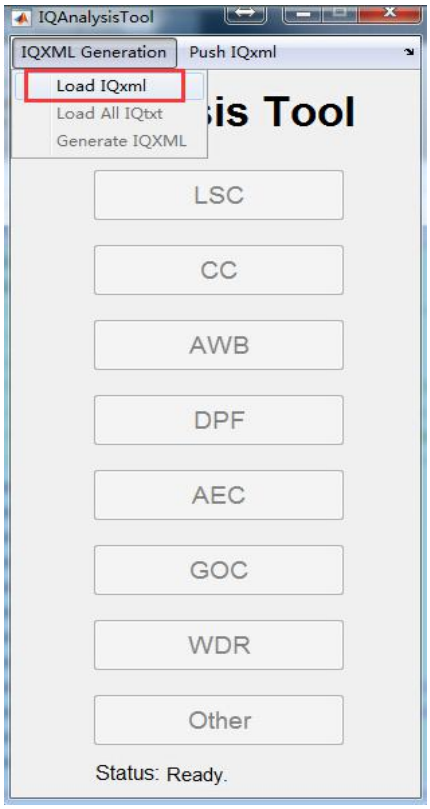
Picture 6- 3

Picture 6- 4

6.1 Menu bar

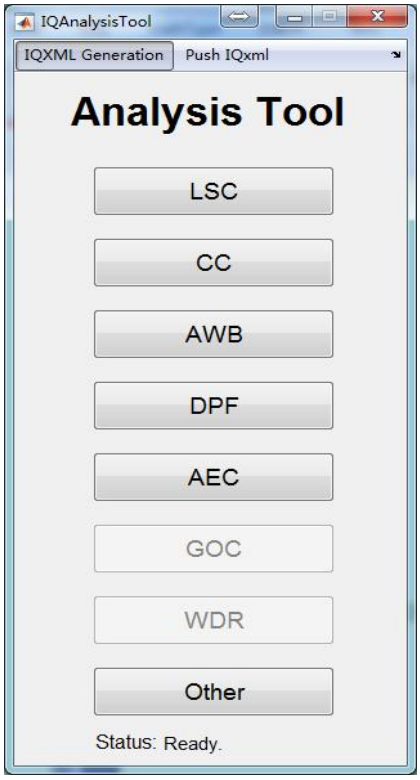
6.1.1 *Load IQXML*

Click *IQXML Generation- Load IQXML* to load the IQXML file first.



Picture 6- 5

The main interface status is updated as below after succeeding to load IQXML:

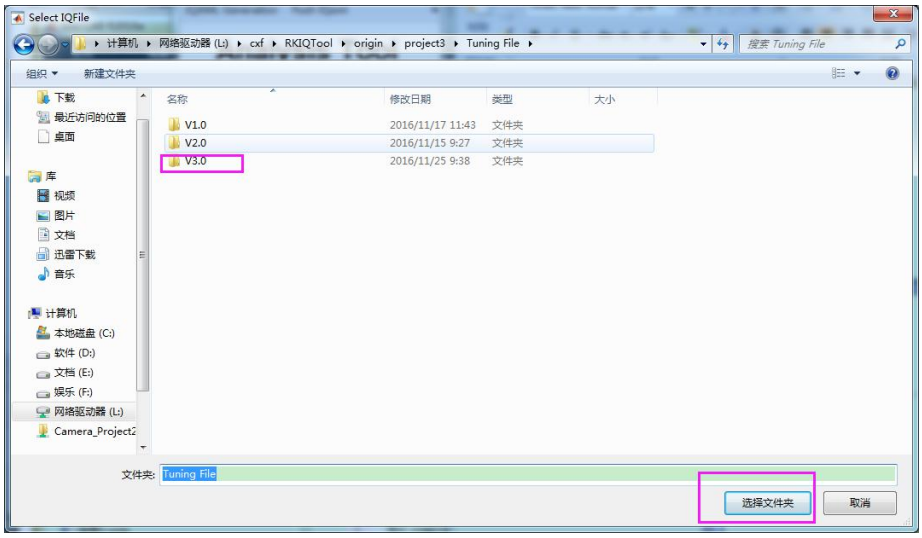


Picture 6- 6

If need to fill parameters of all modules' TXT documents into IQXML, you can operate as section 6.1.2. Besides, you can modify the parameters of one module or load the parameters of from one TXT document to corresponding module, referring to section 6.2~6.8.

6.1.2 Load tuning files and fill into IQXML

Single click "*Load TXT*" button in the menu bar, and then select the root directory saving the file of tuning parameters (the naming restriction of the file and folder of the root directory is the same as section 5.6.1).

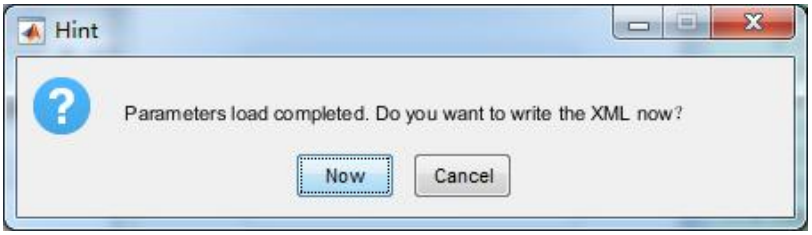


Picture 6- 7

Then pop up the following dialog:

Picture 6- 8

Single click *Load* will pop up the following dialog:



Picture 6- 9

Click *Now* will load all modules' TXT files and write those parameters to IQXML at once, Then it will pop up below interface after completed.

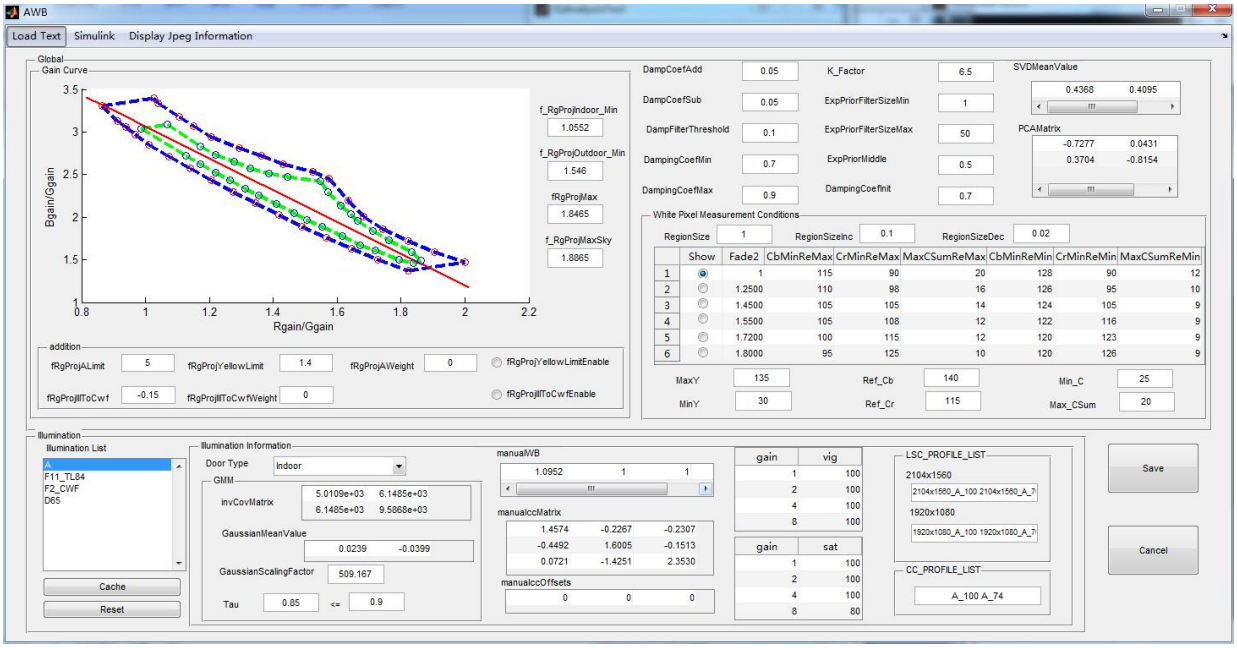
Picture 6- 10

The new IQXML file's name is the same as the loaded IQXML file's name. The route of the file is ../result, where ../ represents the route of IQXML loaded.

6.2 AWB

6.2.1 Interface

Single click *AWB* button in Picture 6-4 will pop up the interface of AWB fine tuning tool as below:



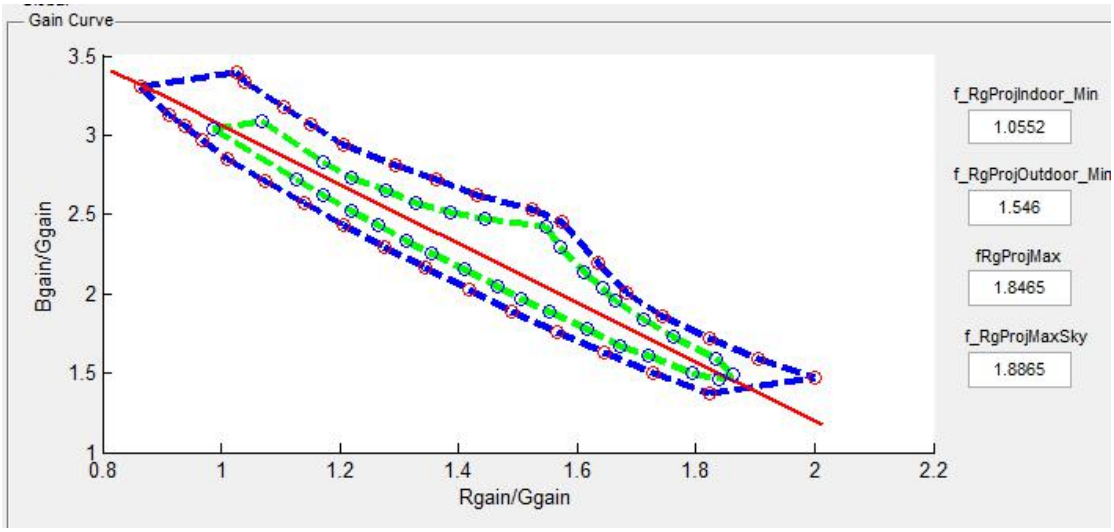
Picture 6- 11

As shown in above picture, most of AWB module's parameters in IQXML are displayed in this interface.

6.2.2 Modules of interface introduction

（1）Modify white balance gain range

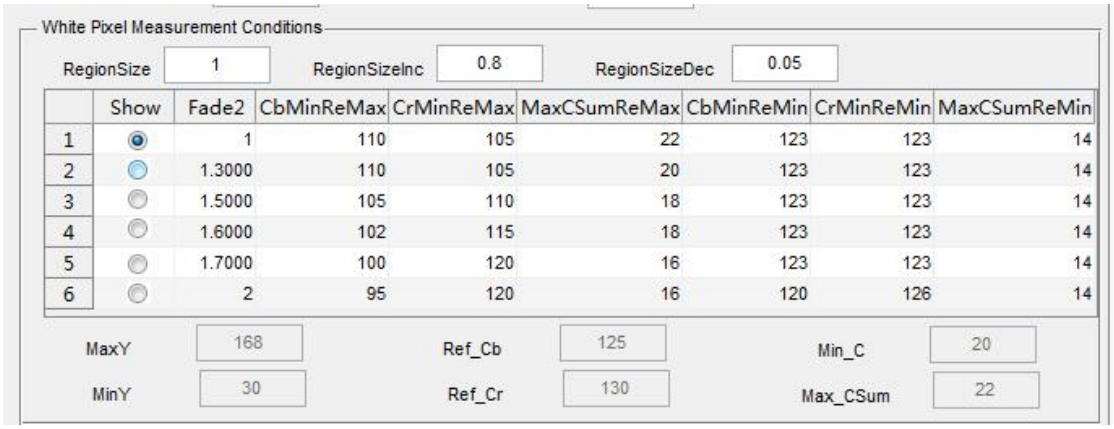
The white balance gain range can be modified by dragging the dots or modifying the value of textboxes in Picture 6-12.



Picture 6- 12

（2）Modify white points detection condition

The parameters of white points condition in IQXML are *CbMinReMax*, *CrMinReMax*, *MaxCSumReMax*, *CbMinReMin*, *CrMinReMin* and *MaxCSumReMin*. These parameters can be different due to different gainR/gainG value of the scene. The white points condition *MaxY, Ref_Cb, Min_C, MinY, Ref_Cr, Max_CSum* can be calculated automatically from these parameters as shown in Picture 6-13.



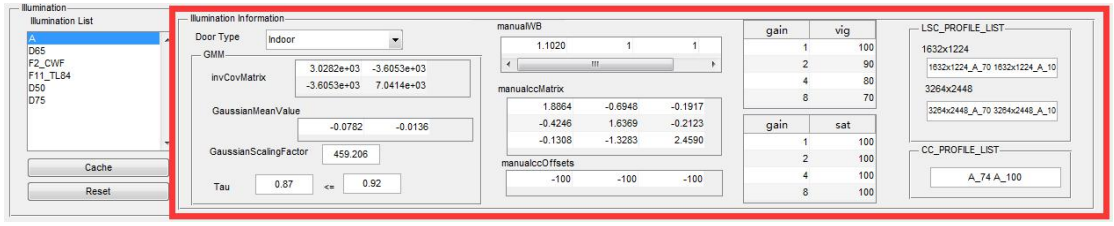
Picture 6- 13

（3）The parameters corresponding to different light sources

Click the light source of *Illumination List* in Picture 6-14, and the corresponding parameters of the light source will be displayed on the right.

Click *Cache* to save the parameters of the light source. Click *Cache* before click another light source of Illumination, otherwise the modification of current light source parameters will be abandoned.

Click *Reset* to abandon the modification.



Picture 6- 14

（4）load txt

Click *Load Text* button in the menu bar can load AWB parameters from TXT document. But the light sources' name and number loaded must be the same as before.

（5）Load JPG Info

Click Display Jpeg Information to load one picture to show the debug information of the picture.

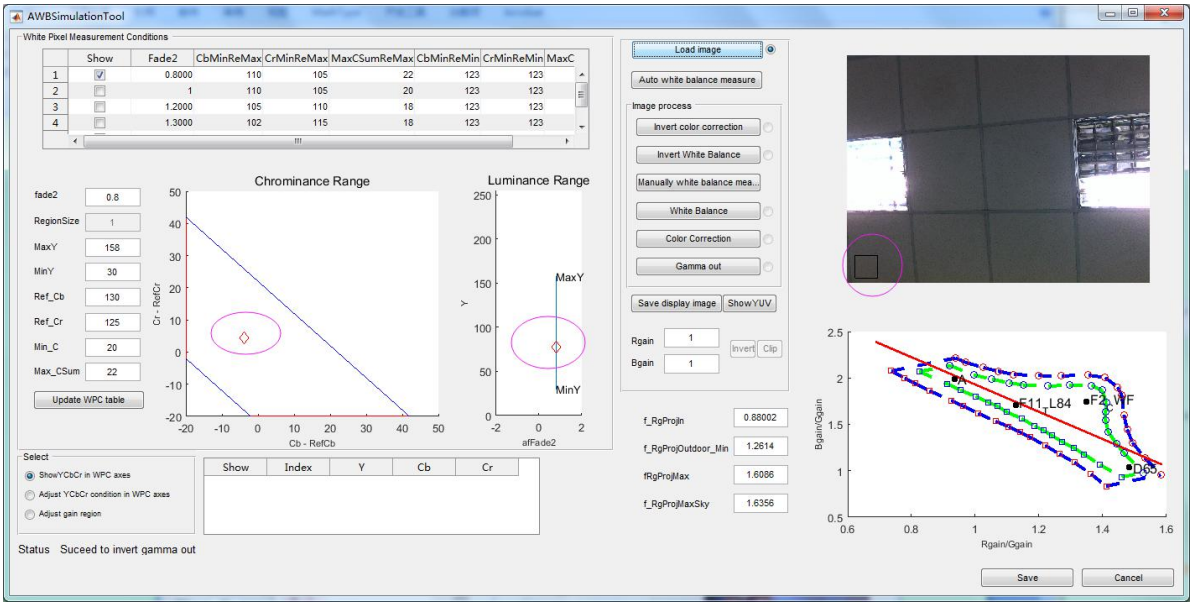
（6）Save

Click *Save* to save all the modifications in the interface.

6.2.2 White points condition debugging tool

When the white balance is abnormal, you can capture the JPEG picture of the scene, and use the tool to analysis the problem, including simulating white points detection, and modifying the white points condition under the color temperature similar to the scene.

Click *Simulink - White Point Condition Tuning* in the menu bar to open the white points condition debugging tool. And Click *Load image* to load the picture, and the interface will show as Picture 6- 15.



Picture 6- 15

1) Check YCbCr value of the image

Move the mouse on the loaded image, it will update the mean Y Cb Cr value of the block around the mouse in the axes of *Chrominance Range* and *Luminance Range* (need to select "*Show YCbCr in WPC axes*" in *Select* module to enable this function). Scroll the mouse can zoom in and zoom out the size of the block around the mouse.

Note:

(a) The range of Y is 16~236. The range of Cb is 16~240. The range of Cr is 16~240.

(b) If there is gamma out curve in IQXML and the input picture is ".jpg" format, it will directly invert gamma on the picture after loaded. This is because the gain value of white balance is calculated before gamma process, but the captured jpeg picture is processed by gamma , it is necessary to invert gamma out operation before debugging the white points condition. If there is no gamma out curve, you can select gamma 2.2 curve or load the used gamma parameters from IQXML.

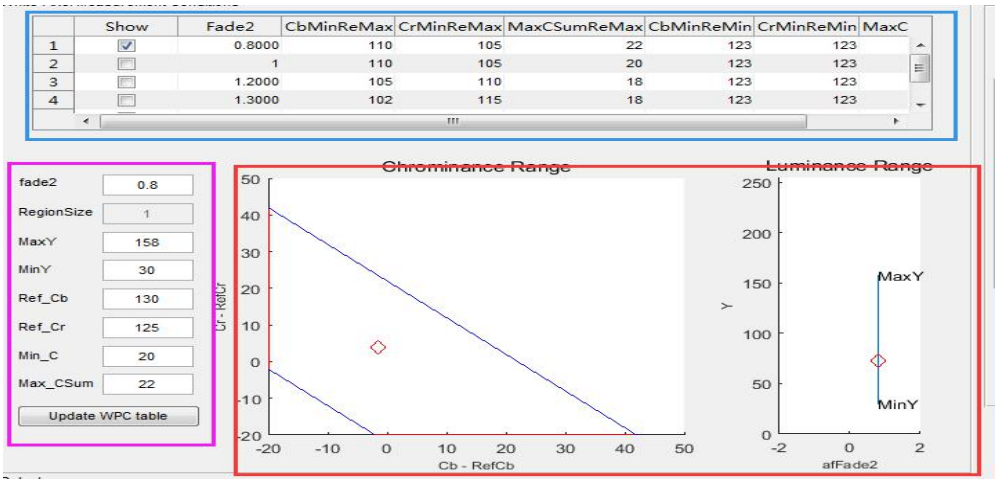
(c)Support to load ".bin" file, this kind of files consists of YUV data and ISP debug information ,which are captured on RV1XXX platform. The YUV data doesn't need to invert gamma after loaded.

2) white points detection simulation

Tick the row in "*White pixel measurement conditions*" table, and click "*Auto white balance measure*". It will automatically detected white points with the selected white points condition. and it will pop up the binary figure, the white represent the white points, while the black represents the non-white points.

Note:

Tick the different row of "*White pixel measurement conditions*", it will automatically update parameters in the textboxes below the table, and display the white points area in the axes of *Chrominance Range* and *Luminance Range*.



Picture 6- 16

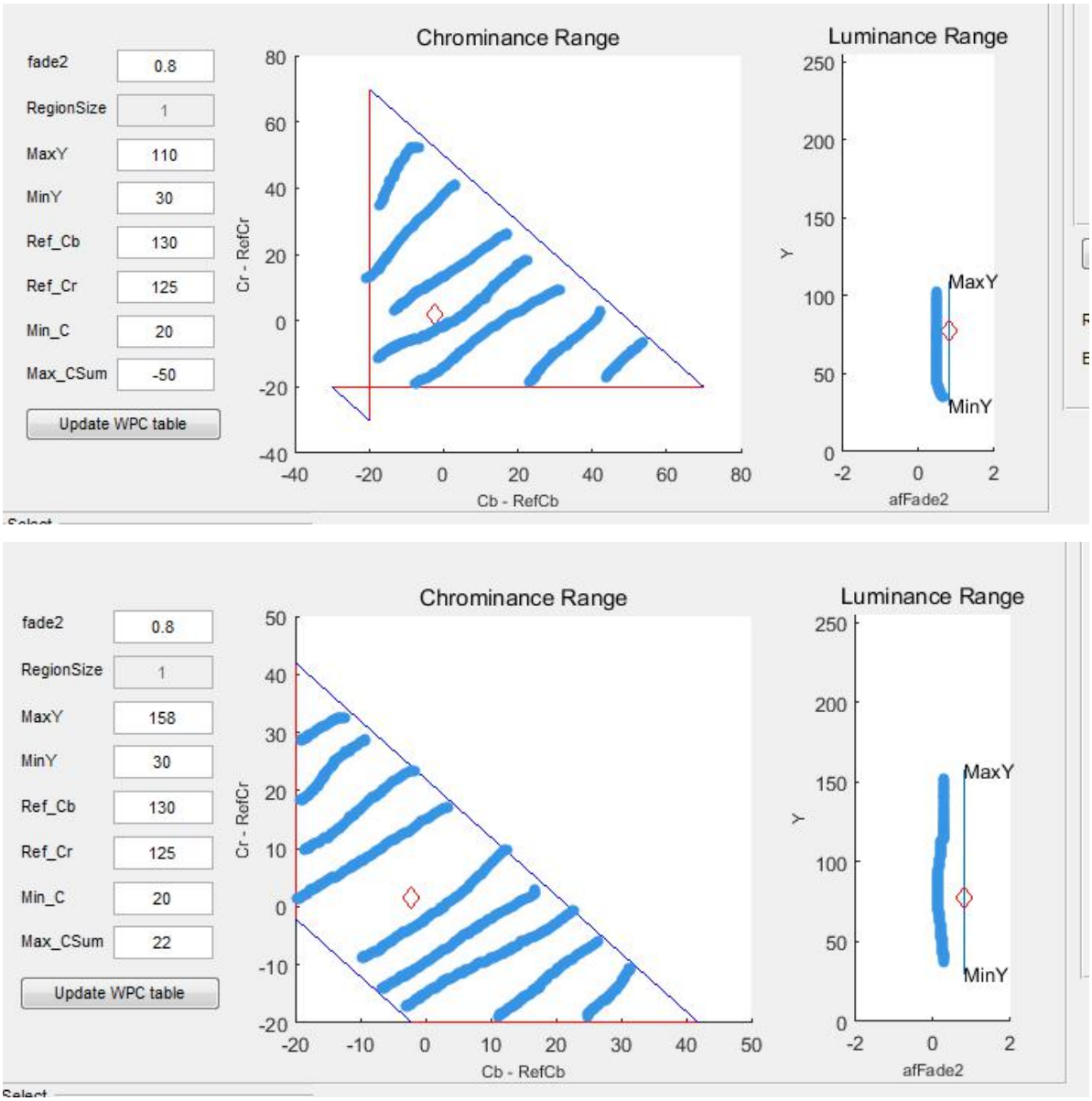
Different rows represent the parameters of the white points condition applied for different Rg_proj value (corresponding to different color temperatures). Which row of white points condition should be selected for debugging? You can get Rg_Proj value of the picture from log in the black command window of the tool, and then select the row with the value fade2 closest to Rg_Proj value.

3) Modify the white points condition

A pixel is detected as a white point should meet below six conditions at the same time, that is only when point (Cb,Cr) falls in the area enclosed by four straight lines in *Chrominance Range* and the corresponding Y falls between MinY and MaxY in the *Luminance Range*, this point is judged as a white point.

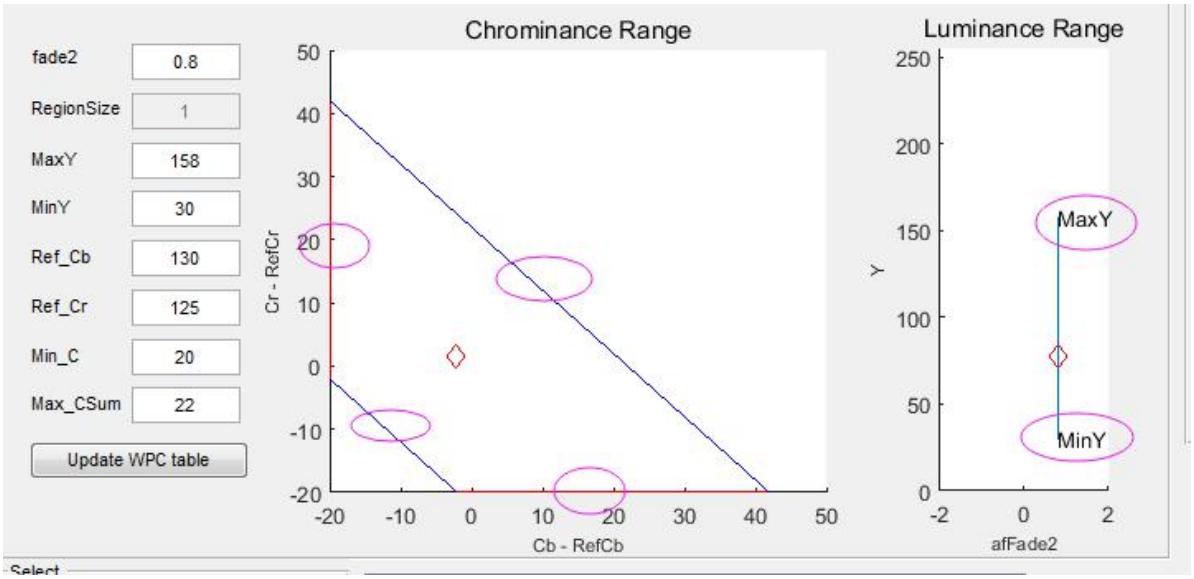
1. Y >= MinY
2. Y <= MaxY
3. (Cb - Ref_Cb) >= - Min_C
4. (Cr - Ref_Cr) >= - Min_C
5. (Cr - Ref_Cr) + (Cb - Ref_Cb) <= Max_CSum
6. (Cr - Ref_Cr) + (Cb - Ref_Cb) >= - Max_CSum

Below pictures show two white points conditions. When the point is in to the blue area of *Chrominance Range* and the blue area of *Luminance Range*, it is detected as a white point, otherwise it is not a white point.



Picture 6- 17

Debug the white points condition on 1108 platform:



Picture 6- 18

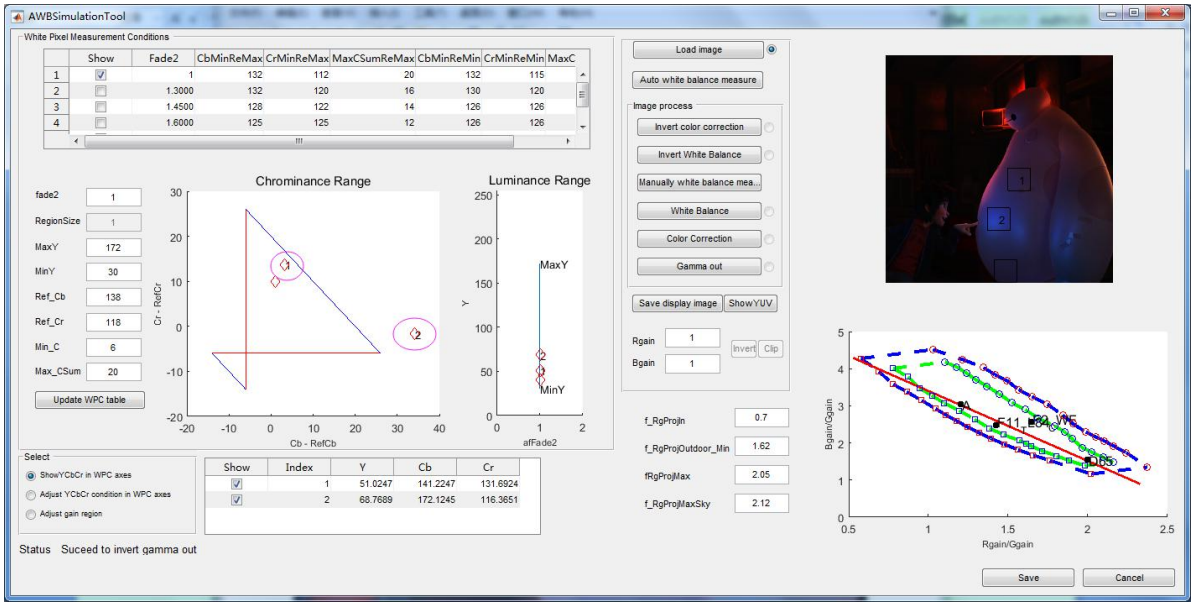
i. Select the radio button of "*Adjust YCbCr condition in WPC axes*" in *Select*.

ii. Drag *MaxY* to change *MaxY* using the mouse, when click *update WPC table*, *afMaxYRegionMax* and *afMaxYRegionMin* of the selected row in the table will be modified.

iii. Drag *minY* to change *MinY* using the mouse, when click *update WPC table*, *afMinYMaxGRegionMax* and *afMinYMaxGRegionMin* of the selected row in the table will be modified.

iv. Drag the red line parallel to the horizontal axis or vertical axis in *Chrominance Range* using the mouse will change the value of *Min_C*. When *click update WPC table*, *afMinCRegionMax* and *afMinCRegionMin* of the selected row in the table will be modified.

v. Drag the blue line with slope equal to -1 in *Chrominance Range* using the mouse will change the value of *Min_CSum*. When click *update WPC table*, *afMaxCSumRegionMax* and *afMaxCSumRegionMin* of the selected row in the table will be modified.



Picture 6- 19

vi. Rhombus *1* and *2* in *Chrominance Range* correspond to the block 1 and 2 of the loaded image, drag rhombus 1 or 2 in *Chrominance Range* will change the value of *Ref_Cr* and *Ref_Cb*. When click *update WPC table*, *afRefCr* and *afRefCb* of the selected line in the table will be changed.

afRefCb=Ref_Cr - 0.5 * RegionSize * (afCrMinRegionMax - afCbMinRegionMax);
afRefCr=Ref_Cb - 0.5 * RegionSize * (afCbMinRegionMax - afCrMinRegionMax);

There is restriction of Ref_Cr + Ref_Cb = afRefCb + afRefCr, so the position of Rhombus 1 and 2 is limited.

Note: the formulas between the white points condition and the parameters of IQXML on 1108 platform

f_CbMin = RegionSize * afCbMinRegionMax;
f_CrMin = RegionSize * afCrMinRegionMax
f_MaxCSum = RegionSize * afMaxCSumRegionMax
f_MinC = RegionSize * afMinCRegionMax
f_MaxY = RegionSize * afMaxYRegionMax
f_MinY_MaxG = RegionSize * afMinYMaxGRegionMax

Since：

f_shift = -(f_CrMin + f_CbMin) / 2;
Ref_Cr = f_CrMin + f_shift + afRefCb
Ref_Cb = f_CbMin + f_shift + afRefCr
Min_C = f_MinC;
Max_CSum = f_MaxCSum;
MaxY = f_MaxY;
MinY = f_MinY_MaxG;

So

Ref_Cr = 0.5 * RegionSize * (afCrMinRegionMax - afCbMinRegionMax) + afRefCb
Ref_Cb =0.5 * RegionSize * (afCbMinRegionMax - afCrMinRegionMax) + afRefCr
Min_C = RegionSize * afMinCRegionMax
Max_CSum = RegionSize * afMaxCSumRegionMax
MaxY = RegionSize * afMaxYRegionMax
MinY = RegionSize *afMinYMaxGRegionMax

Ref_Cr + Ref_Cb = afRefCb + afRefCr

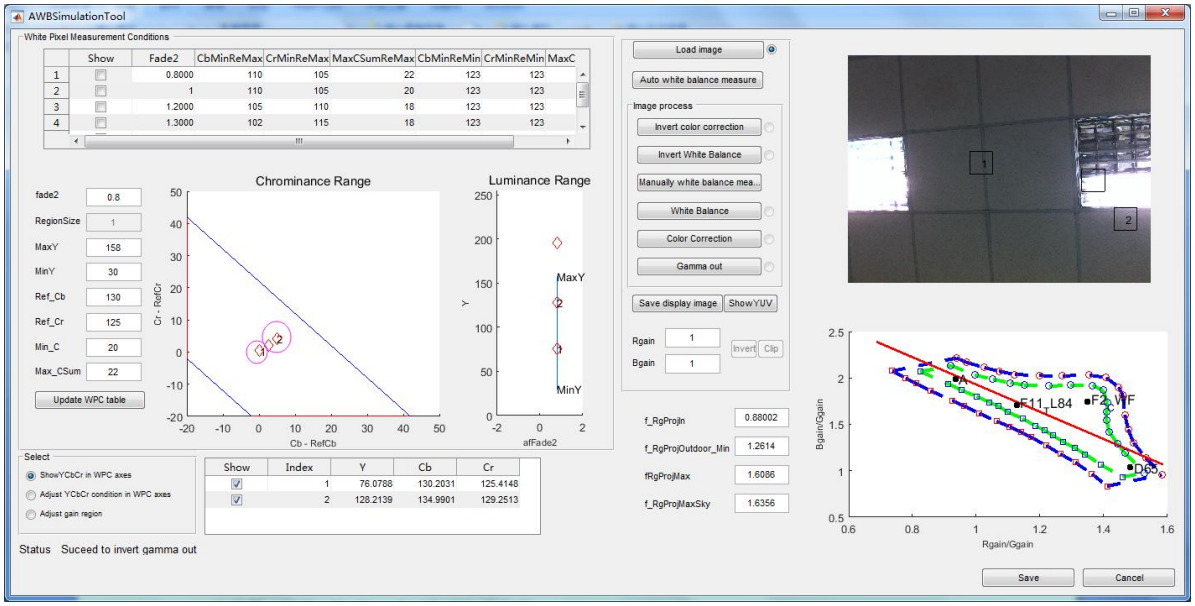
Debug the white points condition of 3xxx platform:

i. Select the radio button of "*Adjust YCbCr condition in WPC axes*" in "*Select*".

ii. *MaxY* is controlled by *afCbMinRegionMax*, *afCbMinRegionMin*, *afCrMinRegionMax* and *afCrMinRegionMin*, cannot be dragged to modify.

iii. *MinY* is fixed, cannot be dragged to adjust.

iv. Drag the blue line with slope equal to -1 in *Chrominance Range* using the mouse will change the value of *Min_CSum*. When click *update WPC table, afMaxCSumRegionMax* and *afMaxCSumRegionMin* of the selected row in the table will be modified.



Picture 6- 20

v. Rhombus 1 and 2 in *Chrominance Range* correspond to the projection of block 1 and 2 of the loaded image. Drag rhombus 1 or 2 in Chrominance Range will change the value of *Ref_Cr*, *Ref_Cb* and *MaxY*. When click *update WPC table*, *afCbMinRegionMax*, *afCbMinRegionMin*, *afCrMinRegionMax* and *afCrMinRegionMin* of the selected row in the table will be modified.

f_CbMin= 0.5*(Ref_Cb-Ref_Cr)-Min_C+128
f_CrMin=0.5*(Ref_Cr-Ref_Cb)-Min_C+128

vi. Drag the red line parallel to the horizontal axis or vertical axis in the *Chrominance Range* using the mouse will change the value of *Min_C* and *MaxY*. When *click update WPC table*, *afCbMinRegionMax*, *afCbMinRegionMin*, *afCrMinRegionMax* and *afCrMinRegionMin* of the selected row in the table will be modified.

The relationship between the white points condition and the parameters of IQXML on 3288

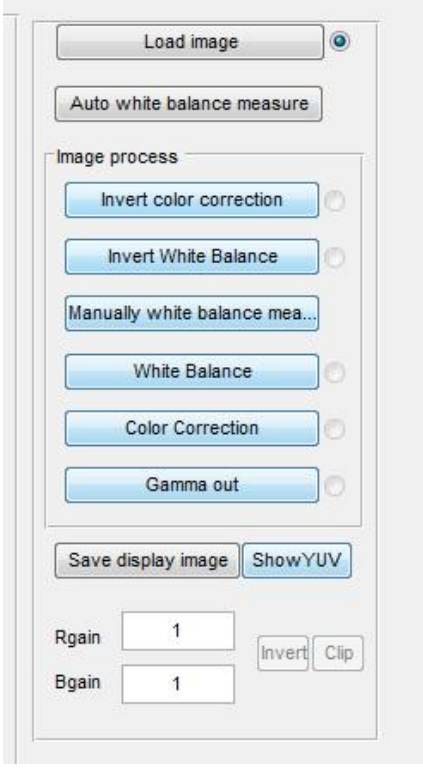
f_CbMin=floor(RegionSize*afCbMinRegi onMax+(1-RegionSize)*afCbMinRegionMin);
f_CrMin=floor(RegionSize*afCrMinRegi onMax+(1-RegionSize)*afCrMinRegionMin);
f_MaxCSum =floor(RegionSize*afMaxCSu mRegionMax+(1-RegionSize)*afMaxCSumRegionM in);

Ref_Cr=floor(0.5*(f_CrMin-f_CbMin)+1 28);
Ref_Cb=floor(0.5*(f_CbMin-f_CrMin)+1 28);
Min_C=floor(-0.5*(f_CrMin+f_CbMin)+1 28);
Max_CSum=round(f_Max CSum);
MinY=30;
MaxY=CalculateMaxY(Ref_Cb,Ref_Cr,Min _C,Max_CSum);

Besides, you can also directly modify the parameters of the white points condition in the textbox. Click *update WPC table* button to update the parameters.

Need to select the option of "*Adjust YCbCr condition in WPC axes*" in *Select* if want to change the white points condition by dragging.

4) Simulation introduction

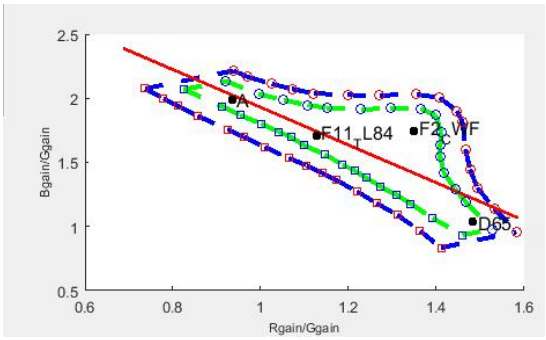


Picture 6- 21

From up to down, there are *Load image*, *Auto white balance measure*, *Image process* and gain value adjustment (*Invert*, *clip*).

Click *Auto white balance measure* automatically will recognize the white points according to the white points condition selected in the table, show the detected white points, calculate the white balance gain, update them to the textbox *Rgain*, *Bgain*, and display as *AWBgain* in the axes of white balance gain range.

The white balance measure on ISP is after color calibration and white balance calibration, and the white balance calibration is executed on raw, so WB gain value measured based on the captured image should be inverted (including invert color calibration and invert white balance) to get WB gain value applied to raw. Besides, actual WB gain value will be clip inside the range of green line as shown below. If WB gain is outside the green line, click *clip* to clip to the green line after, otherwise it will keep unchanged. Current WB gain value is the final value applied to raw.



Picture 6- 22

Image process modules are including *invert color calibration, invert white balance, manual white*

balance measure, white balance, color calibration and gamma out. Except the two modules of white balance measure, the pictures processed by other modules will be updated to the right axes, click the corresponding radio button will recover the data to the corresponding module and update in the axes.

Invert color calibration and *color calibration* need the applied CCM parameters, which you can acquire from the additional information of the captured picture (RV1XXX applicable), or select the CCM corresponding to the captured light source from IQXML (RK3XXX applicable).

Invert white balance operation requires the applied white balance gain, which you can directly acquire from the additional information of the picture, or manually input according to the hint.

The white balance uses *Rgain Bgain* value in the textbox to do the calibration.

Rgain Bgain value can be acquired by *Manually white balance measure* or *auto white balance measure*.

Click *Manual white balance measure* will calculate the white balance gain based on the white blocks selected manually, update to the value in textbox *Rgain Bgain*, and display as *MWBgain* in the axes of white balance gain range. Before manually select the white block, need to select the option of "*Show YCbCr in WPC axes*" in *Select*. Move the mouse on the loaded image, and click the left mouse button to select the block as a white block, the size of the block can be adjusted by scrolling the mouse. After click the *manual white balance*, it will prompt to select some blocks to take part in the white balance gain measure.

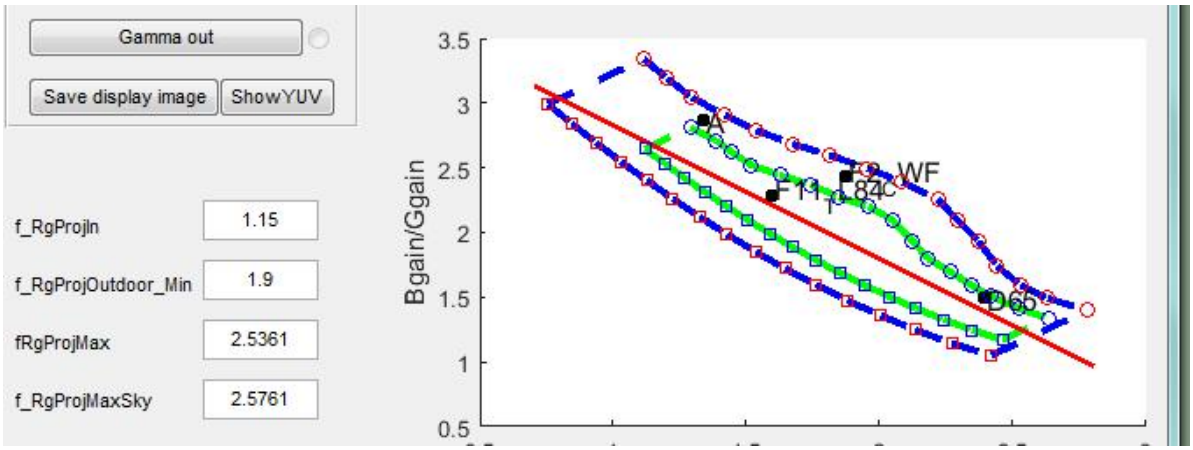
Image process module is designed to obtain white balance picture from bluish or color cast picture by simulation. Execute as following steps:

Invert color calibration-> invert white balance->manual white balance measure->white balance->color calibration.

Invert color calibration and *invert white balance* operation must select the parameters applied to the color cast picture. However the calibration parameters for color calibration should correspond to the parameters of the light source of the picture.

5) Modify the white balance gain range

Select the radio button of "*Adjust gain region*" in *Select*, drag red and blue points to adjust the area, modify the value in the textbox can change the minimum value or maximum value.

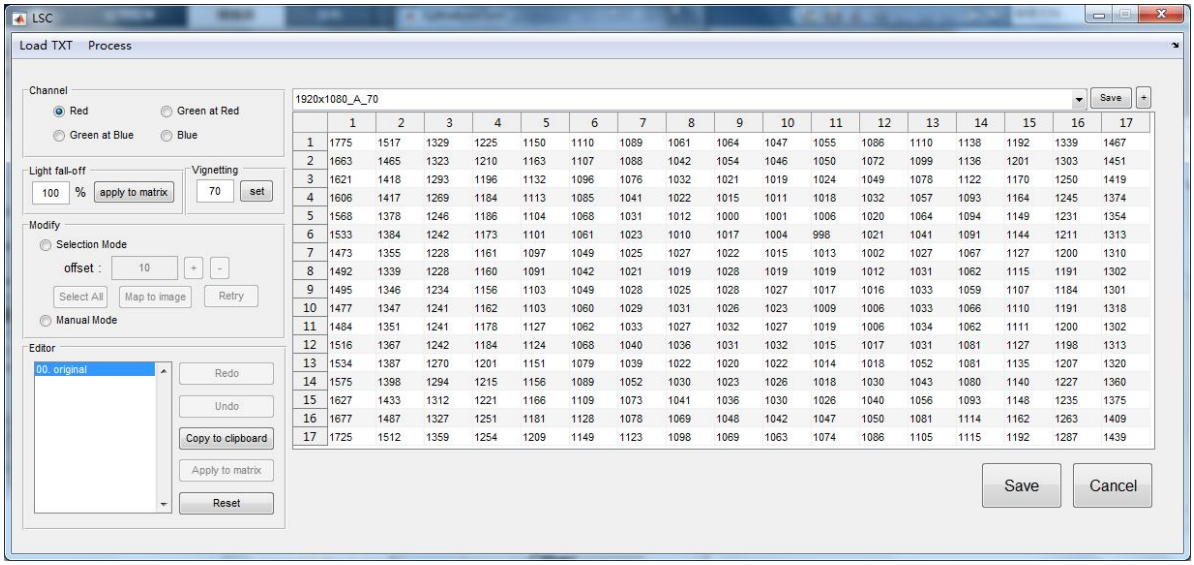


Picture 6- 23

6.3 LSC

6.3.1 Interface

Single click *LSC* button in the main interface will pop up below interface with LSC fine tuning tool:



Picture 6- 24

6.3.2 Modules introduction

（1）LSC matrix

Select the corresponding calibration parameters from the drop-down menu according to different resolution, different light source and different vignetting, and the data in the table will be updated

If the value of the calibration parameters are modified, need to click *Cache* to save current change before select another group parameters from the drop-down menu

Clip "+" in top right corner will add an empty calibration matrix.

Picture 6- 16

Only need to fill in the *Resolution*, *Illumination* and *Vignetting*.

（2）*Channel*

Each group of calibration data has four channels' matrix, and which channel's data will be displayed in the table is decided by the selected channel in *Channel*. In the same group of data, switch channel will not lose the data modification operation.

（3）*Light fall-off*

Adjust value of *Light fall-off* can adjust the calibration effect, and the max value is 100%, which means the brightness of four corners the same to the center. If the value is 70%, the brightness of four corners is around 70% of the center after calibration, same as tuning parameters of compensation 70%

（4）*Vignetting*

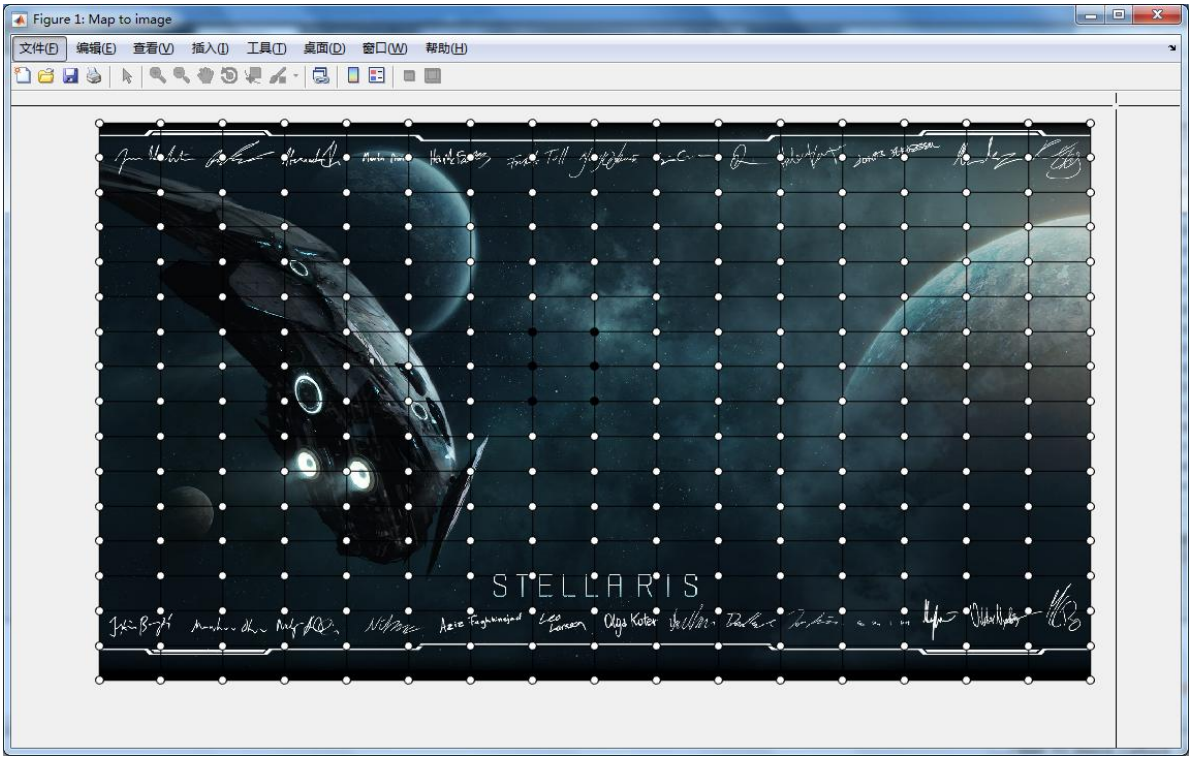
This value is used as vignetting parameter for naming. Recommend to use default value.

（5）*Modify*

It is used to select the way to modify the matrix. *Selection mode* supports to select several data in the table batch modify. And the selected data is marked with green color. After selecting you can use +, - to modify the selected data. *Select All* means all data in the table are selected. Retry means all are unselected. Manual mode supports to manually modify the data in the table one by one. After modifying, data marked with red color means it's bigger than the original value, while blue means smaller than the original value.

（6）*Map to image*

Because directly modify the data of the matrix is too abstract and inaccurate, and in order to which data in table should be modified, this function can map the data location of the matrix into the picture. As shown in Picture 6-26, empty dots correspond to the nodes unselected, and it will change to be filled dot after selected. Close this window, the selected nodes in the matrix will be changed to the selected state as green.



Picture 6- 26

（6）*Editor*

Record all the operations of the matrix, support recall, revert, matrix copy, matrix paste and reset.

（7）*Process-Apply*

Select Bayer array type applied to the picture. Apply current matrix parameters to calibrate loaded raw image.

（8）*Load TXT*

You can load LSC parameters from a txt file separately, if the file's name is the same to existing one, the existing one will be overwrote, otherwise it will create a new group of parameters.

（9）*Save*

Click *Save* to save the modification,. Note, if want to exit, also need to press *Write&Back*, directly close will make all the modifications lost.

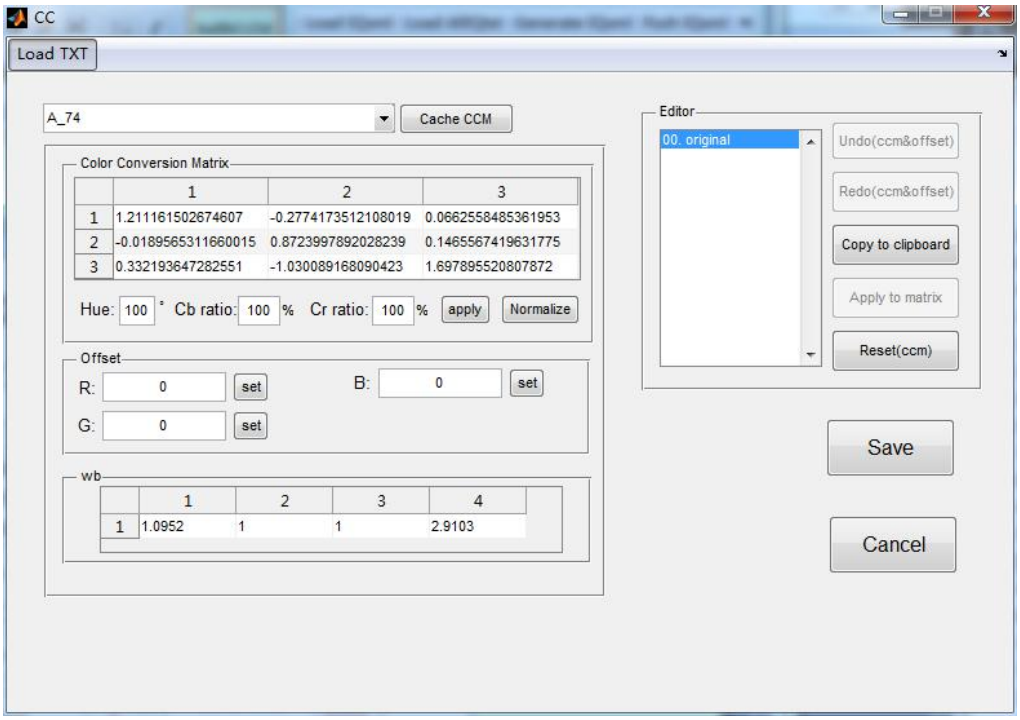
（10）*Cancel*

Do not save current parameters and return to the interface of *Analysis tool*.

6.4 CC

6.4.1 Interface

Single click CC button in Picture 6-4 will pop up the interface of CC fine tuning tool as below:



Picture 6- 27

6.4.2 Modules introduction

(1)*Color Conversion Matrix*

CCM parameters supports to be manually modified directly. The drop-down menu above can select different light sources and different saturation parameters. *Hue* affects the hue, while *Cb ratio* and *Cr ratio* respectively affect Cb and Cr.

(2)*Offset*

Directly modify CCOffset of IQXML.

(3)*Editor*

Record all the operations of the matrix, support recall, revert, matrix copy, matrix paste and reset.

(4)*Load TXT*

You can load CCM parameters of a txt file separately, if the file's name is the same to existing one, the existing one will be overwrote, otherwise it will create a new group of parameters.

(5)Save

Click *Save* to save the modification,. Note, if want to exit, also need to press *Write&Back*, directly close will make all the modifications lost.

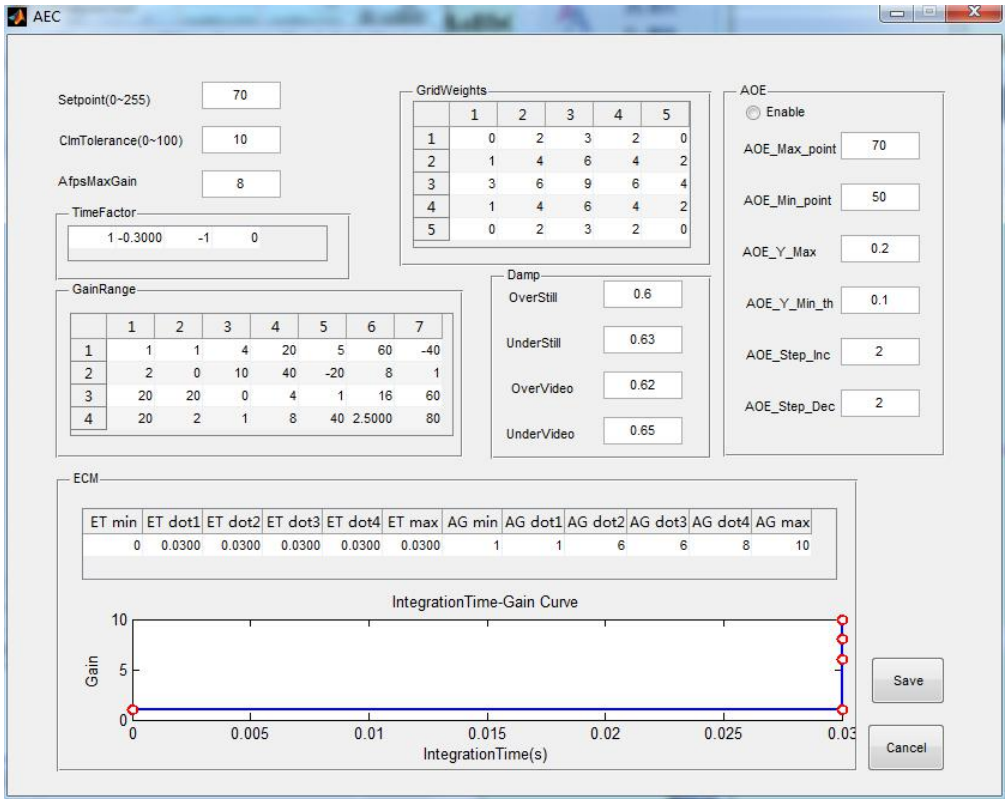
（6）*Cancel*

Do not save current parameters and return to the interface of *Analysis tool*.

6.5 AEC

6.5.1 RV1108 interface

Single click AEC button in Picture 6-4 will pop up the interface of AE fine tuning tool as below:

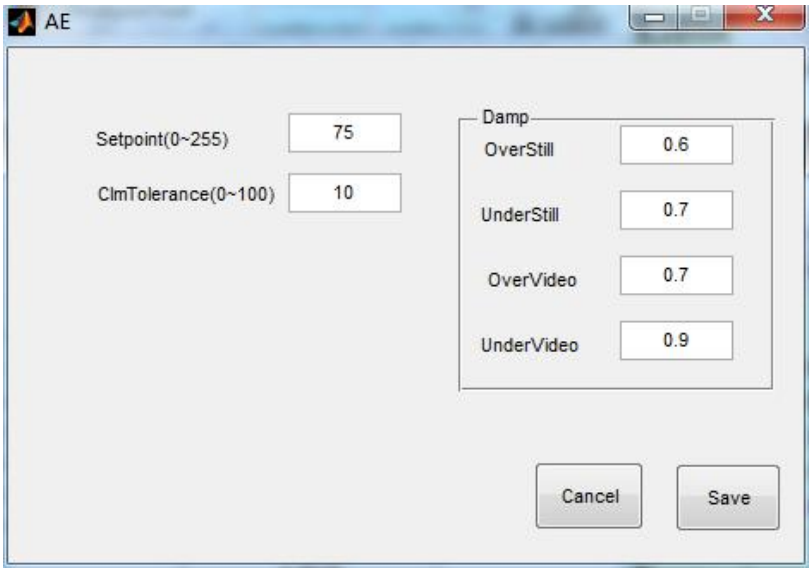


Picture 6- 28

Edit the textbox or the table can modify the corresponding parameters.

EcmTimeDot EcmGainDot of IQXML is the coordinate value of ECM curve points, which is displayed in the table of *ECM* module, and *IntegrationTime-Gain Curve* is the corresponding curve.

6.5.2 Other platform interface

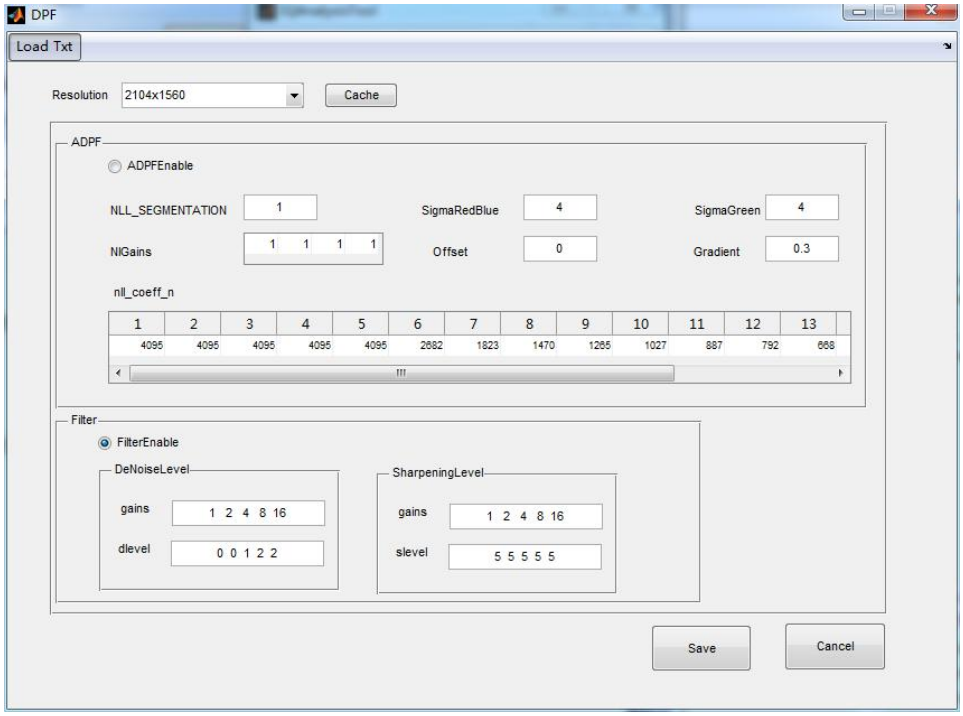


Picture 6- 29

6.6 DPF

6.6.1 RV1108 interface

Single click *DPF* button in Picture 6-4 will pop up the interface of DPF fine tuning tool as below:



Picture 6- 30

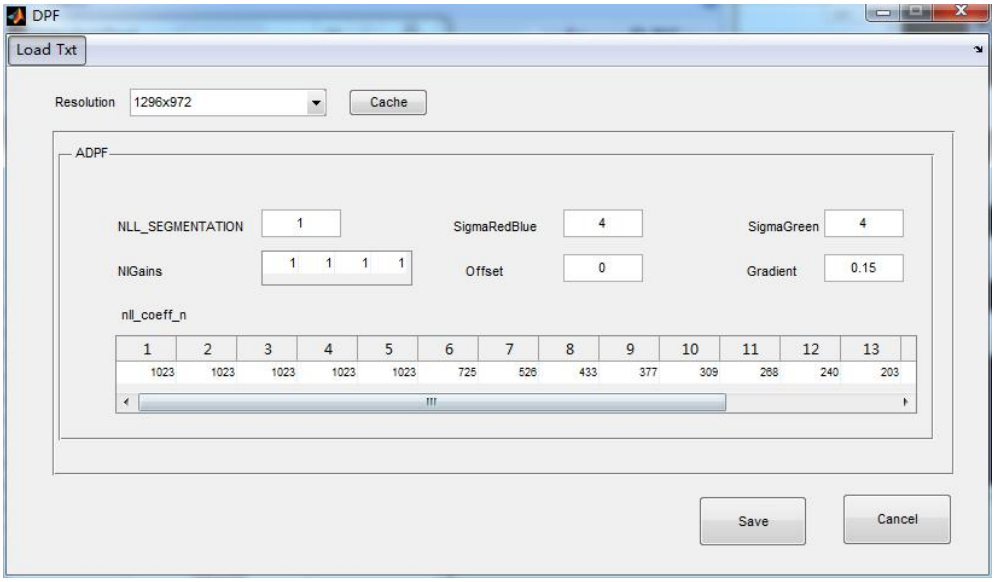
Different *resolutions* can configure different *SharpeningLevel* and *DeNoiseLevel*. You can configure different *SharpeningLevel* and *DeNoiseLevel*. The size of gain is changeable.

If some useful modification is done with current resolution, you must click cache before switching to another resolution.

Click *Save* to save the modifications.

Click *Load Txt* button in the menu bar can load the new DPF tuning parameters.

6.6.2 Other platform interface

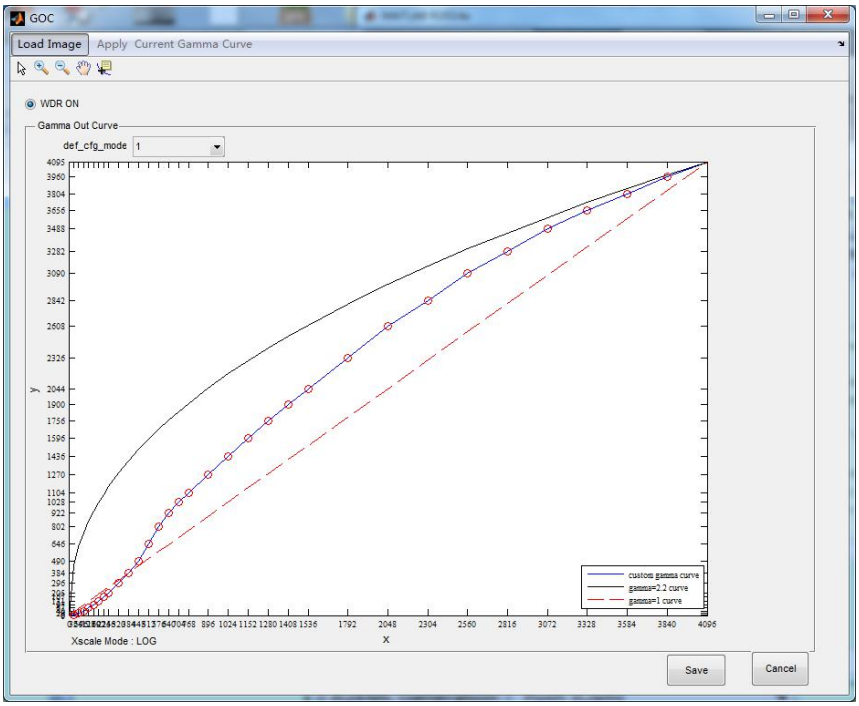


Picture 6- 31

6.7 GOC

6.7.1 Interface

Single click *GOC* button in Picture 6-4 will pop up the following interface of GOC tool :



Picture 6- 32

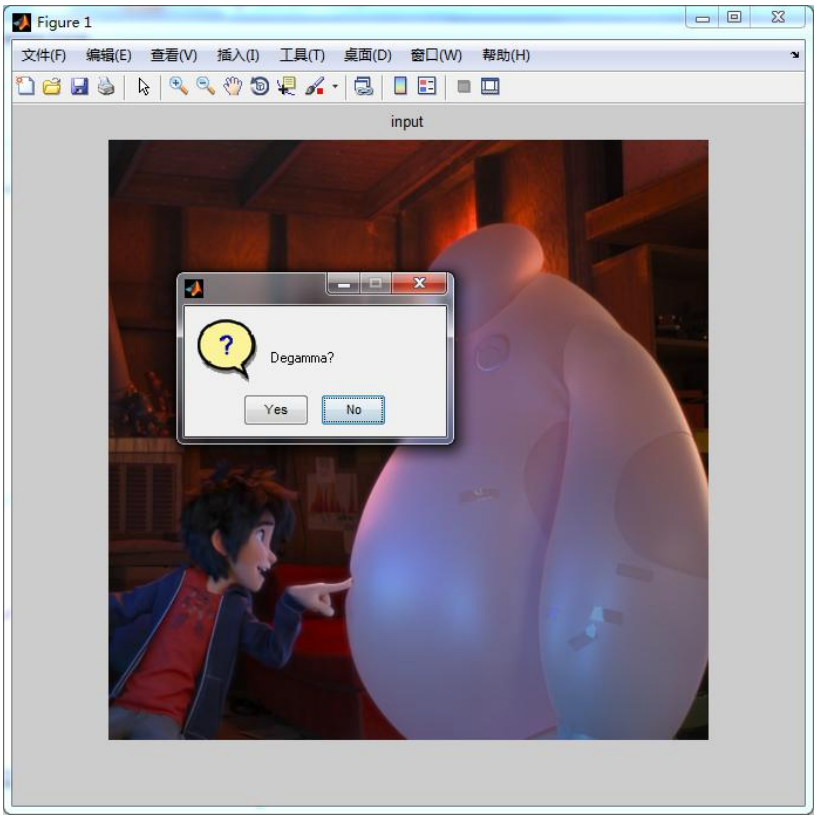
6.7.2 Modules introduction

The interval mode of x axis of Gamma Out curve is the same as LOG logarithm interval mode. The interval of y axis can be modified by dragging the red dots.

If WDR ON radio button is selected, currently curve with red circle dots is used when WDR is enabled, otherwise the gamma curve is used when WDR is disabled.

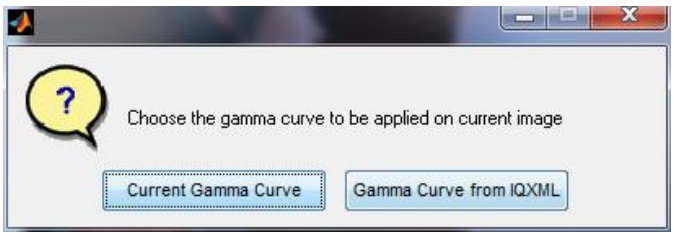
（1）Load Image

Click *Load Image* to load a RGB picture.



Picture 6- 33

Click *Yes* to invert gamma on the image, while click *No* to do nothing. If the following dialog pops up after clicking *Yes*, select the gamma curve to apply on the image.



Picture 6- 34

Current Gamma Curve means the curve that can be dragged in the interface.

Gamma Curve from IQXML means the corresponding curve which is loaded from IQXML.

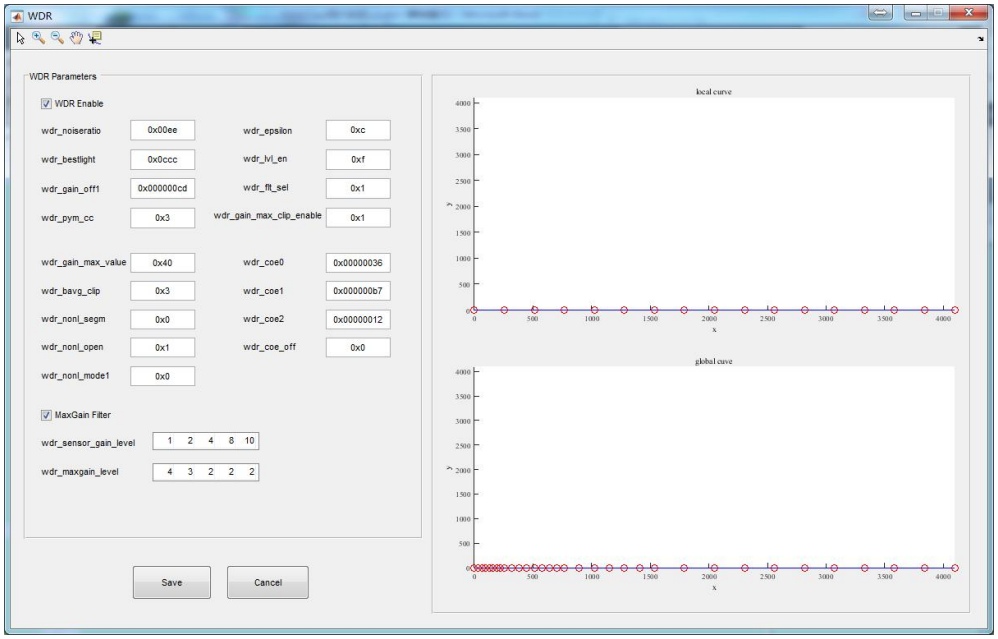
（2）Apply Current Gamma

Click *Apply Current Gamma*, and then it will display the result of gamma calibration after applying the curve.

6.8 WDR

Only RV1108 platform supports this module.

Single click WDR in Picture 6-6, and it will pop up below interface:

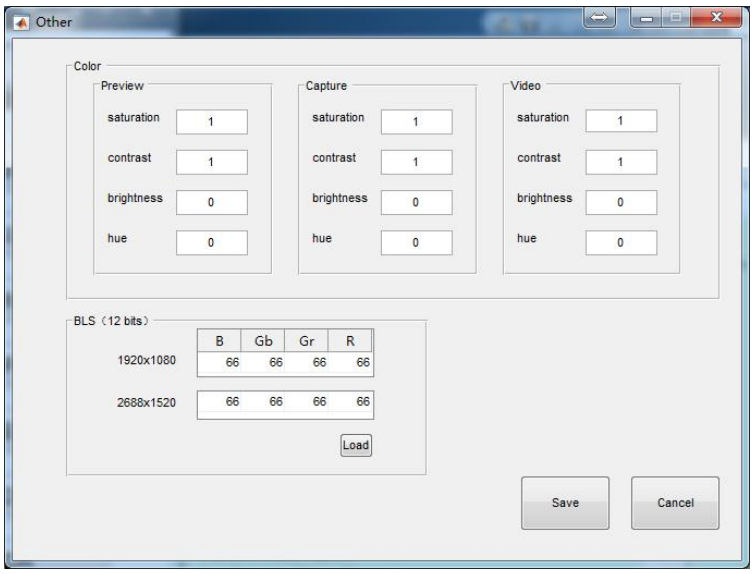


Picture 6- 35

The interval mode of x axis of the curve is LOG logarithm interval mode. The interval of y axis can be modified by dragging the red dots.

6.9 Other

Click *Other* in Picture 6-4, and it will pop up below interface:



Picture 6- 27

Color module can set the color related parameters of *preview*, *capture* and *video* modes. *BLS* module can set the black level value for different resolutions.

7 Tool update log

v1.1.8.1

Details :

1）Respectively compatible with Android7.x and previous and Android8.x and later platforms, fit with XML storage route.

2）Capture Tool fits with capture raw script of RK1808.

3）Get average value of AWB directly from loaded PNG images, cancel the step of loading cc.txt.

4）support XML load and generation of V11 and V10 two versions, when AWB parameters are updated, it will automatically switch to V10 version.

5）Improve the compatibility when error types are used in IQ XML.

v1.1.6a

Please update all the files in the directory of xml, otherwise the tool will not work! ADB related files are also required to be updated.

Details :

1） Improve the capture speed of the capture tool in filter mode, and add the function to calculate the average value or the max value of the specific image area in filter mode.

2） Solve the issue of easy to crash when using the capture tool on RK3XXX platforms.

3） Add the function of PC preview for UVC Camera and quick acquisition of YUV data on RV1XXX platforms.

4） Add the function of gamma out curve fine tuning in Analysis Tool on RK3XXX platforms.

5） Add the function to stop and start video after push IQXML in Analysis Tool.

6） Add the function of debugging AWB white points condition in Analysis Tool.

7） Resolve other bugs.

v1.1.4a

Please update all the files in the directory of xml, otherwise the tool will not work!

Details :

1) fix to support the device number polling in dumpsys

Dumpsys is the raw capture tool of RV1108 platform. Old version of dumpsys doesn’t support the device number polling, so when the device number is changed, it may cause the camera fail to work. Please update to new version as soon as possible.

2) Prefer to use IQXML of the device as the base version of IQXML.

Before Start Capturing and XML Generation, please connect the device to PC, and confirm ADB connection is normal. The tool will search the existing IQXML of the device according to the configuration in Configuration, and use it as the basic template for later capturing and parameters filling once found. If cannot find IQXML when the device is not connected normally or the name in Configuration is configured mistakenly, the tool will use the default IQXML template. The default IQXML doesn't ensure the parameters outside the Calibration are correct, such as AEC, Gamma etc. modules. Need to use Analysis Tool to adjust these modules.

3) The filter mode of Capture Tool allows to adjust the step size of exposure time and gain.

It is not able to modify the step of Gain and Time in the setting of Capture Tool in old version. The fixed step will cause some device with large aperture cannot capture the picture within the appropriate luminance. In order to avoid the Flicker phenomenon produced by 50Hz AC source, we recommend use 10ms as Time default value.

4) Ask if need to load to the device after XML generation finishes.

5) Not easy to be influenced by ADB disconnection when loading XML.

6) Add the configuration of capturing CC background picture in Capture Tool.

7) Use Bayer order configured in Configuration in the file name of the generated parameters.

8) Fix the issue that it may prompt no parameters to be found when loading CC or LSC when a new light source not existing in the base version of IQXML appears in Tuning Tool.

9) Add the function of Image-mapping in LSC Tuning of Analysis Tool, which can modify the value of LSC matrix according to the actual picture.

11) When Tuning Tool is generating XML, if it detects CC or LSC or the parameters are missing, it will automatically generate the parameters and inform the user.

13) Fix the resolution error that may occur when using the default IQXML.

15) Change the csv file used in the tool to .mat file, in order to resolve the issue that in some environment it may not be able to read the csv file properly.

16) It will warn the user when the parameters file generated by Tuning Tool may overwrite the original parameters.