

**MEDIATEK**

CONFIDENTIAL B

# Basic Tuning Flow – AWB Calibration

# AWB calibration

## ➤ Module AWB light source area tuning

- New module must calibrate the location of white points in each color temp.
- Tuning environment must have following light source or the result won't be correct.
  - a) D65
  - b) DNP
  - c) CWF
  - d) TL84
  - e) A
  - f) Horizon
  - g) DF
  - h) Strobe

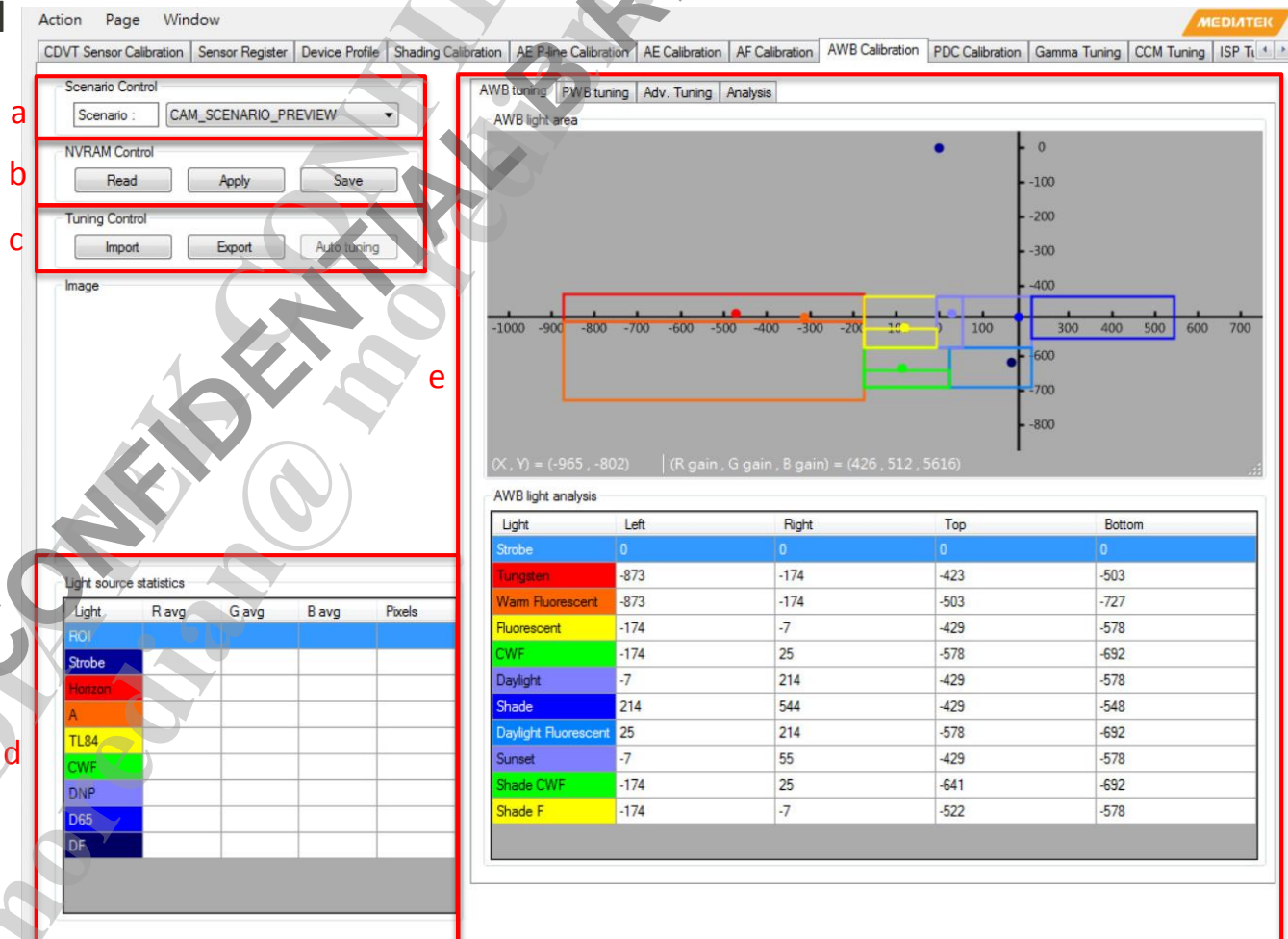
## ➤ AWB Preference Tuning

- CCT can finetune the preference color in each color temp.
- Each color temp. can be mapping a set of Preference Gain.
  - Tungsten / Warm Fluorescent / Shade : Offset and Preference Gain
  - Daylight / CWF / Fluorescent / Daylight Fluorescent : Only Preference Gain

# AWB calibration

## ➤ AWB tuning introduction

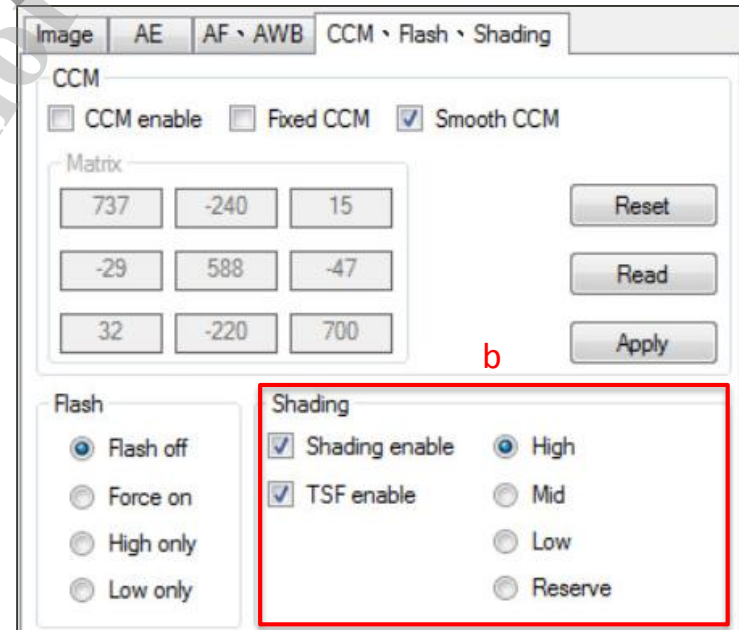
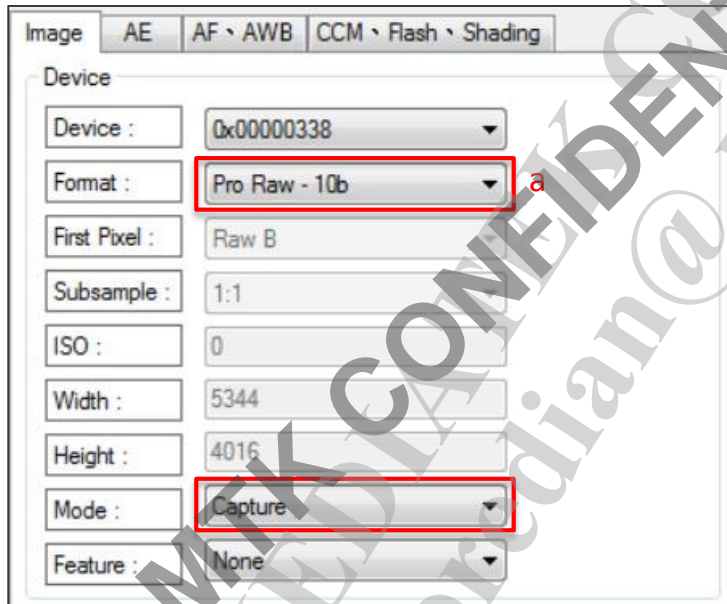
- Scenario Control
  - Import csv file
  - Export csv file
- NVRAM I/O control
- Tuning control
  - Import
  - Export
  - Auto tuning
- Light source
  - List the RGB statics of ROI in RAW
- Tuning area
  - Main tuning area of AWB, PWB etc.



# AWB calibration

## ➤ AWB calibration flow

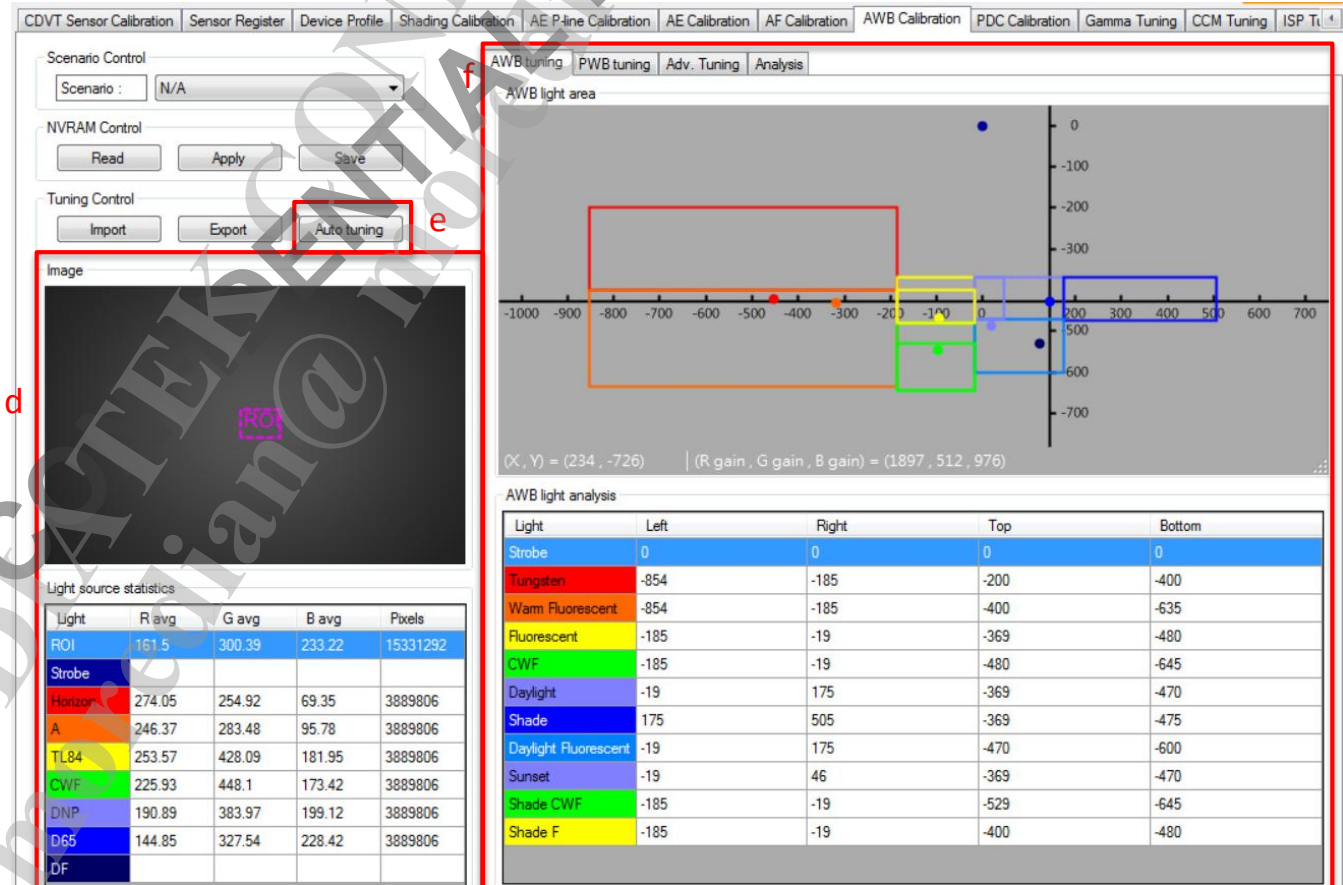
- Select capture setting
  - Set format to “Pro Raw 10b”
  - Set mode to “Capture”
- Enable Shading (Enable TSF if the phone already adapts to TSF Parameter and it's has been calibrated)
- Capture gray card picture and over 90% area.



# AWB calibration

## ➤ AWB calibration flow

- Select a ROI (about 10%), then click the mapping color to update current RGB statics. Repeat until all light source have been updated.
- Click "Auto Tuning"
- Tuning result is shown in AWB tuning page.



# AWB calibration

## ➤ AWB preference Tuning

- Preference Color
  - Tungsten, Warm Fluorescent, Shade, Blue Sky
  - Modify the offset value to finetune the specified Preference Color.
- Preference Gain
  - Each light source can be finetuned by specified LV

Preference Color

Light	Offset
Tungsten	6078
Warm Fluorescent	6078
Shade	909

Preference Gain

Light Source: Strobe

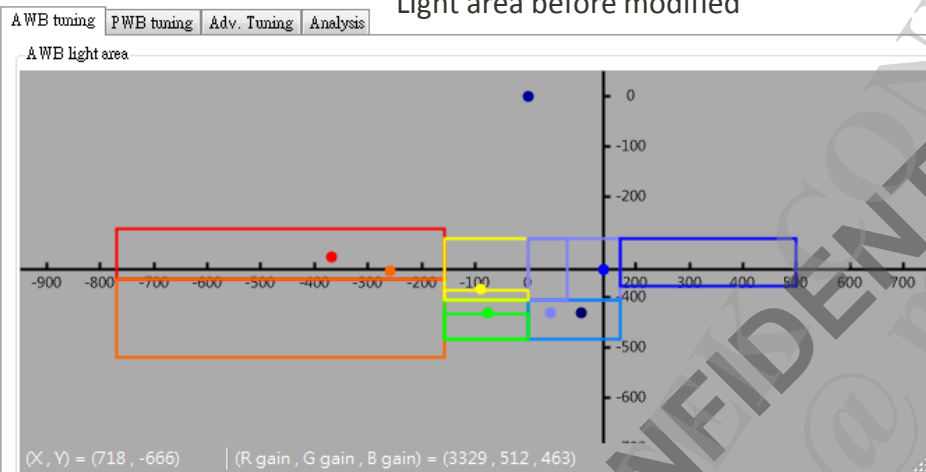
LV	R gain	G gain	B gain
LV0	512	512	512
LV1	512	512	512
LV2	512	512	512
LV3	512	512	512
LV4	512	512	512
LV5	512	512	512
LV6	512	512	512
LV7	512	512	512
LV8	512	512	512
LV9	512	512	512
LV10	512	512	512
LV11	512	512	512
LV12	512	512	512
LV13	512	512	512
LV14	512	512	512
LV15	512	512	512
LV16	512	512	512

# AWB calibration

## ➤ AWB light area tuning

- Modify the rectangle for finetune of calibration result.
- Left : red, Right : blue, Top : purple, Bottom : green

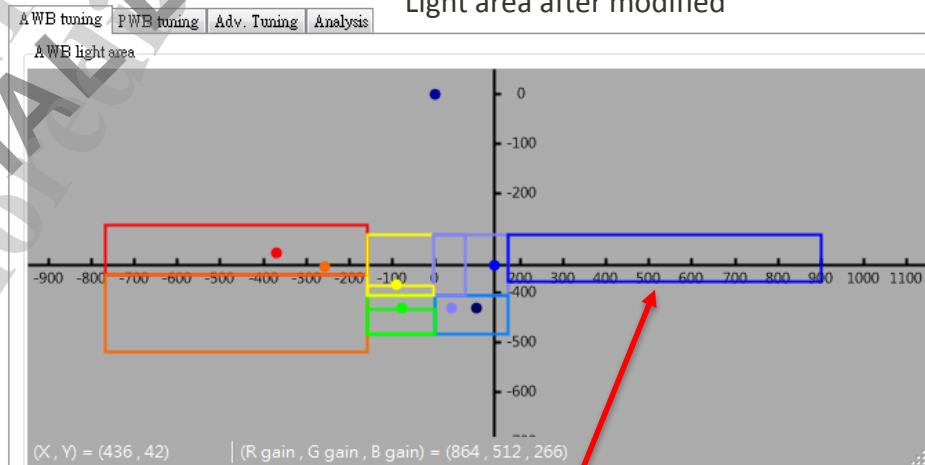
Light area before modified



AWB light analysis

Light	Left	Right	Top	Bottom
Strobe	0	0	0	0
Tungsten	-769	-157	-264	-365
Warm Fluorescent	-769	-157	-365	-519
Fluorescent	-157	-2	-284	-406
CWF	-157	0	-406	-484
Daylight	-2	170	-284	-406
Shade	170	500	-284	-378
Daylight Fluorescent	0	170	-406	-484
Sunset	-2	72	-284	-406
Shade CWF	-157	0	-433	-484
Shade F	-157	-2	-386	-406

Light area after modified



AWB light analysis

Light	Left	Right	Top	Bottom
Strobe	0	0	0	0
Tungsten	-769	-157	-264	-365
Warm Fluorescent	-769	-157	-365	-519
Fluorescent	-157	-2	-284	-406
CWF	-157	0	-406	-484
Daylight	-2	170	-284	-406
Shade	170	900	-284	-378
Daylight Fluorescent	0	170	-406	-484
Sunset	-2	72	-284	-406
Shade CWF	-157	0	-433	-484
Shade F	-157	-2	-386	-406



# AWB calibration

➤ camera\_awb\_tuning\_para\_\$scenario\_\$sensor.h

AWB Calibration Data

```
// AWB NVKAM
// rCalGain (calibration gain: 1.0 = 512)
0, // uR
0, // uG
0, // uB
},
// rDefGain (Default calibration gain: 1.0 = 512)
0, // uR
0, // uG
0, // uB
},
// rDESGain (D65 WB gain: 1.0 = 512)
896, // uR
512, // uG
535, // uB
},
// Original XY coordinate of AWB light source
// Horizon
-427, // uX
-387, // uY
},
// A
-280, // uX
-385, // uY
},
// TL84
-106, // uX
-372, // uY
},
// CWF
-64, // uX
-494, // uY
},
// DNP
65, // uX
-356, // uY
},
// D65
219, // uX
-258, // uY
},
// D75
240, // uX
-291, // uY
},
// DF
0, // uX
0, // uY
},
}
```

AWB XY Domain Info

```
// Rotated XY coordinate of AWB light source
// Horizon
-505, // uX
-281, // uY
},
// A
-361, // uX
-313, // uY
},
// TL84
-188, // uX
-339, // uY
},
// CWF
-174, // uX
-468, // uY
},
// DNP
-17, // uX
-362, // uY
},
// D65
165, // uX
-302, // uY
},
// D75
168, // uX
-339, // uY
},
// DF
0, // uX
0, // uY
},
// Rotation matrix parameter
13, // uRotationAngle
125, // uRH11
23, // uRH12
-29, // uRH21
125, // uRH22
},
// Daylight locus parameter
-207, // uSlopeNumerator
128, // uSlopeDenominator
},
}
```

AWB Light Source Area

```
// AWB light area
// Tungsten
-238, // uRightBound
-888, // uLeftBound
-247, // uUpperBound
-347, // uLowerBound
},
// Warm fluorescent
-238, // uRightBound
-888, // uLeftBound
-347, // uUpperBound
-467, // uLowerBound
},
// Fluorescent
-67, // uRightBound
-238, // uLeftBound
-274, // uUpperBound
-403, // uLowerBound
},
// CWF
-67, // uRightBound
-238, // uLeftBound
-403, // uUpperBound
-518, // uLowerBound
},
// Daylight
200, // uRightBound
-67, // uLeftBound
-222, // uUpperBound
-387, // uLowerBound
},
// Shade
522, // uRightBound
200, // uLeftBound
-259, // uUpperBound
-419, // uLowerBound
},
// Daylight Fluorescent
150, // uRightBound
20, // uLeftBound
-387, // uUpperBound
-500, // uLowerBound
},
}
```

PWB Light Source Area

```
// PWB light area
// Reference area
522, // uRightBound
-888, // uLeftBound
-222, // uUpperBound
-518, // uLowerBound
},
// Daylight
200, // uRightBound
-67, // uLeftBound
-222, // uUpperBound
-387, // uLowerBound
},
// Cloudy daylight
248, // uRightBound
200, // uLeftBound
-259, // uUpperBound
-419, // uLowerBound
},
// Shade
408, // uRightBound
248, // uLeftBound
-259, // uUpperBound
-419, // uLowerBound
},
// Twilight
-67, // uRightBound
-227, // uLeftBound
-222, // uUpperBound
-387, // uLowerBound
},
// Fluorescent
205, // uRightBound
-238, // uLeftBound
-289, // uUpperBound
-518, // uLowerBound
},
// Warm fluorescent
-238, // uRightBound
-411, // uLeftBound
-289, // uUpperBound
-518, // uLowerBound
},
// Incandescent
-238, // uRightBound
-411, // uLeftBound
-222, // uUpperBound
-387, // uLowerBound
},
// Gray World
10000, // uRightBound
-10000, // uLeftBound
10000, // uUpperBound
-10000, // uLowerBound
},
}
```

AWB XY Domain Info



# AWB calibration

➤ camera\_awb\_tuning\_para\_\$scenario\_\$sensor.h

PWB Default Gain

```
// PWB default gain
// Daylight
825, // u4R
512, // u4G
607, // u4B
},
// Cloudy daylight
990, // u4R
512, // u4G
503, // u4B
},
// Shade
1083, // u4R
512, // u4G
436, // u4B
},
// Twilight
687, // u4R
512, // u4G
814, // u4B
},
// Fluorescent
880, // u4R
512, // u4G
741, // u4B
},
// Warm fluorescent
676, // u4R
512, // u4G
1133, // u4B
},
// Incandescent
589, // u4R
512, // u4G
1040, // u4B
},
// Gray World
512, // u4R
512, // u4G
512, // u4B
},
}
```

AWB Preference Gain

```
// AWB preference color
// Tungsten
50, // i4SliderValue
4680, // i4OffsetThr
},
// Warm fluorescent
50, // i4SliderValue
4690, // i4OffsetThr
},
// Shade
50, // i4SliderValue
536, // i4OffsetThr
},
// Daylight WB gain
788, // u4R
512, // u4G
648, // u4B
},
// Preference gain: tungsten
512, // u4R
512, // u4G
512, // u4B
},
// Preference gain: warm fluorescent
512, // u4R
512, // u4G
512, // u4B
},
// Preference gain: fluorescent
512, // u4R
512, // u4G
512, // u4B
},
// Preference gain: CWF
512, // u4R
512, // u4G
512, // u4B
},
// Preference gain: daylight
512, // u4R
512, // u4G
512, // u4B
},
// Preference gain: shade
512, // u4R
512, // u4G
512, // u4B
},
// Preference gain: daylight fluorescent
512, // u4R
512, // u4G
512, // u4B
},
}
```

CCT Estimation: 各光源的估計色溫

```
// CCT estimation
// CCT
2300, // i4CCT[0]
2850, // i4CCT[1]
4100, // i4CCT[2]
5100, // i4CCT[3]
6500, // i4CCT[4]
7500, // i4CCT[5]
},
// Rotated X coordinate
-660, // i4RotatedXCoordinate[0]
-512, // i4RotatedXCoordinate[1]
-343, // i4RotatedXCoordinate[2]
-170, // i4RotatedXCoordinate[3]
0, // i4RotatedXCoordinate[4]
13, // i4RotatedXCoordinate[5]
},
}
```

# Face assist reference target Calibration

- Face Assisted AWB need to refer different lightsource Face XY target. Different FaceXY reference need to be calibrated.

```
// i4RefTargetThr
{
    // Ref_Low      Ref_Mid      Ref_High
    {{4095, 4095}, {4095, 4095}, {4095, 4095}}, // STROBE
    {{-602, -292}, {-602, -292}, {-602, -292}}, // HORIZON
    {{-449, -304}, {-449, -304}, {-449, -304}}, // A
    {{-249, -397}, {-249, -397}, {-249, -397}}, // TL84
    {{-241, -485}, {-241, -485}, {-241, -485}}, // CWF
    {{-123, -296}, {-123, -296}, {-123, -296}}, // DNP
    {{-3, -307}, {-3, -307}, {-3, -307}}, // D65
    {{-6, -431}, {-6, -431}, {-6, -431}}, // DF
},
```

## ➤ Step

1. Use AWB golden and capture different light source standard face skin card jpeg. You should use the same light box with Normal AWB calibration.



# Face assist reference target Calibration

## ➤ Step

2. Use DP and get ORIG\_FACE\_XR/YR in different light source

AWB\_TAG\_FACEAST\_ORIG\_FACE\_XR -288  
AWB\_TAG\_FACEAST\_ORIG\_FACE\_YR -383

3. Face Low/mid/high is different target in different luminance, designed for different human skin(Black/yellow/white), we use the same setting as default. If you need to calibrate different skin color, you need to set a proper threshold.

Reference Target																
1	Mode	100	Coef_A	100	Coef_B	32	ThrLow	64	ThrMid	96	ThrHigh					
	Strobe	Horizon	A	TL84	CWF	DNP	D65	DF								
Tolerance	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Face Low	4095	4095	-602	-292	-449	-304	-249	-397	-241	-485	-123	-296	-3	-307	-6	-431
Face Mid	4095	4095	-602	-292	-449	-304	-249	-397	-241	-485	-123	-296	-3	-307	-6	-431
Face High	4095	4095	-602	-292	-449	-304	-249	-397	-241	-485	-123	-296	-3	-307	-6	-431
Pref. Gain	512	512	512	512	512	512	512	512	512	512	512	512	512	512	512	512

# ParaConverter Introduction

➤ **Prepare: Reference Phone + Tuning Phone(awb golden),**

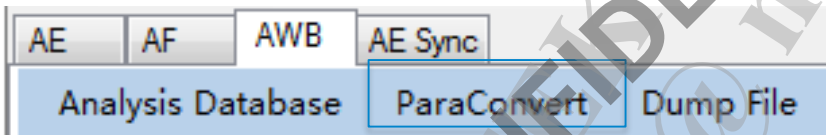
➤ **Step:**

1) 2 Phones should do AWB calibration in the same light box, the same light source.

Reference Phone Parameters: Reference Nvram

Tuning Phone Parameters: Target Nvram

2) Open Analyzer Tool, and choose the AWB→ParaConvert



3) Choose Reference Nvram and Target Nvram che click “Transfer”



# ParaConverter Introduction

## ➤ Step:

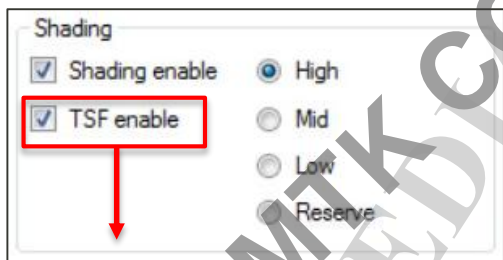
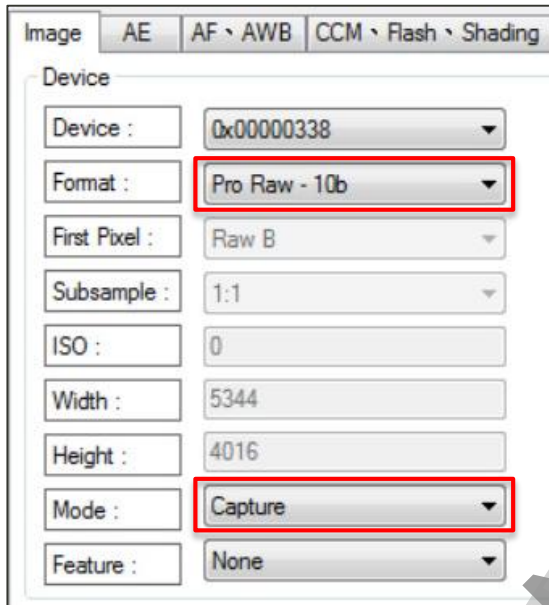
4) “Target\_awb\_custom.cpp” will be generated in Desktop, this is the New AWB Tuning parameter for the Tuning Phone.

## Note:

- a. ParaConverter only supports Same platform conversion
- b. if you need to Convert parameters from P23 To P60, first of all, you need to transfer P23 Parameters to P60 Parameters, new parameters should be Default off.

# Verify AWB calibration data

- Verify AWB calibration data flow



Enable TSF if the phone support TSF

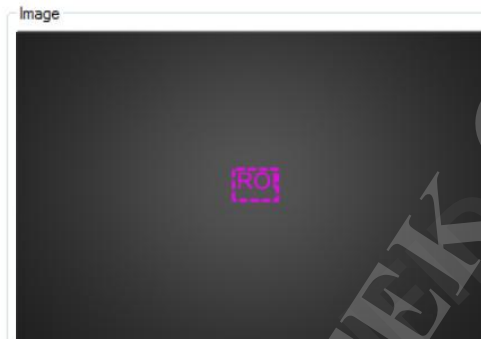
- Press “AWB Default” in Common Control Dialog.
  - Disable AWB and set it to 1x Gain.
  - Disable CCM/PCA/Saturation
- Set up Capture Setting.
  - Set Format to **Process Raw**.
  - Set Mode to Capture.
- Set up correct Shading Table.
  - Select “High” temperature when shooting D65/D75/DNP.
  - Select “Mid” temperature when shooting CWF/TL84.
  - Select “Low” temperature when shooting A Horizon.
- Set up correct Shading Table.
  - If the phone already adapts to TSF Parameter, use **TSF** for tuning.



# Verify AWB calibration data

- Verify AWB calibration data flow

- After taking a picture, frame an ROI area in the picture and fill it to the corresponding light source of EXCEL and CCT.  
(3A\_Calibration\_Check\_Report.xlsx)
- Repeat step B, C, D and E.



Light source statistics

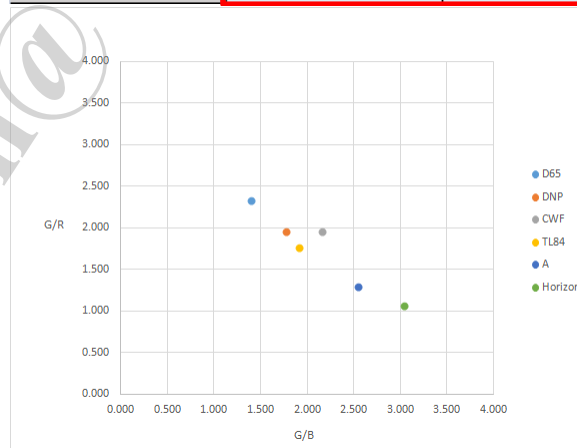
Light	R avg	G avg	B avg	Pixels
ROI	161.5	300.39	220.22	15331292
Strobe				
Horizon	274.05	254.92	69.35	3889806
A	246.37	283.48	95.78	3889806
TL84	253.57	428.09	181.95	3889806
CWF	225.93	448.1	173.42	3889806
DNP	190.89	383.97	199.12	3889806
D65	144.85	327.54	228.42	3889806
DF				

EXCEL verify AWB calibration data

Lightsource	R	G	B
D65	72.2	167.7	119.9
DNP	104.4	203	114.4
CWF	88	171.7	79.5
TL84	88.4	155.7	81.4
A	128.2	164.8	64.6
Horizon	142.4	149.8	49.2

Result PASS

TRUE



# Verify AWB calibration data

- Verify AWB image data
  - Take photos in 6 specified light sources to check the statistic data is locate on the right position or not (Debug parser can check AWB statistic data located in AWB windows.)

