CONFIDENTIAL B

Basic Tuning Flow – AF Calibraion

Outline

- AF HW threshold
- AF Table
- Posture Compensation
- Laser mapping table
- Zoom effect calibration
- Subjective check

AF Calibration

- The items are as follows:

	Item	Test Scene	Test Distance	Limit
1	AF HW threshold	24 color chart	-	-
2	AF Table	A high contrast scene, e.g. Siemens star chart, ISO12233 chart	Refer following pages	-
3	Posture Compensation	Siemens star chart	3M 、10 cm	-
4	Laser mapping table	A high contrast scene, e.g. Siemens star chart, ISO12233 chart	10 cm, 11 cm, 12 cm, 14 cm, 16 cm, 18 cm, 21 cm, 24 cm, 27 cm, 30 cm, 34 cm, 38 cm, 42 cm, 46 cm, 50 cm, 60 cm, … , laser maximum effective distance	-

HW Threshold – Environment Setup

- Target distance: depends on “color checker size should be about 80% of the screen”
- Tool: Camera EM mode
- Test target: Color checker
- Using tripod @ 300 lux

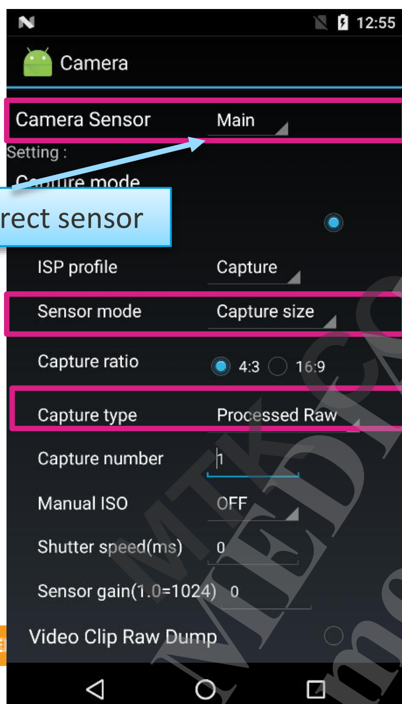
HW Threshold – Get Calibration Data

1. Enter camera EM mode
   - In Dailer APP, enter *#*#3646633#*#*
   - Hardware Testing -> Camera
2. Apply below settings

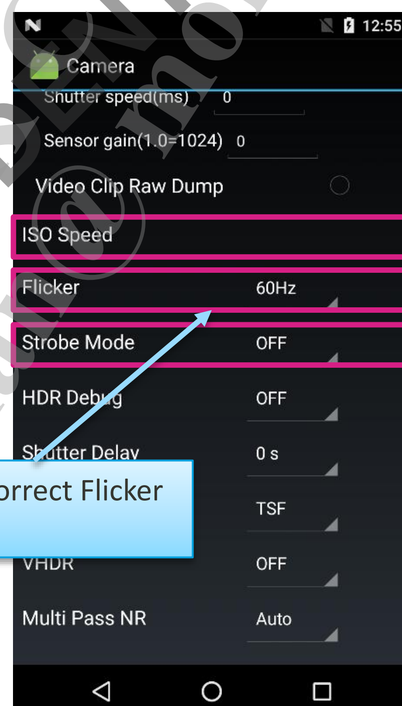
ISO的选择：从ISO100到手机支持的最大ISO，共支持8个档的ISO，可根据实际情况选择。

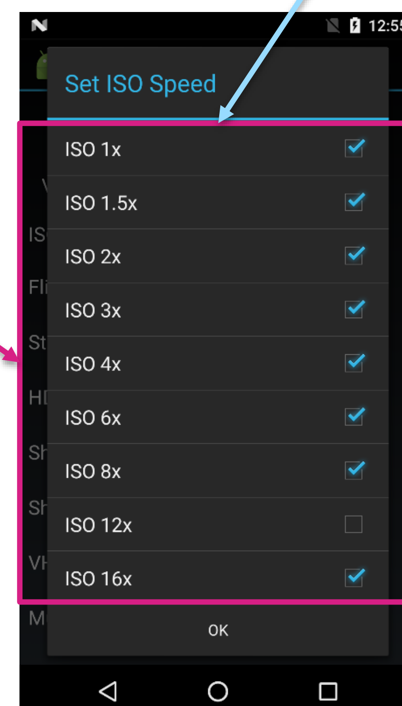
Select 1x, 1.5x, 2x, 3x, 4x, 6x, 8x, 16x

Select correct sensor



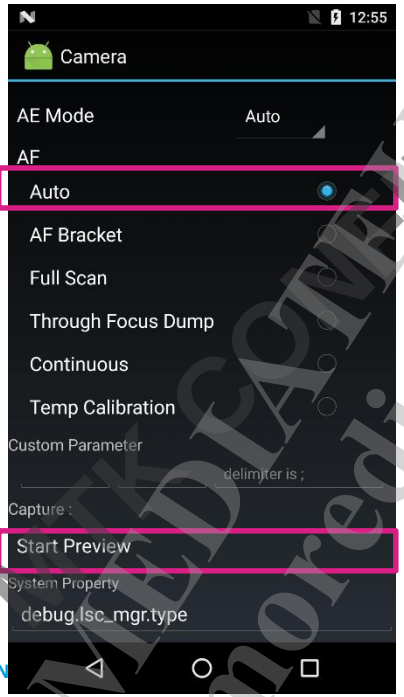
Select correct Flicker mode





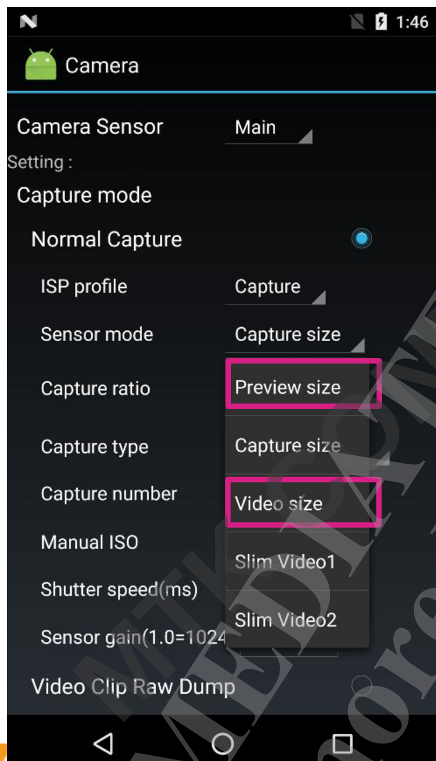
HW Threshold – Get Calibration Data

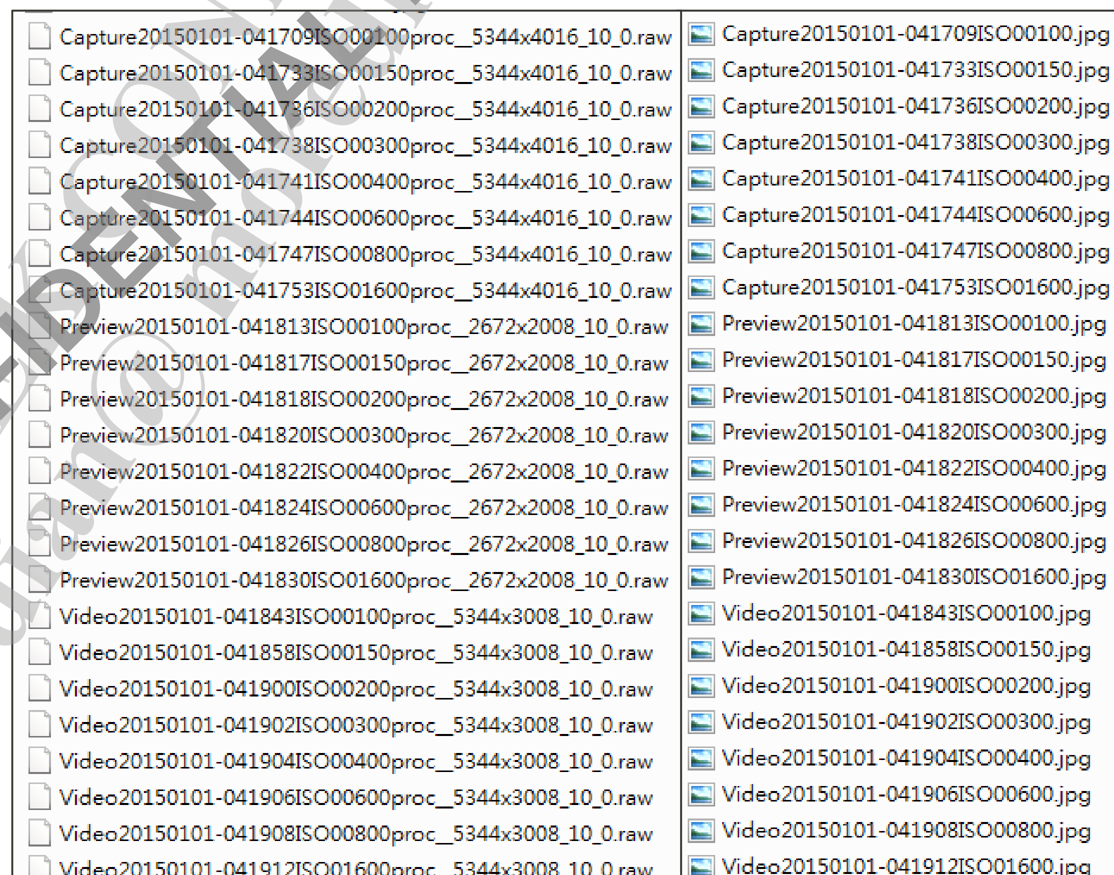
3. Click “Start Preview” to enter capture window
4. Make sure color checker is about 80% of the screen, then press “Capture”



HW Threshold – Get Calibration Data

5. Repeat step 1~4 two times, but the sensor mode should be configured as “Preview size” and “Video Size” respectively
6. The raw & jpeg files will be generated



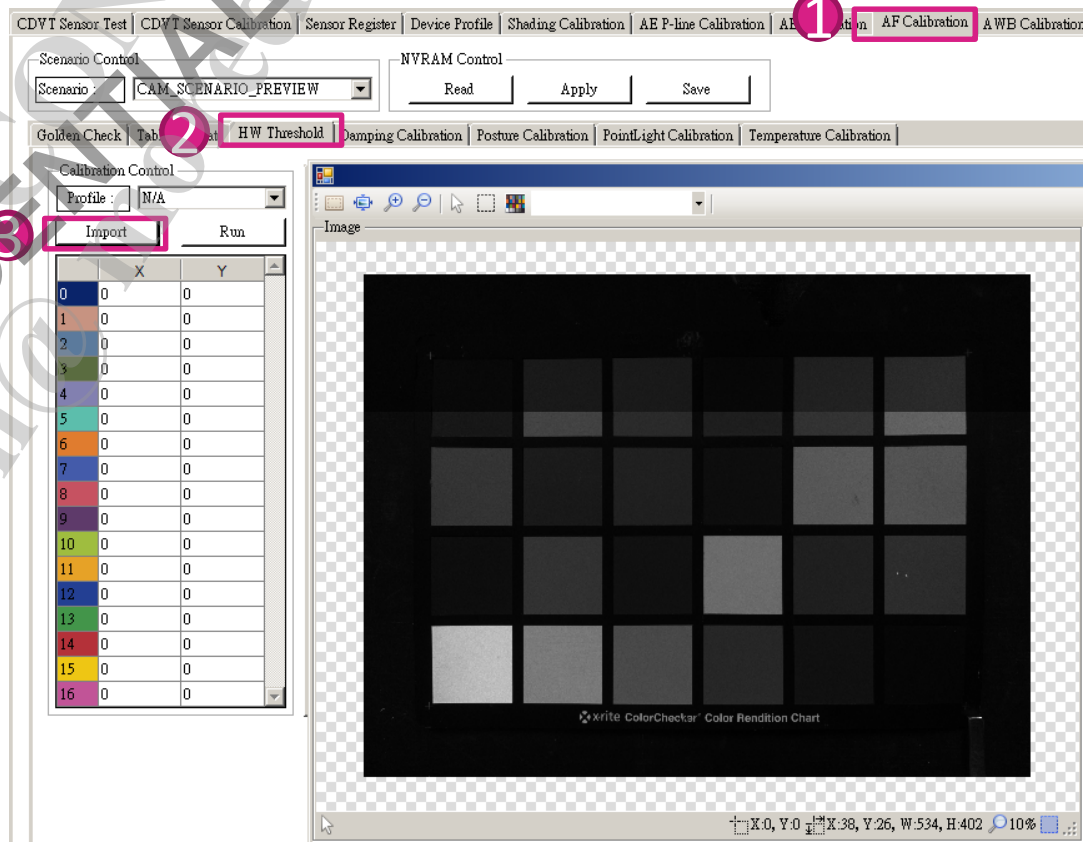


HW Threshold – Generate Parameter

1. Get calibration data from phone
   - Connect phone to PC
   - Open command window, and use below command to get data
     - adb pull /sdcard/DCIM/CameraEM

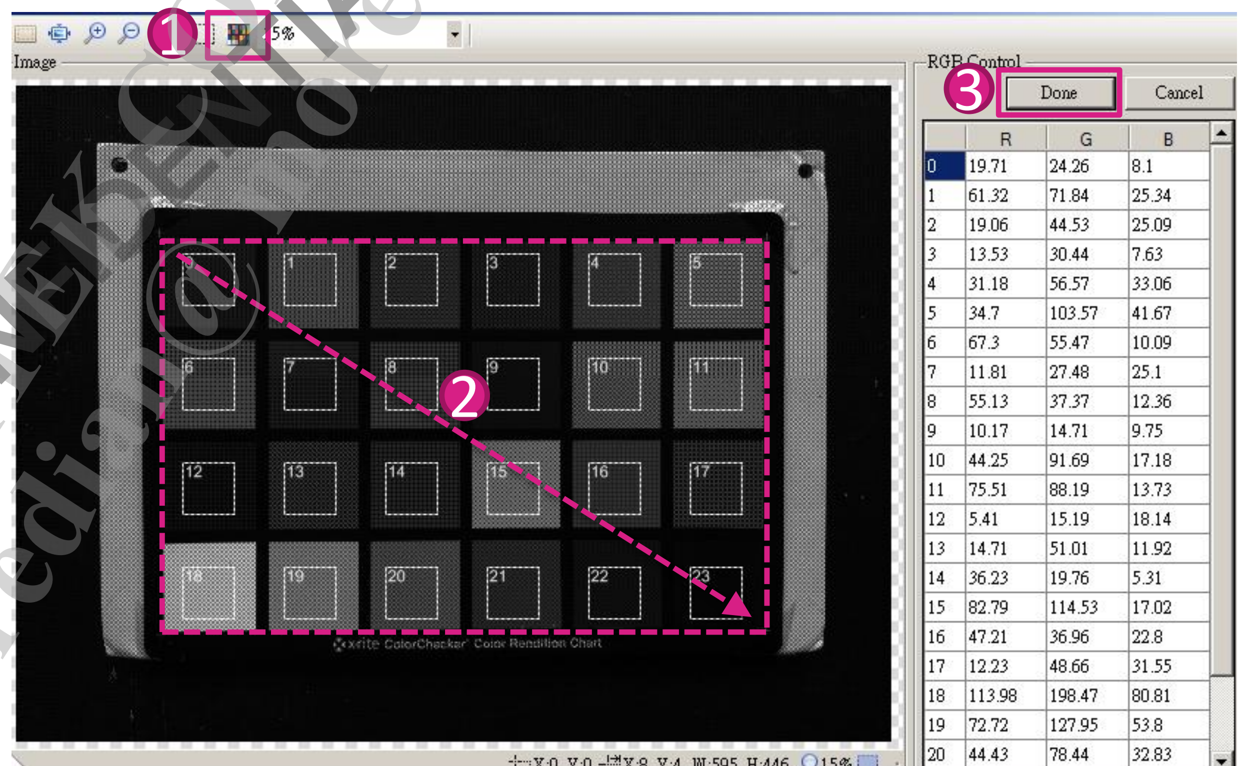
HW Threshold – Generate Parameter

2. Open CCT, goes to “AF Calibration” -> “HW Threshold”
3. Click “Import” to select the 8 raw files of capture mode (Capture*.raw), and the 1st will be shown as popup window



HW Threshold – Generate Parameter

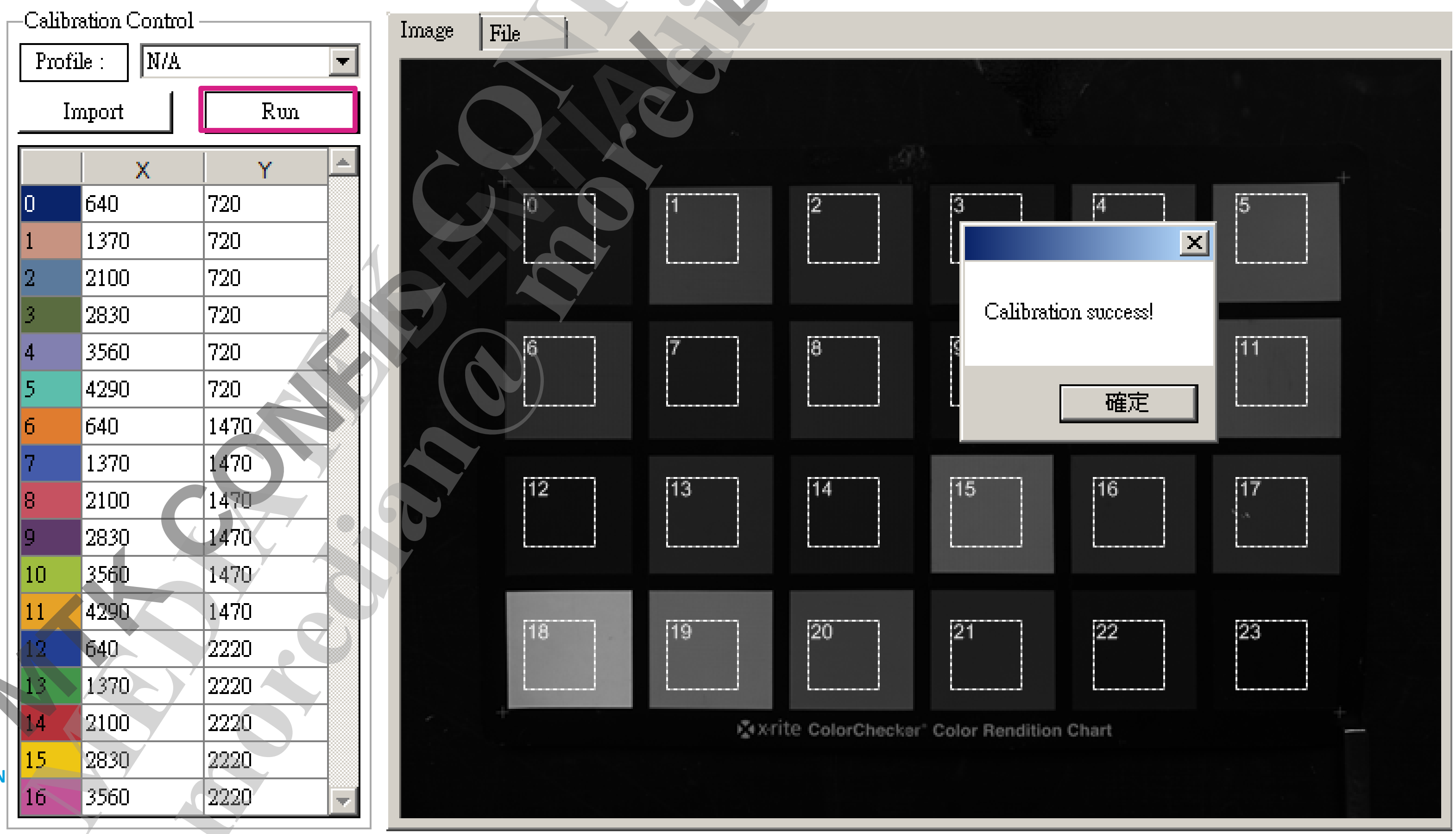
4. Click “Checker Mode” to select ROI
   – Make sure rectangles 0~23 must be positioned in each cell of color checker
5. Click “Done” to confirm the ROI



Select ROI:
Right-click in the left-top corner of color checker, then drag-and-move to the right-bottom corner.

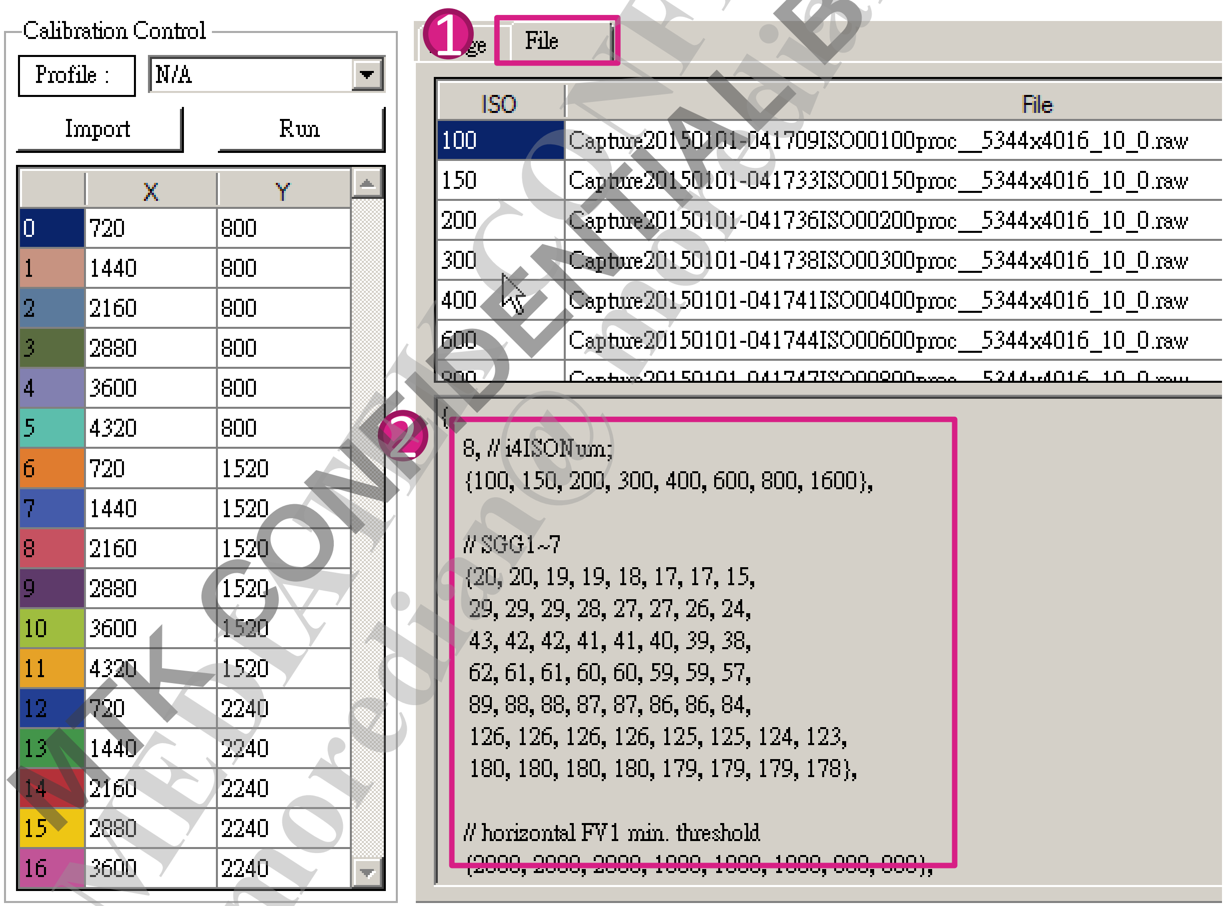
HW Threshold – Generate Parameter

6. Click “Run” to generate parameter



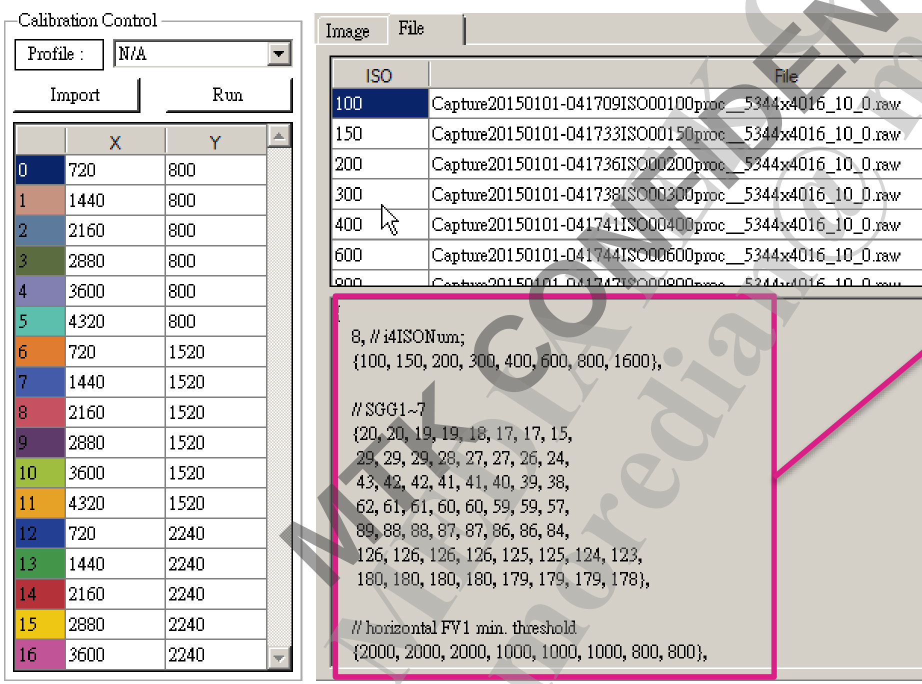
HW Threshold – Apply Parameter

1. After generating parameter, click "File" tag, and the parameters are shown in the UI



HW Threshold – Apply Parameter

2. Merge HW threshold to source code
   – vendor/mediatek/proprietary/custom/$project$/hal/lens/$lens$/
      • lens_para_$lens$_cap.cpp : for full-size preview
   – Use parameters shown in CCT, to replace with the above file



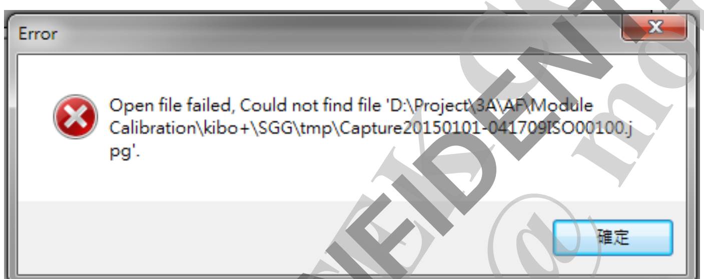

```
// -------------------- sAF_TH --------------------
{
    8, // i4ISONum
    {100, 150, 200, 300, 400, 600, 800, 1600},

    // SGG1~7
    {
        20, 19, 19, 18, 18, 17, 17, 16,
        29, 29, 28, 28, 27, 27, 26, 25,
        42, 42, 42, 41, 41, 40, 40, 38,
        61, 61, 61, 60, 60, 59, 59, 57,
        88, 88, 88, 87, 87, 86, 86, 85,
        126, 126, 126, 125, 125, 125, 124, 123,
        180, 180, 180, 180, 179, 179, 179, 178
    },

    // horizontal FV1 min. threshold
    {2000, 2000, 2000, 1000, 1000, 1000, 800, 800},

    // horizontal FV1 threshold
    {2, 2, 2, 2, 2, 2, 3, 4},

    // horizontal FV2 min. threshold
    {2000, 2000, 2000, 1000, 1000, 1000, 800, 800},

    // horizontal FV2 threshold
    {2, 2, 2, 2, 2, 2, 3, 4},

    // vertical FV min. threshold
    {2000, 2000, 2000, 1000, 1000, 1000, 800, 800},

    // vertical FV threshold
    {2, 2, 2, 2, 2, 2, 3, 4},
},
```

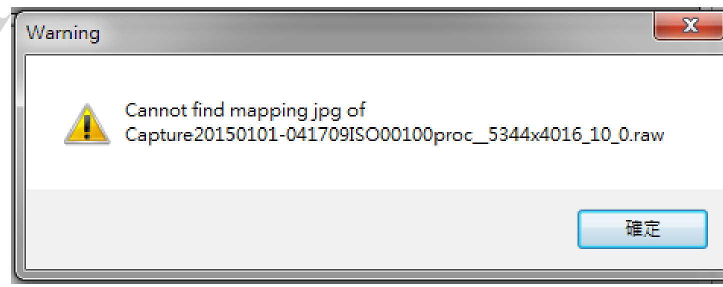
HW Threshold – Repeat

1. Repeat "Generate Parameter" & "Apply Parameter", but
   - import Preview*.raw
   - Apply HW threshold to below source code
     - lens_para_$lens$.cpp : for default value
     - lens_para_$lens$_pv.cpp : for binning-size preview
     - lens_para_$lens$_cus3.cpp : for binning-size video record
2. Repeat "Generate Parameter" & "Apply Parameter", but
   - import Video*.raw
   - Apply HW threshold to below source code
     - lens_para_$lens$_vdo.cpp : for full-size video record

HW Threshold – Trouble Shooting

- Error case:
  - If you missed to put JPEG in the same directory with Raw, you will see below error message when "Import", and result won't be generated after "Run"





- Solution:
  - Put JPEG & Raw files in the same directory before clicking "Import"

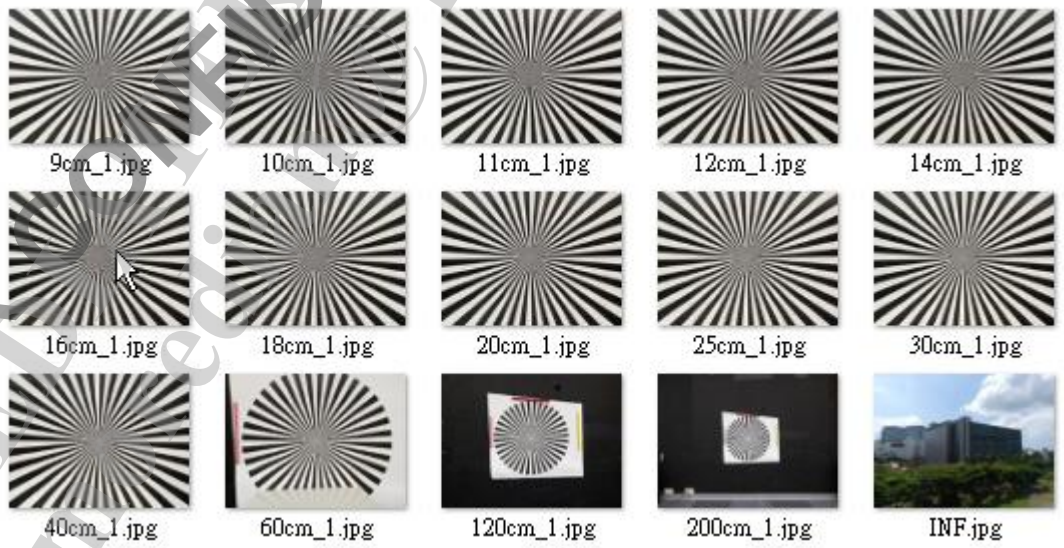
AF Table – Environment Setup

- Target distance

  - The 2nd must be OTP_MAC, the distance which the OTP MAC will use; the second last must be OTP_INF, the distance which the OTP INF will use.
  - The 1st must be Super_MAC, which is nearer than OTP_MAC, and the last must be Real_INF, which should be very far away.
  - For Wide Lens
    - 9cm/ OTP(10cm)/ 11cm/ 12cm/ 14cm/ 16cm/ 18cm/ 20cm/ 25cm/ 30cm/ 40cm/ 60cm/ 120cm/ OTP(200cm)/ INF
  - For Tele Lens
    - 40cm/ OTP(50cm)/ 60cm/ 70cm/ 80cm/ 90cm/ 100cm/ 120cm/ 200cm/ 250cm/ 300cm/ 350cm/ 400cm/ 450cm/ OTP(500cm)/ INF

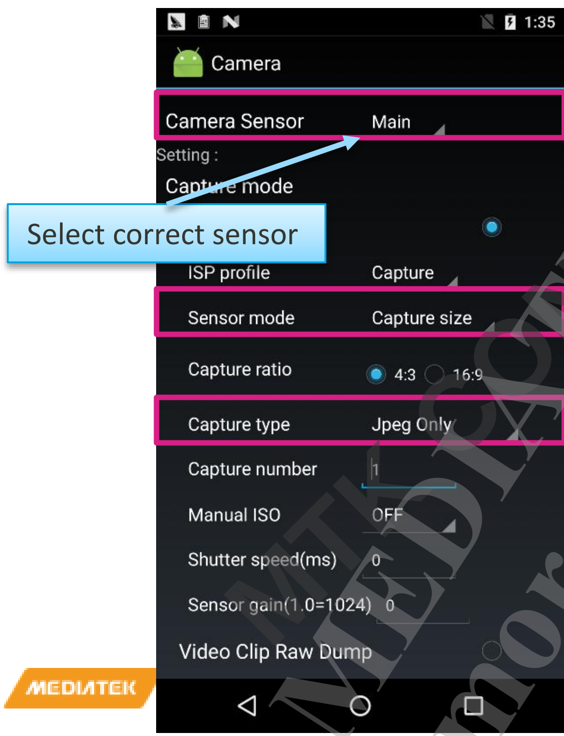
AF Table – Environment Setup

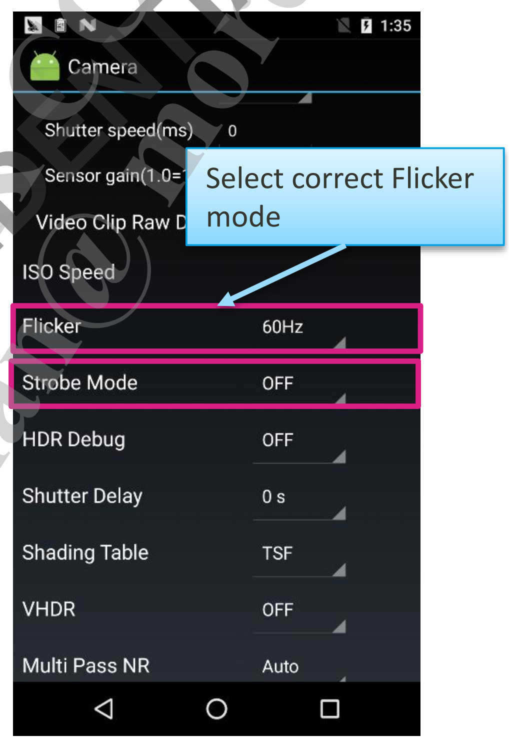
- Tool: Camera EM mode
- Using tripod @ 300 lux
- Test target: Star chart (at least 70cm x 70cm)
  - Using star chart, even for different distance/ angle, the content in ROI keeps the same
  - For Real_INF, you can use far way buildings as target

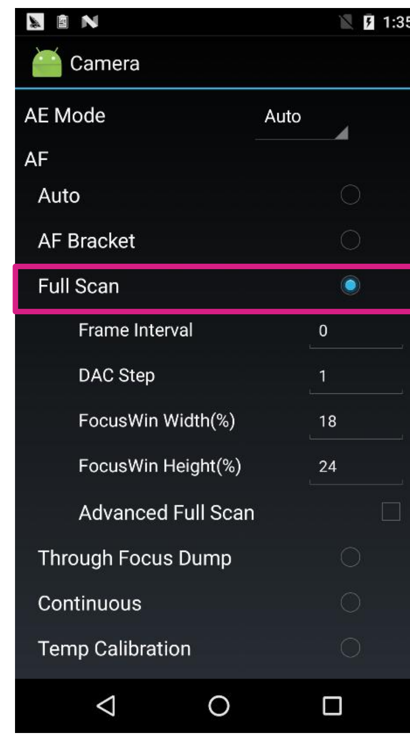


AF Table – Get Calibration Data

1. Enter camera EM mode
   – In Dailer APP, enter *#*#3646633#*#*
   – Hardware Testing -> Camera
2. Apply below settings

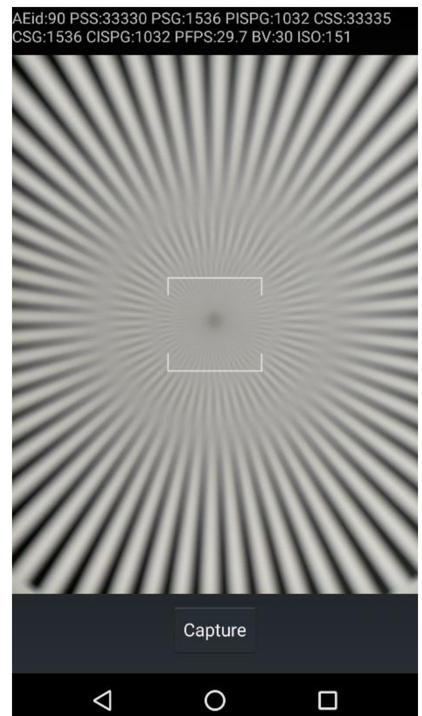






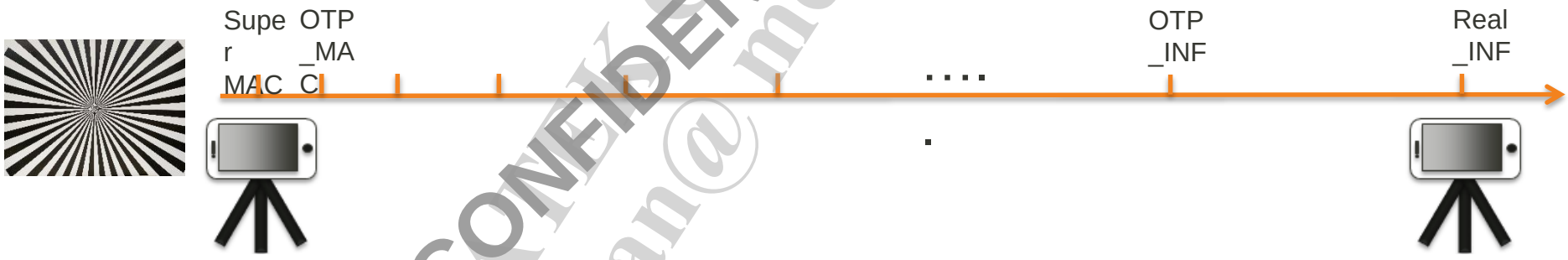
AF Table – Get Calibration Data

3. Press "Start Preview", then you will see the capture window.
   - You have to wait for 5 minutes in the capture window, for lens module temperature stable



AF Table – Get Calibration Data

4. Setup object distance as described in "AF Table – Environment Setup", then click "Capture"
   - For each object distance, you have to move your phone at the correct distance, and click "Capture" to do fullscan.

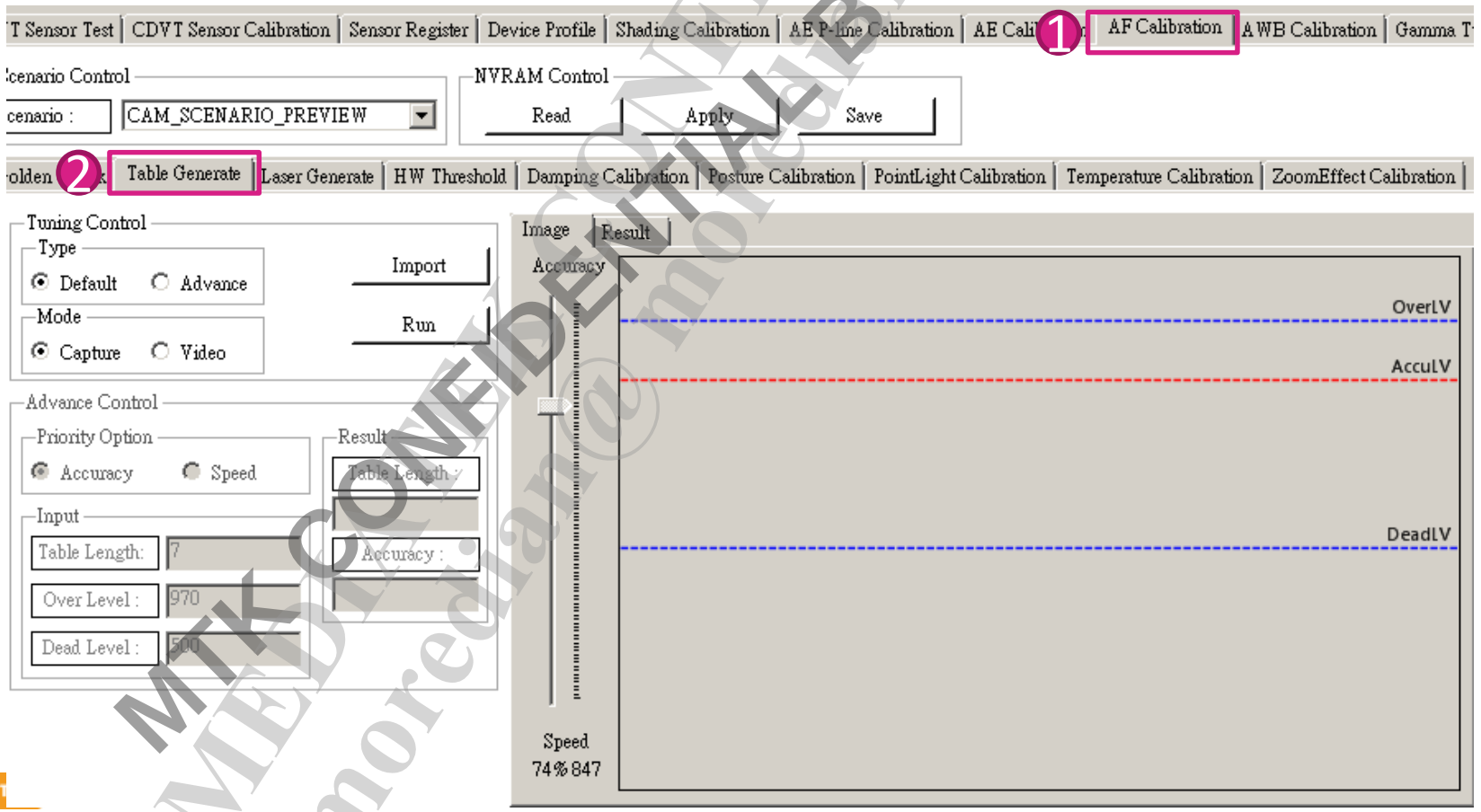


AF Table – Generate Parameter

1. Get calibration data from phone
   - Connect phone to PC
   - Open command window, and use below command to get data
     - adb pull /sdcard/DCIM/CameraEM

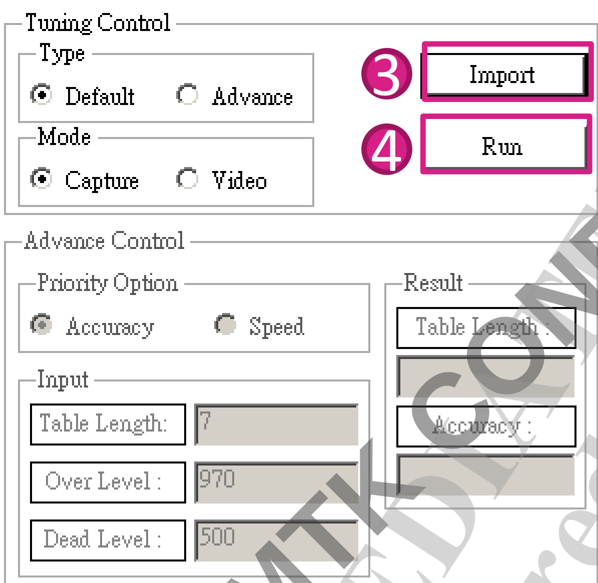
AF Table – Generate Parameter

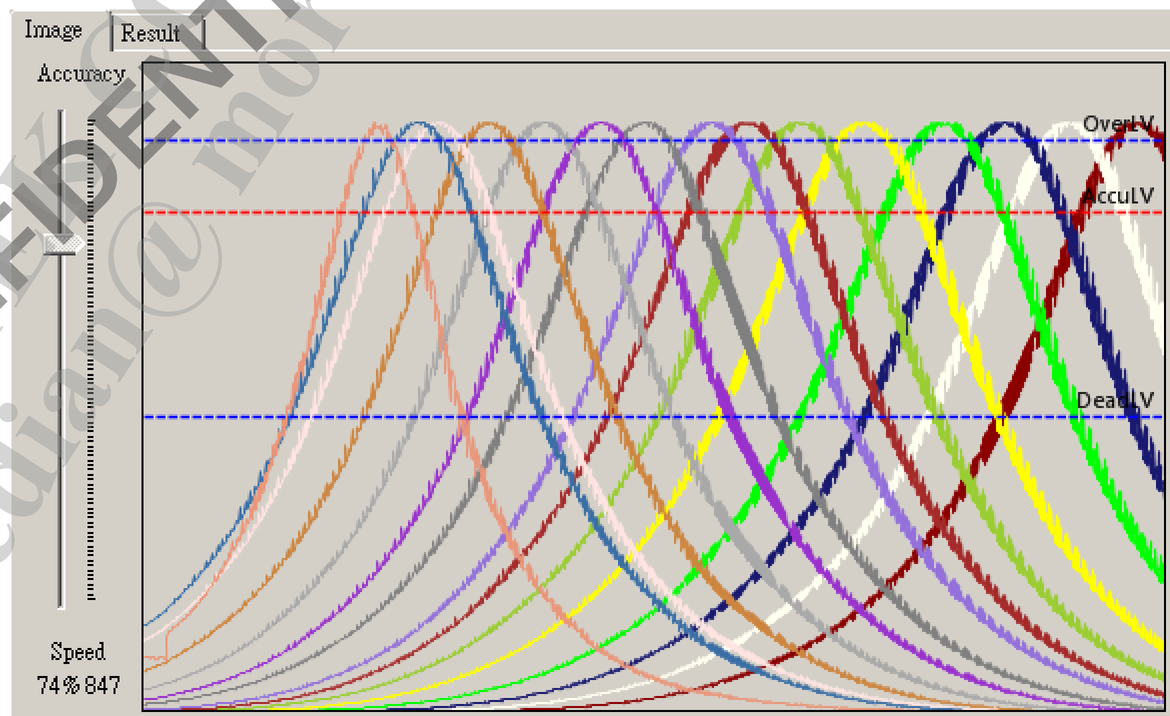
2. Open CCT, and select “AF Calibration”, then “Table Generate” page



AF Table – Generate Parameter

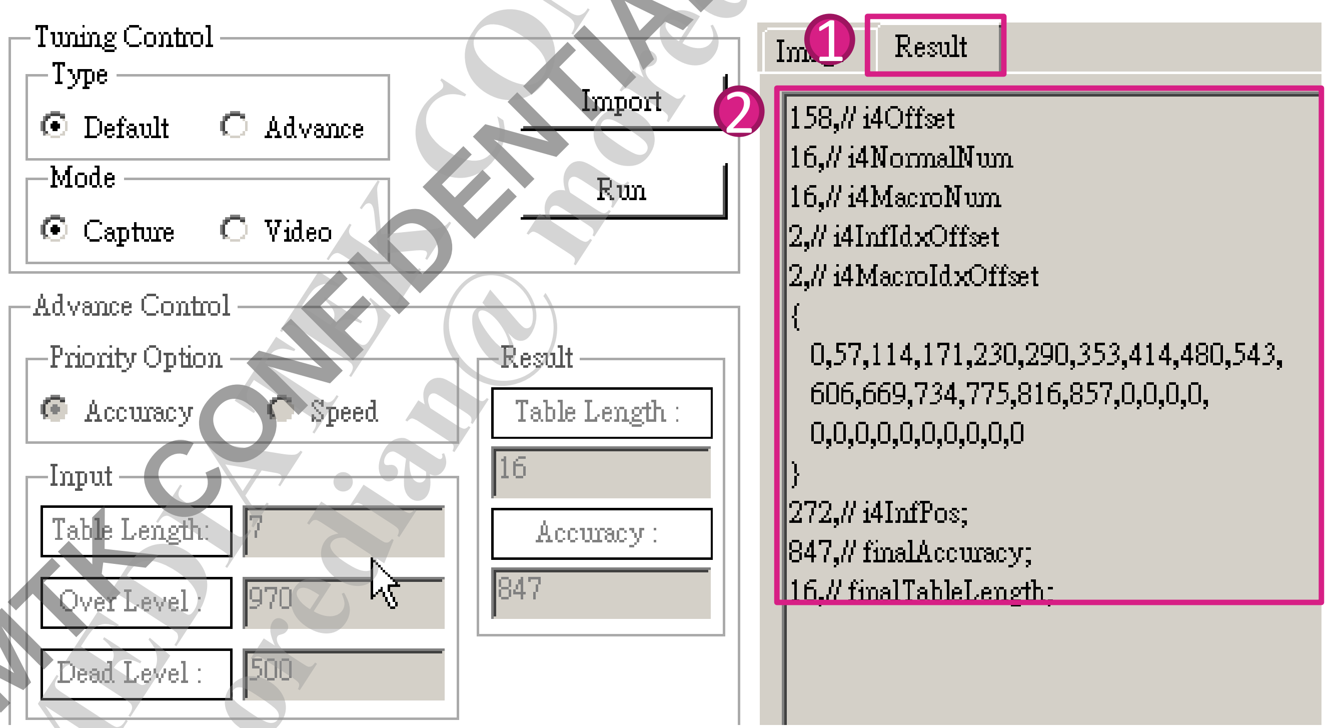
3. Click “Import” to select the calibration data
   - jpegs captured at each different distance
4. Click “Run” to generate AF table parameter





AF Table – Apply Parameter

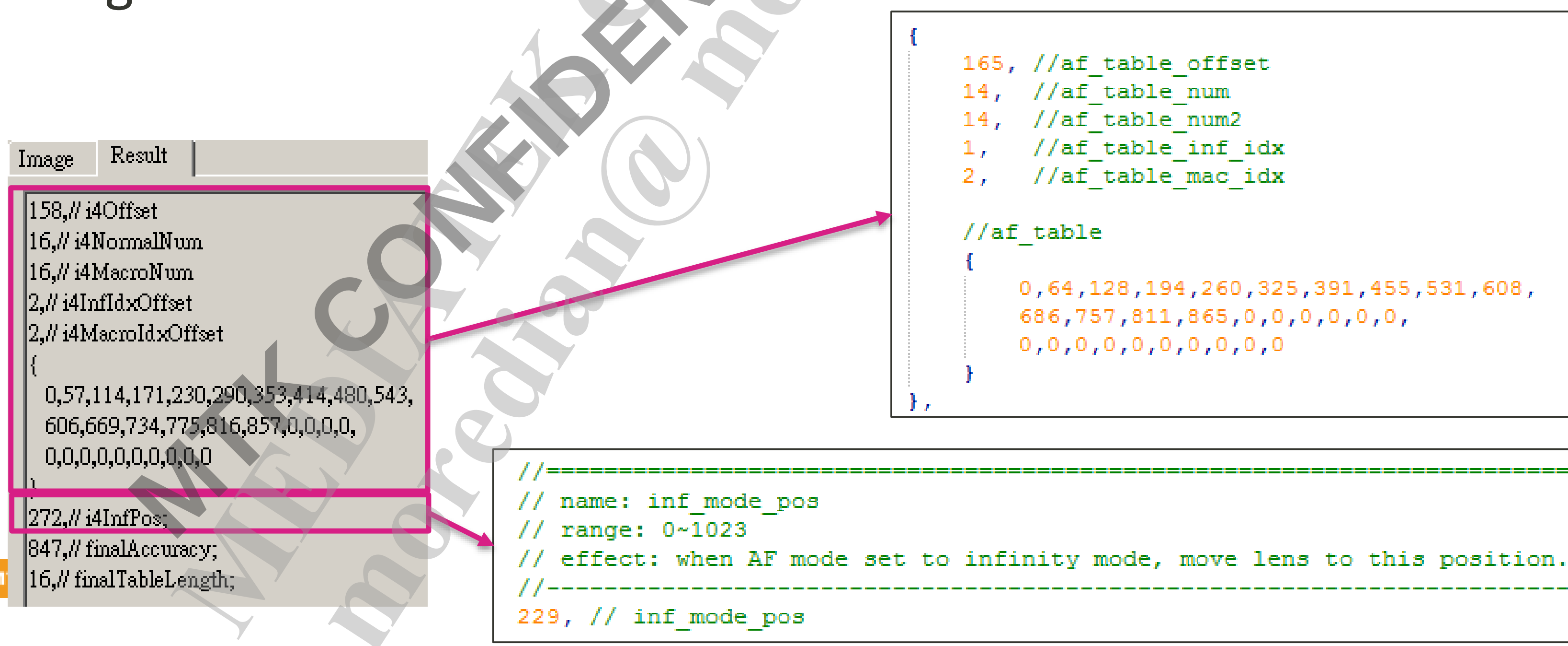
1. Select the "Result" tab, and the parameters are shown in the UI



AF Table – Apply Parameter

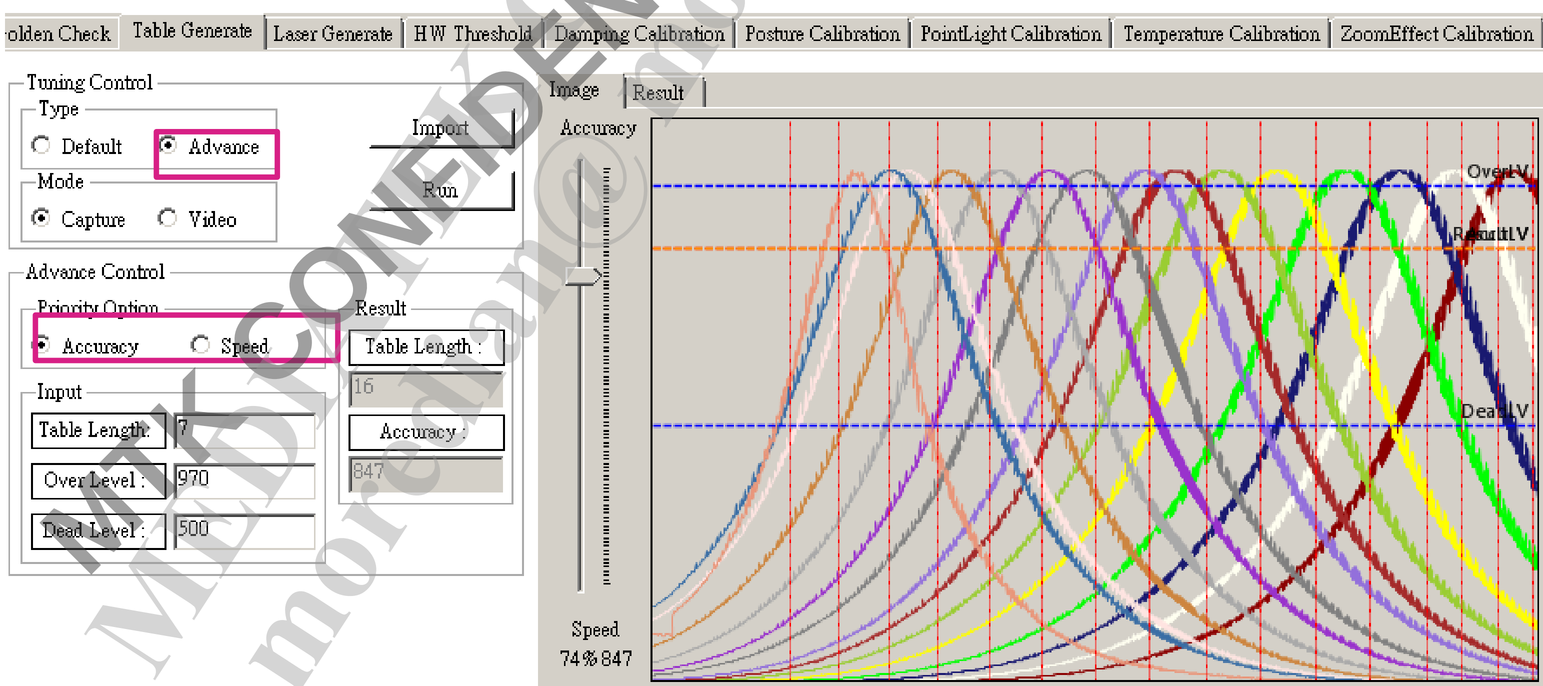
2. Merge AF Table parameter to source code
   - vendor/mediatek/proprietary/custom/$project$/hal/lens/$lens$/
     - lens_para_$lens$.cpp : for default value
     - lens_para_$lens$_cap.cpp : for full-size preview
     - lens_para_$lens$_pv.cpp : for binning-size preview
     - lens_para_$lens$_vdo.cpp : for full-size video record
     - lens_para_$lens$_cus3.cpp : for binning-size video record

3. Copy generated parameters to the above files, see below diagram for reference



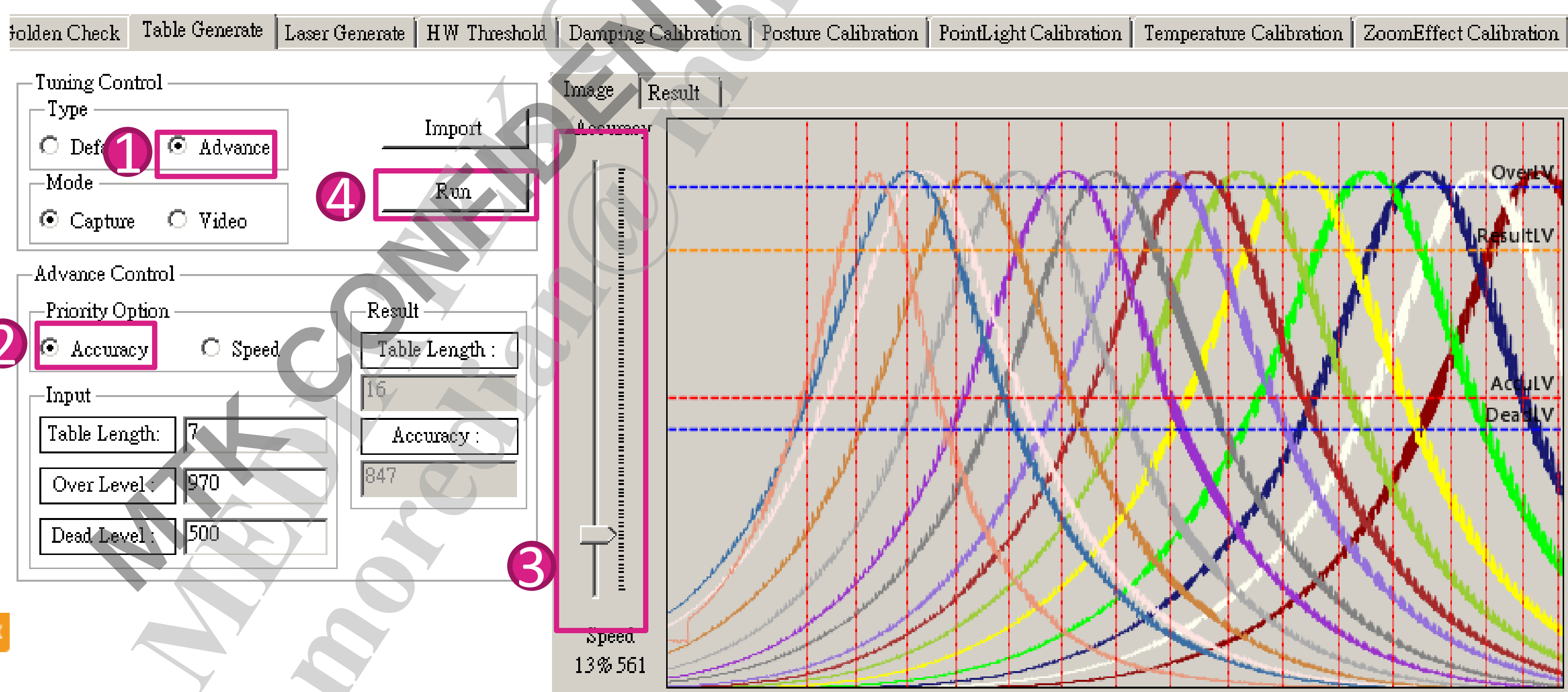
AF Table – Advanced Option

- Caution: Be careful to use this feature, and make sure you know what the function is
- Select “Advance”, then you can choose “Accuracy” or “Speed” mode
  - Accuracy: Control AF table point accuracy
  - Speed: Control AF table point numbers



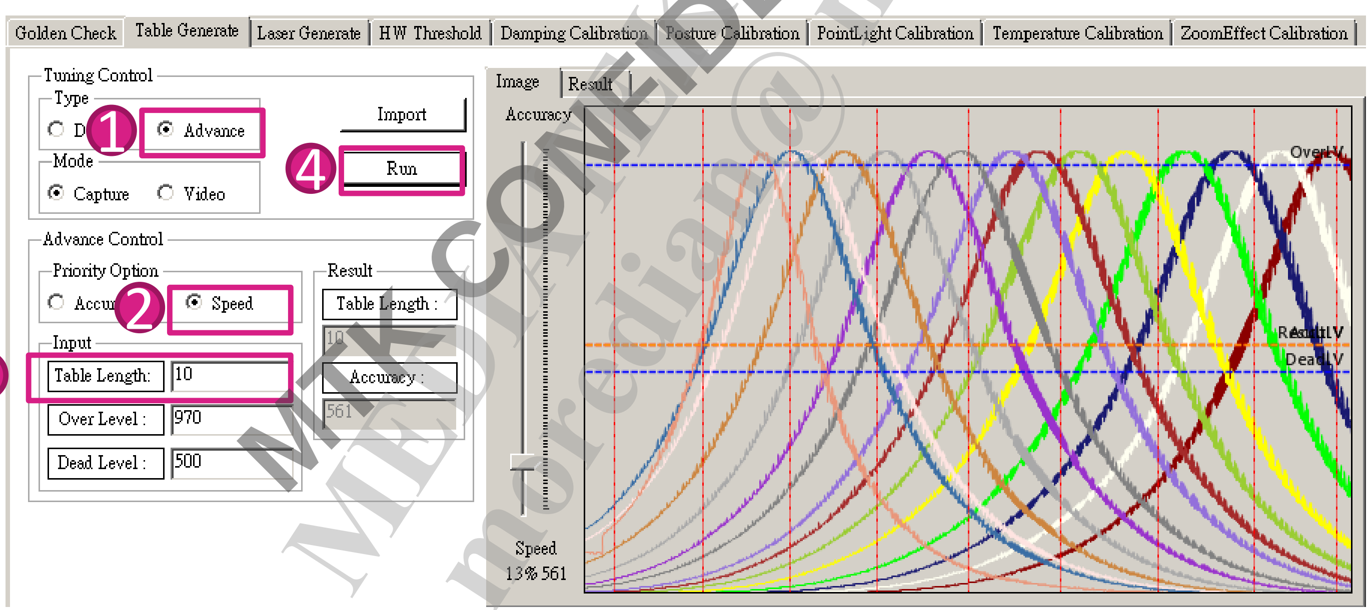
AF Table – Advanced Option (Accuracy Mode)

- Move the slider bar, to set accuracy from 500 ~ 970
  - Higher accuracy -> more table length -> AF more accurate
  - Lower accuracy -> fewer table length -> AF faster
- Click “Run” to generate parameter



AF Table – Advanced Option (Speed Mode)

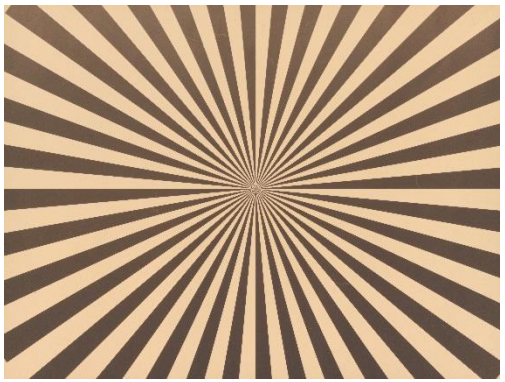
- Set the “Table Length”, to control the output result length
  - More length: AF more accurate
  - Fewer length: AF faster
- Click “Run” to generate parameter
- Table Length falls within 5 ~ 30, and the result Accuracy must fall within 500~ 970; otherwise error dialog will appear



Error Dialog

Posture Calibration – Environment Setup

- Target distance: 120cm
- Tool: Camera EM mode
- Test target: Star chart
- Using tripod @ 300 lux



Posture Calibration – Environment Setup

- **G/Gyro calibration check** before posture calibration

G/Gyro Sensor Calibration

1.Power off

2.volume down +power key to power on to factory mode

3.单项测试->选择：陀螺仪传感器校准

4.平放静置桌面->选择：进行校准(误差20%)

5.出现”执行成功”提示即完成

6.单项测试->选择：加速度传感器校准

7.平放静置桌面->选择：进行校准(误差20%)

8.出现”执行成功”提示即完成

注：上音量：返回上级目录；下音量：移至待选项；电源键：确定

Posture Calibration

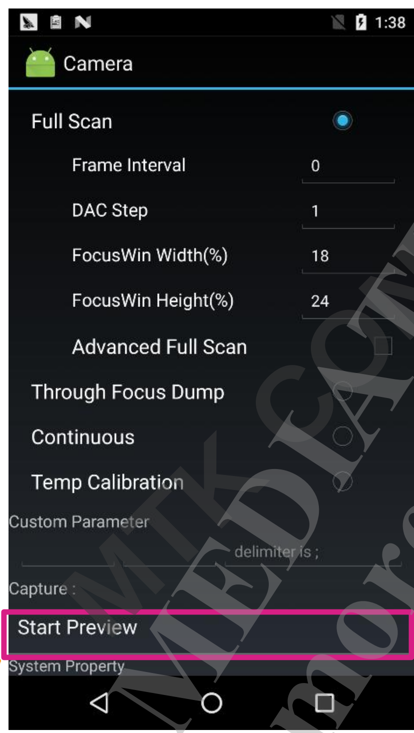
- You can do posture calibration by EM mode (recommended) or optional method
- 1.EM mode
  - EM mode can support calibration.
- 2.Optional method (if EM mode is finished, skip optional method) [Link]
  - If your device's EM mode cannot support calibration, please check optional method.

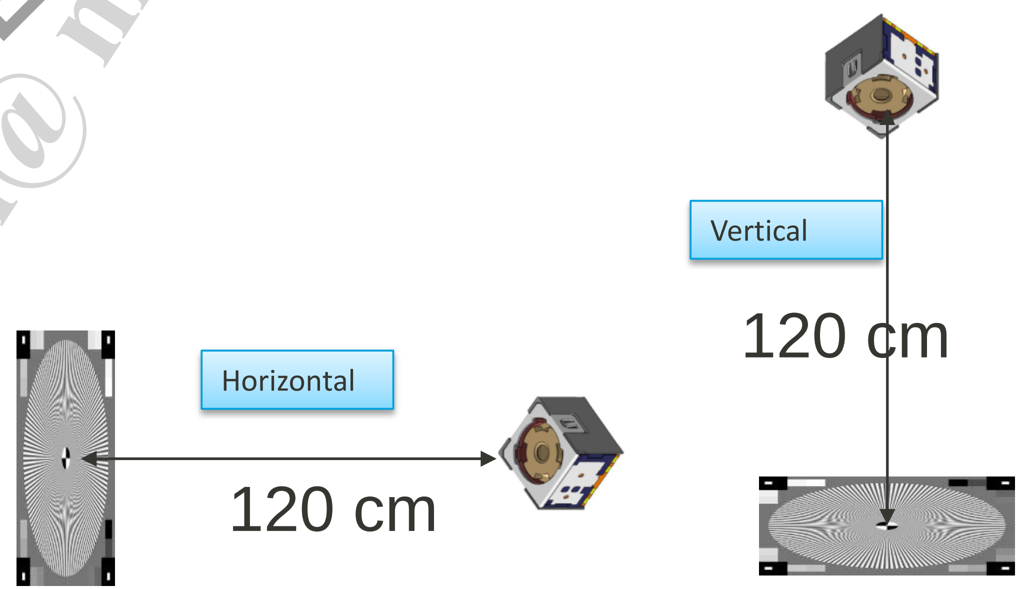
Posture Calibration – Get Calibration Data

1. Enter camera EM mode
   - In Dailer APP, enter *#*#3646633#*#*
   - Hardware Testing -> Camera
2. Apply below settings

Posture Calibration – Get Calibration Data

3. Press "Start Preview", then you will see the capture window.
   - Wait for 5 minutes in the capture window
4. Use tripod, and take picture horizontally & vertically at 120cm individually, by clicking "Capture" button



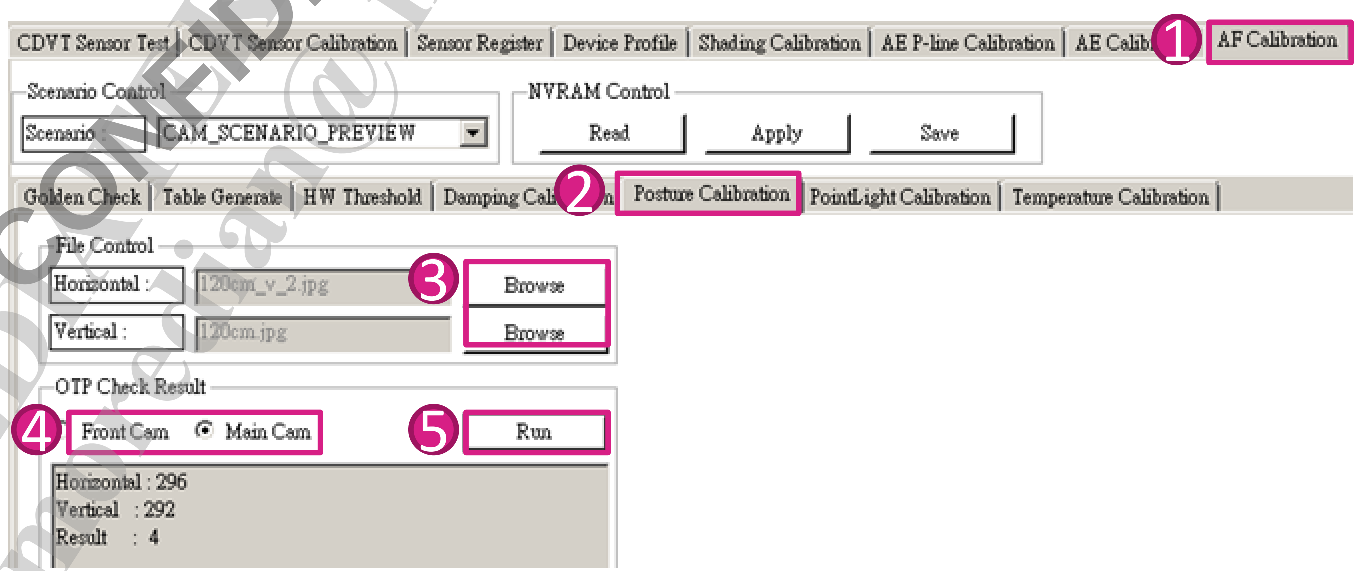


Posture Calibration – Generate Parameters

1. Get calibration data from phone
   - Connect phone to PC
   - Open command window, and use below command to get data
     - adb pull /sdcard/DCIM/CameraEM

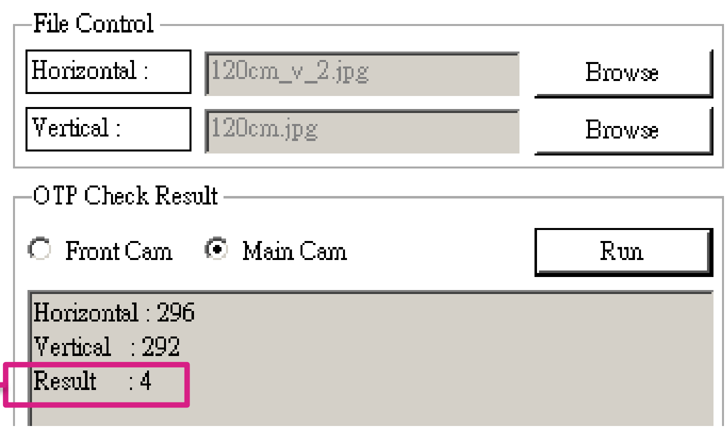
Posture Calibration – Generate Parameters

2. Open CCT, goes to "AF Calibration" -> "Posture Calibration"
3. Load horizontal & vertical pictures by "Browse" button
4. Select "From Cam" or "Main Cam" according to your setting
5. Click "Run" to generate compensation value



Posture Calibration – Apply Parameters

1. Merge Posture parameter to source code
   - vendor/mediatek/proprietary/custom/$project$/hal/lens/$lens$/
     - lens_para_$lens$.cpp : for default value
     - lens_para_$lens$_cap.cpp : for full-size preview
     - lens_para_$lens$_pv.cpp : for binning-size preview
     - lens_para_$lens$_vdo.cpp : for full-size video record
     - lens_para_$lens$_cus3.cpp : for binning-size video record
2. Copy value in the "Result" field, and apply to the i4PostureComp field in the above files




```
//================================================================
// name: posture_comp
// range: integer
// default: 0
// effect: horizontal and vertical posture compensation
//----------------------------------------------------------------
4,  // posture_comp
```

Posture Calibration

- You can do posture calibration by EM mode (recommended) or optional method
- 1.EM mode
  - EM mode can support calibration.
- 2.Optional method (if EM mode is finished, skip optional method) [Link]
  - If your device's EM mode cannot support calibration, please check optional method.

Posture Compensation

- 準備工具:
  - 模組廠提供的模組變異性數據 (請參照Pre_Check_Report.xls)

- Calibration步驟:
  - **Step 1**: 開啓模組廠提供的模組變異性數據
  - **Step 2**: 檢查姿勢差 Max – Min是否小於50, 若大於50 , 為了AF 整體品質考量, 建議三方向(水平、向上、向下)作Calibration

編號	Infinity 3M		Macro 10 CM		3M	10 cm
	水平	垂直向下	水平	垂直向下	姿勢差	姿勢差
#94	346	150	652	566	196	86
#95	220	160	718	534	60	184
#96	308	140	711	530	168	181
#97						
#98						
#99						
#100						
Max	385	240	770	590	249	258
Min	200	110	595	492	35	40
Avg	330.7	163.5	648.02	528.17	167.2	119.85
Post Comp					195.5	

3M Max – Min = 214 > 50
10 cm Max – Min = 218 >50

Posture Compensation

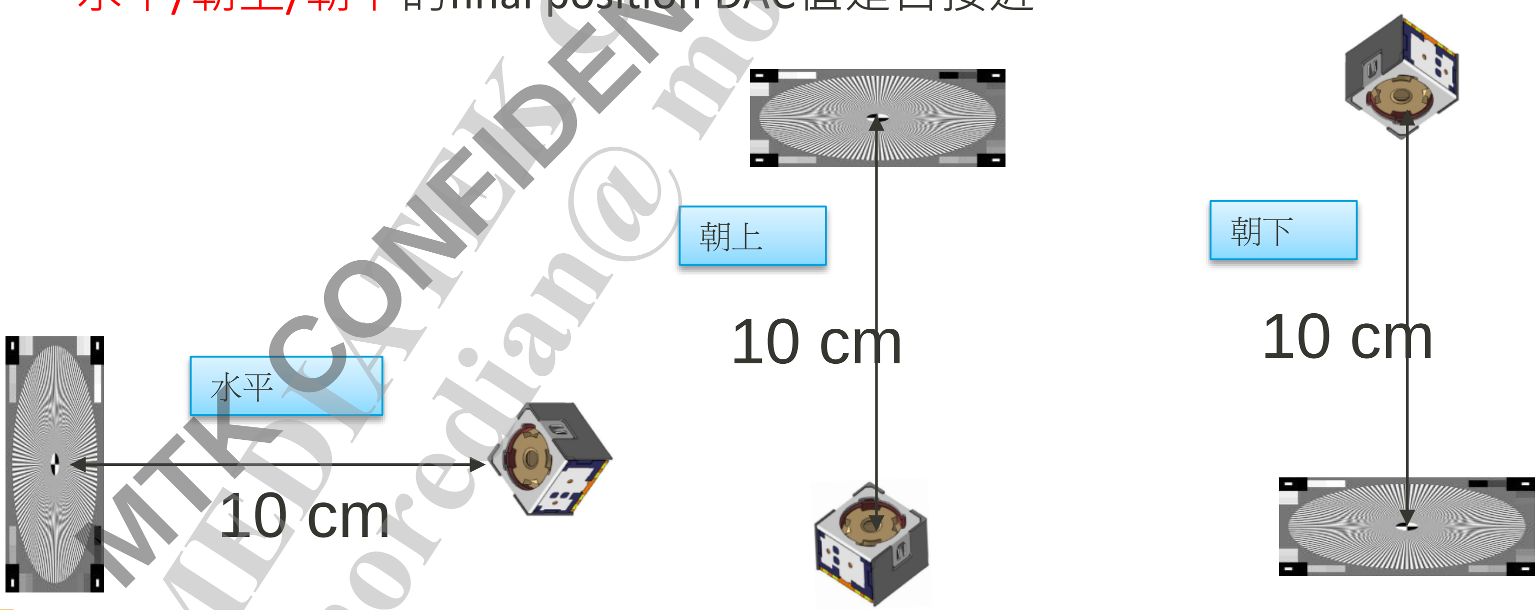
- Calibration步驟:
  - **Step 3**: 開啓lens_para_xxx.cpp, 尋找i4PostureComp。
  - **Step 4**: 將下方藍框的資料填入i4PostureComp 。

編號	Infinity 3M		Macro 10 CM		3M	10 cm
	水平	垂直向下	水平	垂直向下	姿勢差	姿勢差
#94	346	150	652	566	196	86
#95	220	160	718	534	60	184
#96	308	140	711	530	168	181
#97						
#98						
#99						
#100						
Max	385	240	770	590	249	258
Min	200	110	595	492	35	40
Avg	330.7	163.5	648.02	528.17	167.2	119.85
Post Comp					195.5	

196, // i4PostureComp: post comp max offset [0:disable, others:enable] @basic

Posture Compensation

- 手動微調與驗證方式：
  - **Step 1**: 先對著手機做G/Gyro Sensor 校正。
  - **Step 2**: 將太陽圖固定於牆上 & 手機水平/朝上/朝下固定在腳架上。
  - **Step 3**: 將腳架放置在離chart 10 cm 的位置上拍照, 每個距離各拍5張, 確認水平/朝上/朝下的final position DAC值是否接近。

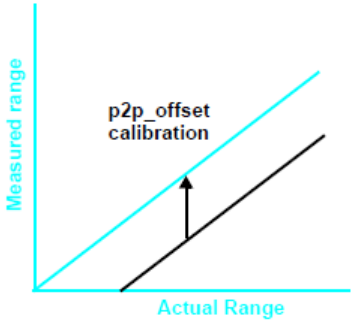


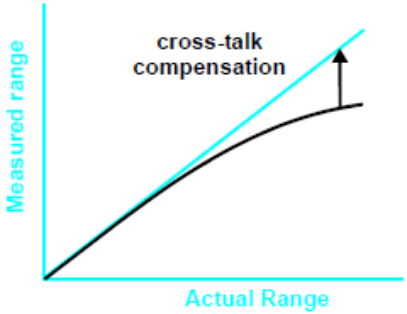
Laser Calibration

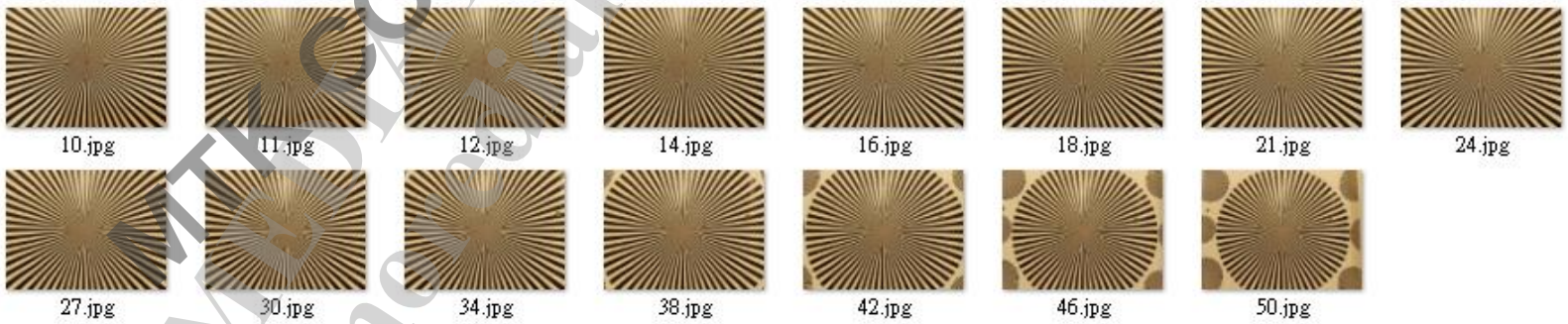
- Laser introduction
  - To estimate distance for fast AF, it applies measuring distance by Laser component.
  - Measuring the time the light takes to travel to the nearest object and reflect back to the sensor (Time-of-Flight).
  - Laser module can only estimate distance < 50cm or 100cm; when out of this range, the estimation confidence level will be low and unstable
- Laser AF
  - The Laser AF control method is similar to the PDAF.
  - The focusing speed of Laser AF is very fast within the valid distance
  - In CAF mode, it supports laser focusing within the valid distance
  - In TAF mode, it can't support laser focusing.

Laser Calibration

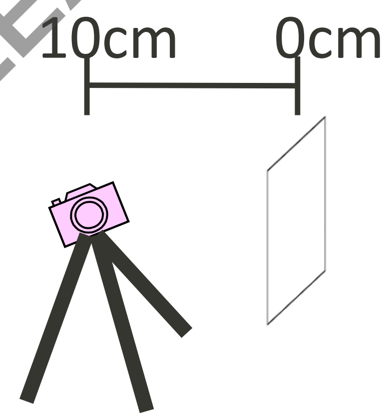
- Laser offset
  - The offset between laser response and real distance
- Laser crosstalk
  - Range error by cover lens, is proportional to the ratio of the cross-talk to the signal return from the target.
- Laser mapping table
  - Mapping laser distance (mm) to lens position (DAC)







Offset – Get Calibration Data

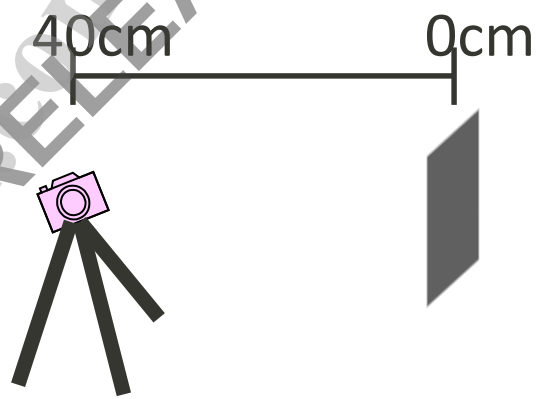


- Environment
  - Target: white target with 88% reflectance
  - Distance: 10cm
  - Using tripod @ 300lux
- Do calibration
  1. Connect Phone to PC using USB
  2. Enter normal camera
  3. adb shell setprop laser.calib.mode 1
  4. Do TAF to trigger offset calibration
  5. adb shell setprop laser.calib.mode 0
- Output parameter

```
LaserCali : getLaserOffsetCalib Start
LaserCali : getLaserOffsetCalib : 14
LaserCali : getLaserOffsetCalib End
```

Cross-Talk – Get Calibration Data

- Environment
  - Target: 17% grey target
  - Distance: 40cm
  - Using tripod @ 300lux



- Do calibration
  1. Connect Phone to PC using USB
  2. Enter normal camera
  3. adb shell setprop laser.calib.mode 2
  4. Do TAF to trigger cross-talk calibration
  5. adb shell setprop laser.calib.mode 0
- Output parameter
  - XTalk must <= 52, otherwise you must confirm the “Cover glass design”

```
LaserCali : getLaserXTalkCalib Start
LaserCali : getLaserXTalkCalib : 0
LaserCali : getLaserXTalkCalib End
```

Offset/ Cross-talk – Apply Parameters

1. Merge Offset/ XTalk parameter to source code
   - vendor/mediatek/proprietary/custom/$project$/hal/lens/$lens$/
     - lens_para_$lens$.cpp : for default value
     - lens_para_$lens$_cap.cpp : for full-size preview
     - lens_para_$lens$_pv.cpp : for binning-size preview
     - lens_para_$lens$_vdo.cpp : for full-size video record
     - lens_para_$lens$_cus3.cpp : for binning-size video record
2. Calculate & apply parameters
   - i4Revs[201] = Enable * 10000 + Offset
     - Ex: LaserEnable = 1, Offset = 14
       - i4Revs[201] = 1 * 10000 + 14 = 10014
   - i4Revs[202] = Enable * 10000 + Xtalk
     - Ex: LaserEnable = 1, Xtalk = 0
       - i4Revs[202] = 1 * 10000 + 0 = 10000

```
{0, 0, 0, 0, 0, 0, 0, 0, 0, 0,   //reserved[256]
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 10014, 10000, 501, 15, 9320010, 8880013, 840
 6020034, 5380038, 5110040, 4720043, 4450045, 42
 0 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0}
```
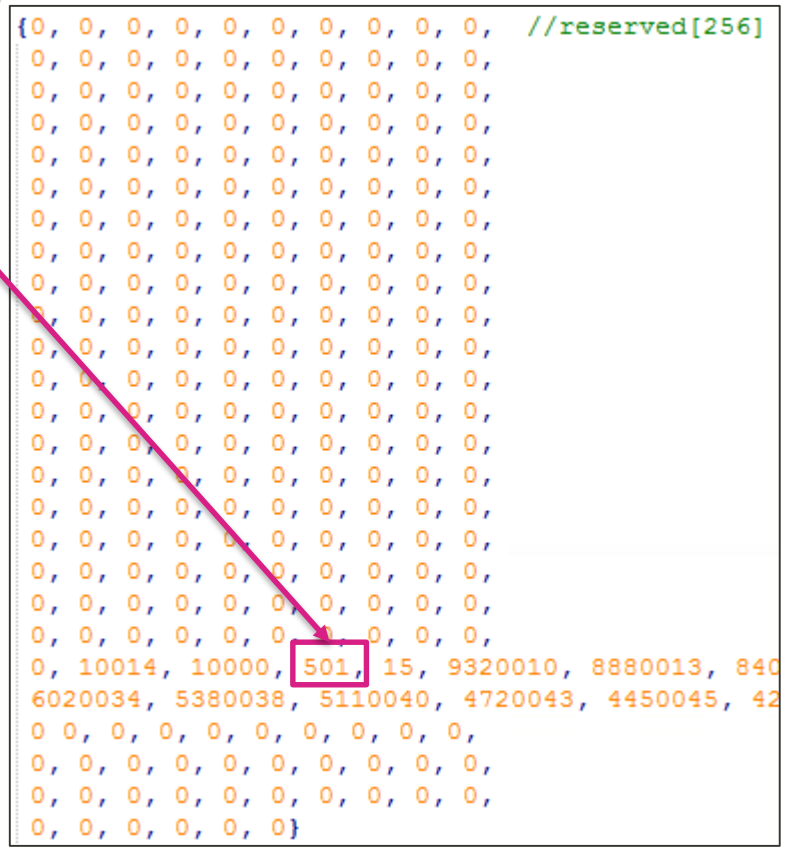
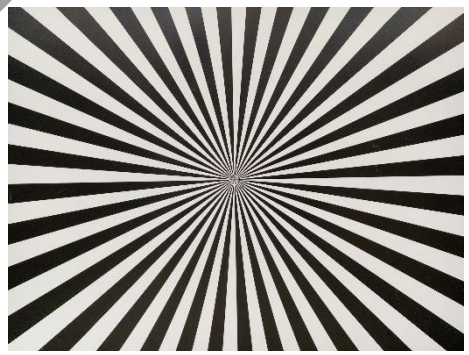

Max Distance – Apply Parameters

1. Merge Offset/ XTalk parameter to source code
   - vendor/mediatek/proprietary/custom/$project$/hal/lens/$lens$/
     - lens_para_$lens$.cpp : for default value
     - lens_para_$lens$_cap.cpp : for full-size preview
     - lens_para_$lens$_pv.cpp : for binning-size preview
     - lens_para_$lens$_vdo.cpp : for full-size video record
     - lens_para_$lens$_cus3.cpp : for binning-size video record
2. Depends on Laser module capability
   - i4Revs[**203**] = max distance (in mm) + 1
   - Example
     - Max distance 50cm (ex: VL6180)
       - i4Revs[**203**] = 501
     - Max distance 100cm (ex: VL53L0)
       - i4Revs[**203**] = 1001



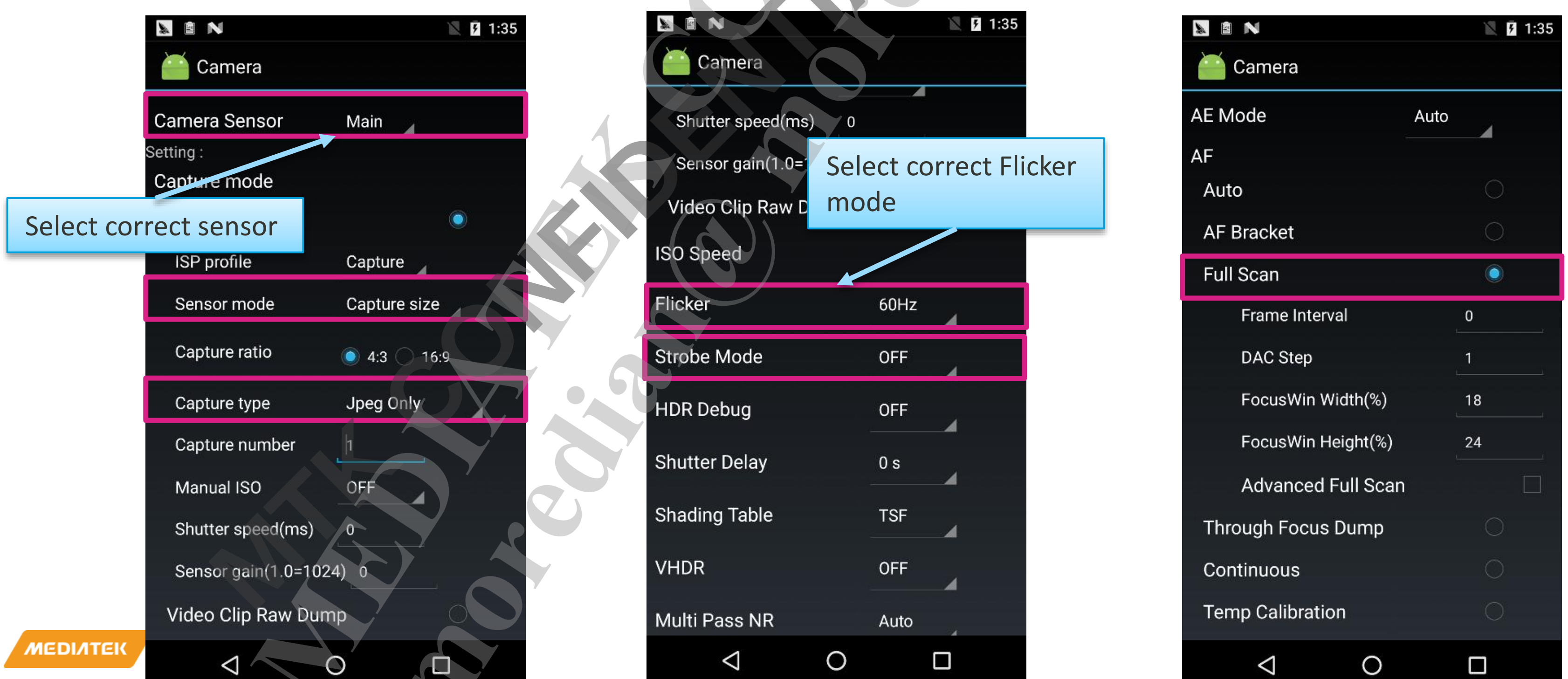
Laser Mapping Table – Environment Setup

- Tool: Camera EM mode
- Using tripod @ 300 lux
- Test target: Star chart
- Distance (cm):
  - Max Laser distance 50cm:
    - 10, 11, 12, 14, 16, 18, 21, 24, 27, 30, 34, 38, 42, 46, 50
  - Max Laser distance 100cm:
    - 10, 11, 12, 14, 16, 18, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100



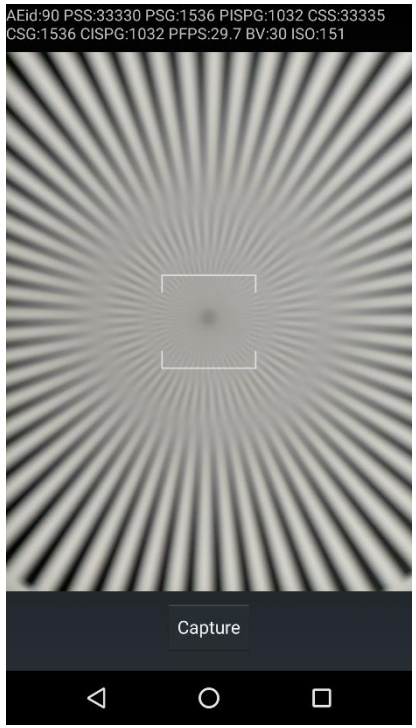
Laser Mapping Table – Get Calibration Data

1. Enter camera EM mode
   - In Dailer APP, enter *#*#3646633#*#*
   - Hardware Testing -> Camera
2. Apply below settings



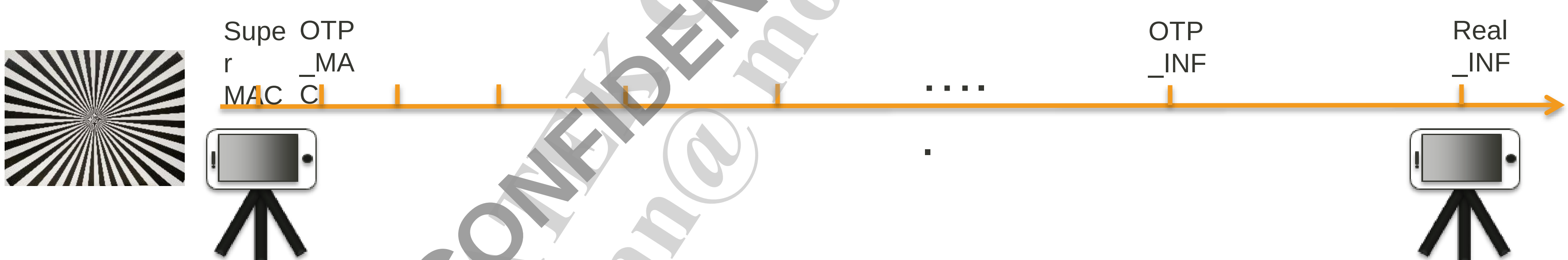
Laser Mapping Table – Get Calibration Data

3. Press “Start Preview”, then you will see the capture window.
   - You have to wait for 5 minutes in the capture window, for lens module temperature stable



Laser Mapping Table – Get Calibration Data

4. Setup object distance as described in "Laser Mapping Table - Distance", then click "Capture"
   - For each object distance, you have to move your phone at the correct distance, and click "Capture" to do fullscan.

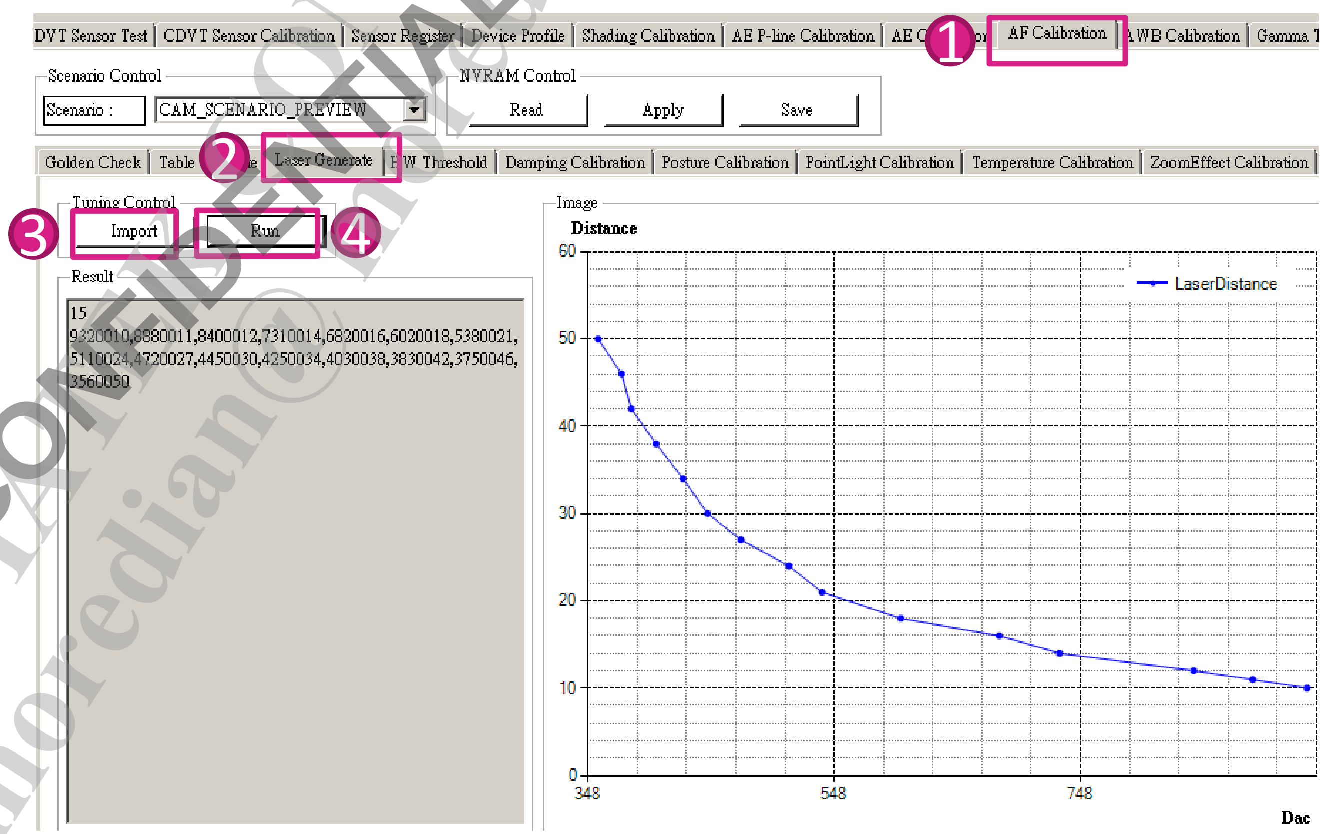


Laser Mapping Table – Generate Parameters

1. Get calibration data from phone
   - Connect phone to PC
   - Open command window, and use below command to get data
     - adb pull /sdcard/DCIM/CameraEM

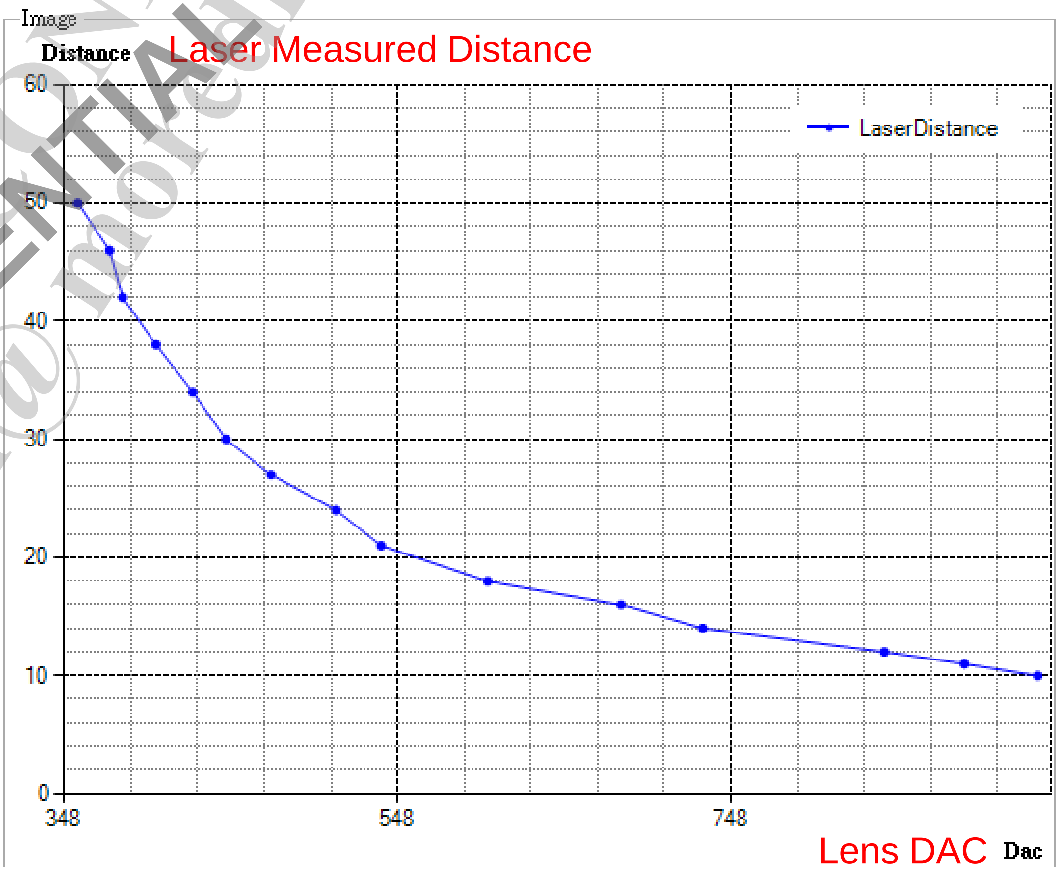
Laser Mapping Table – Generate Parameters

2. Open CCT, goes to “AF Calibration” -> “Laser Generate”
3. Click “Import” to select jpeg files **(30 files at most)**
4. Click “Run” to generate parameters



Laser Mapping Table – Generate Parameters

5. Result curve check
   - The curve must be decline, otherwise you should remove the abnormal jpeg and take pictures again.



Laser Mapping Table – Apply Parameters

1. Merge AF Table parameter to source code
   - vendor/mediatek/proprietary/custom/$project$/hal/lens/$lens$/
     - lens_para_$lens$.cpp : for default value
     - lens_para_$lens$_cap.cpp : for full-size preview
     - lens_para_$lens$_pv.cpp : for binning-size preview
     - lens_para_$lens$_vdo.cpp : for full-size video record
     - lens_para_$lens$_cus3.cpp : for binning-size video record
2. Copy generated parameters to the above files
   - Copy TableLength to i4Revs[**204**]
   - Copy TableContent to i4Revs[**205~234**]

Result

TableLength

```
15
```

TableContent

```
9320010,8880011,8400012,7310014,6820016,6020018,5380021,
5110024,4720027,4450030,4250034,4030038,3830042,3750046,
3560050
```

```
{0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  //reserved[256]
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 10014, 10000, 501, 15, 9320010,8880011,8400012,7310014,6820016,
 6020018,5380021,5110024,4720027,4450030,4250034,4030038,3830042,3750046,3560050,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0
}
```
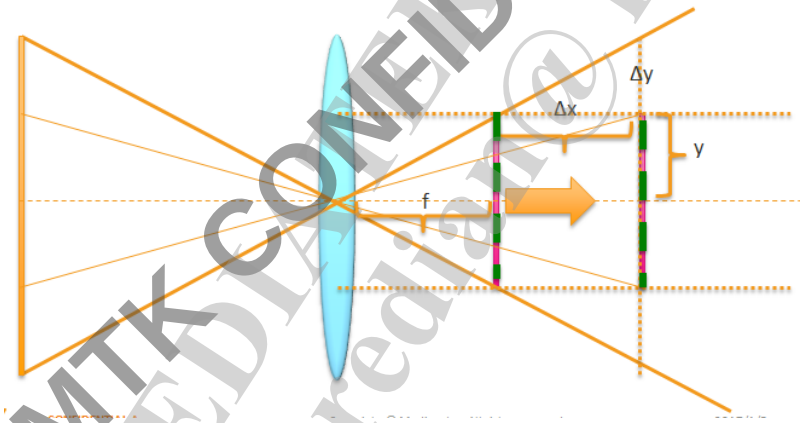
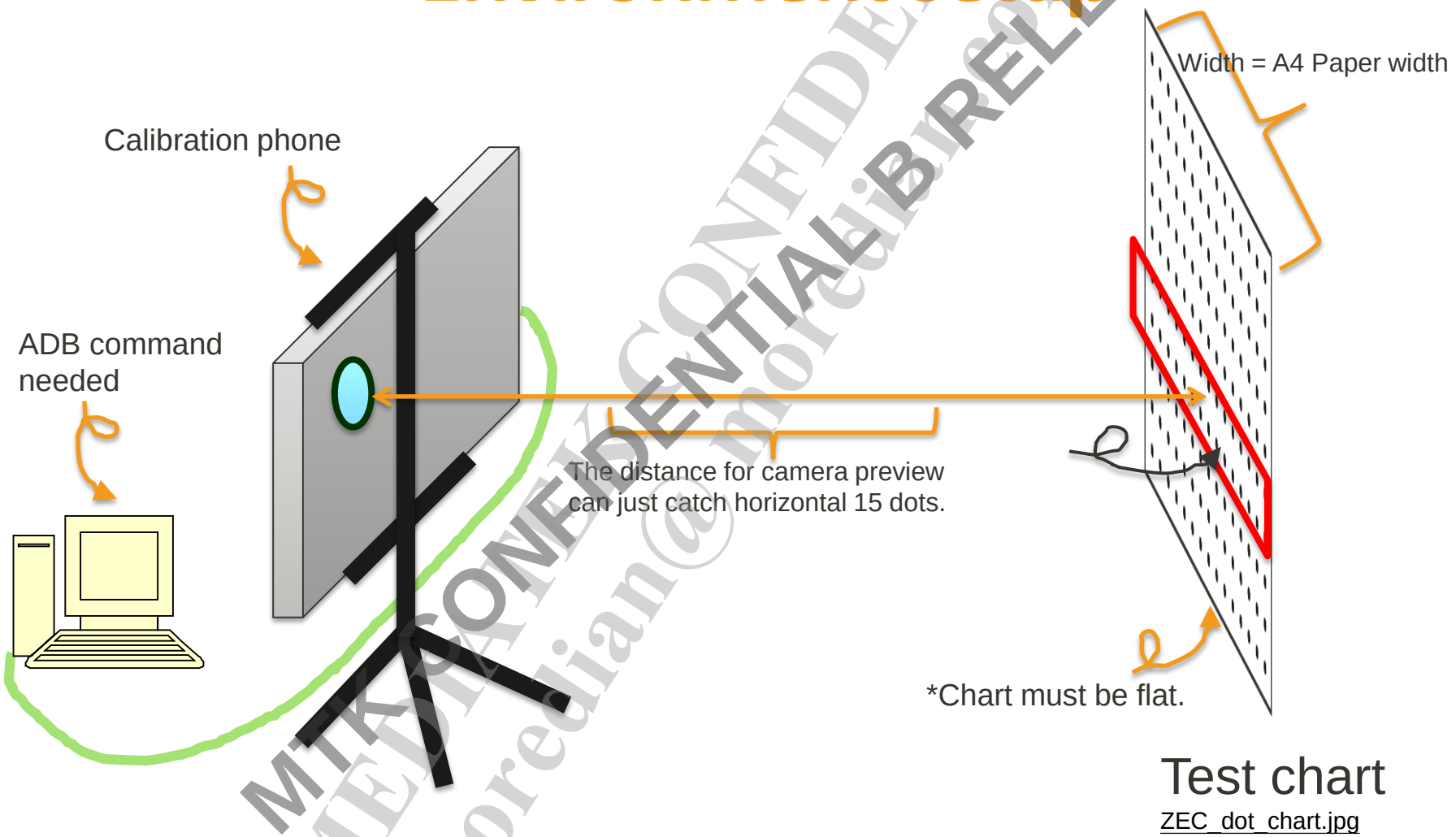

Zoom Effect Calibration

- What is zoom effect?
  - When camera change focus distance (between lens and image sensor), the image field of view (FOV) will change, and image preview shows a small zoom in/out effect.
  - Zoom effect is happened while focusing.

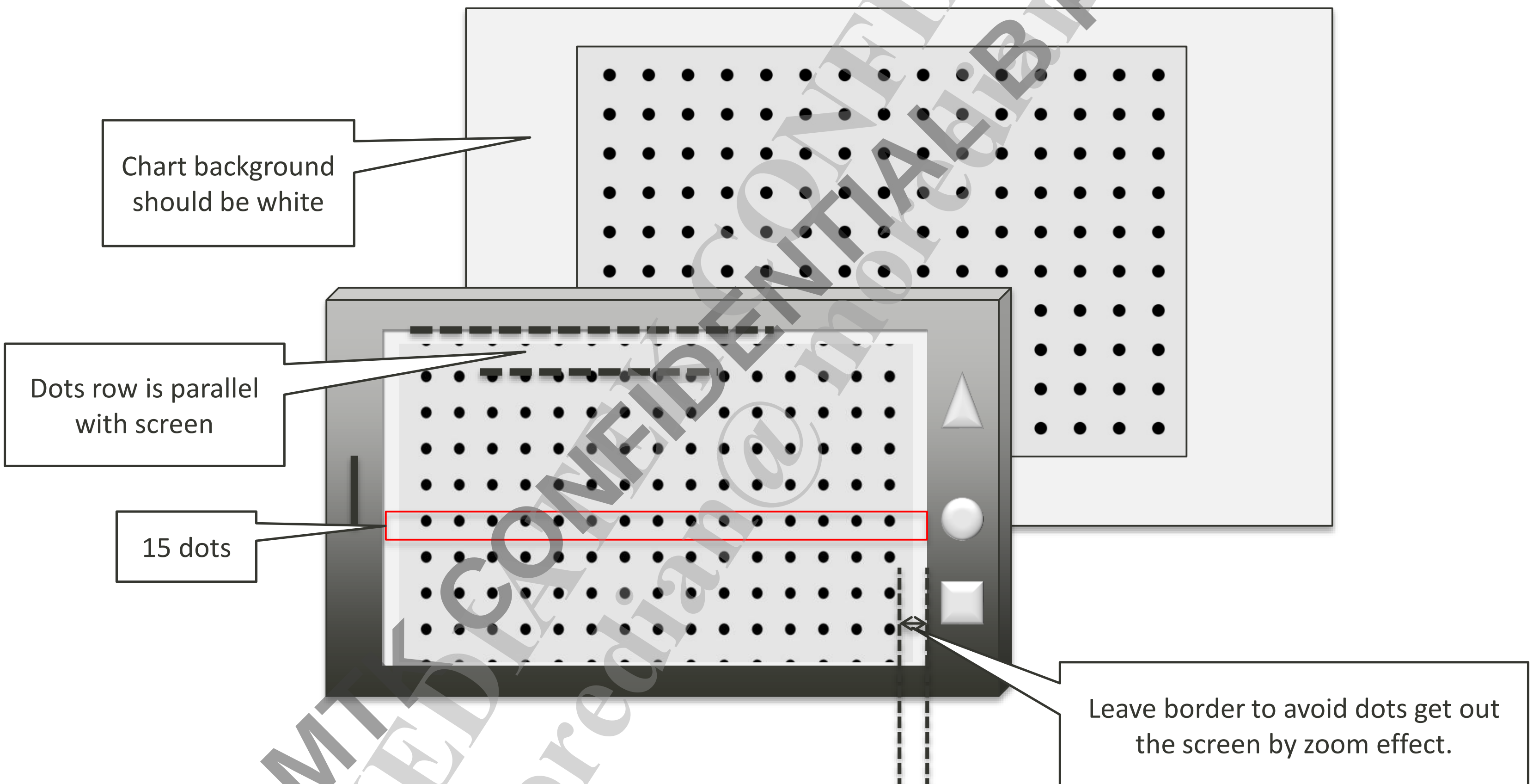


Push 'Shift+F5' for ppt full screen mode and check moving GIF

Zoom Effect Calibration – Environment setup



Zoom Effect Calibration– Environment setup



Zoom Effect Calibration – Get calibration data

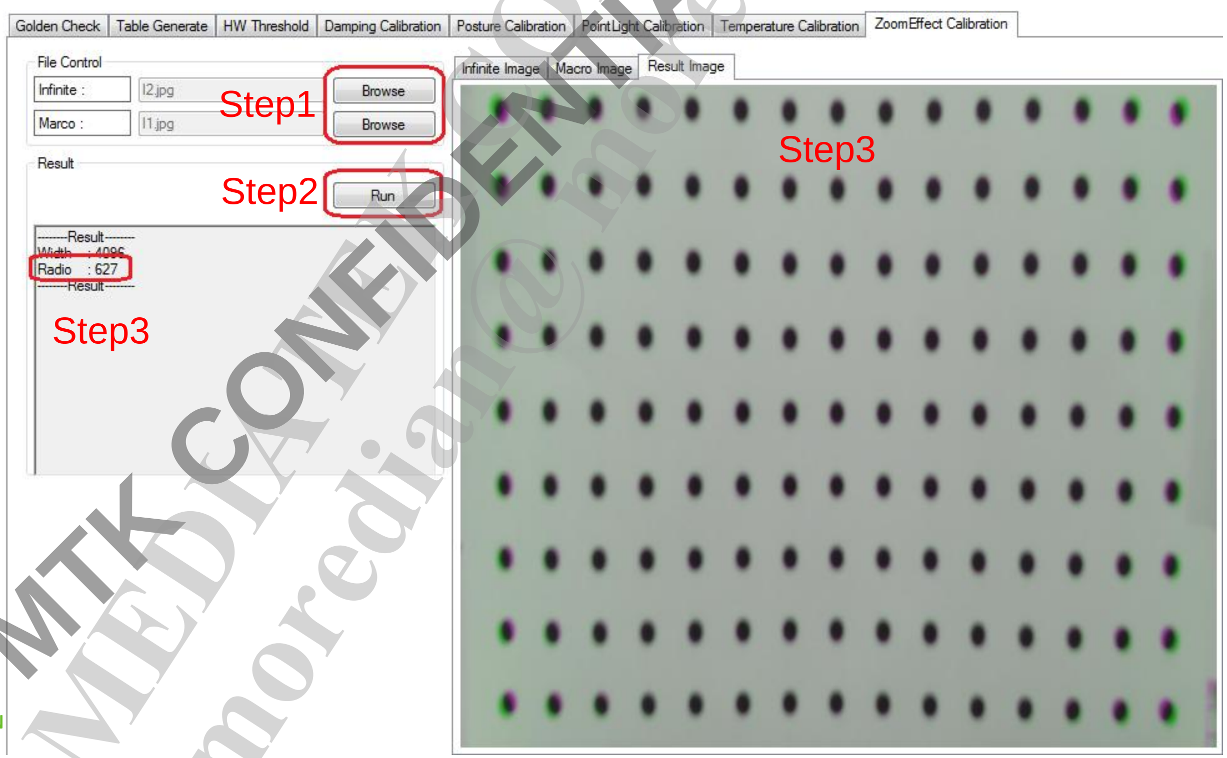
- ZEC calibration tool needs 2 jpeg images:
  - Before zoom effect calibration we need do AF table calibration first
  - If we changed AF table zoom effect calibration need do it again
  - How to get these 2 images?
    - Step1: Enter camera app and set to ZSD preview.
    - Step2: Do TAF (no matter AF OK or fail, don't care)
    - Step3: Type adb command "setprop debug.af.zeccalib 1" then capture image1
    - Step4: Close and re-open camera app
    - Step5: Do TAF (no matter AF OK or fail, don't care)
    - Step6: Type adb command "setprop debug.af.zeccalib 2" then capture image2
  - Sample image as below

Macro side (FOV smaller)

Infinity side (FOV larger)

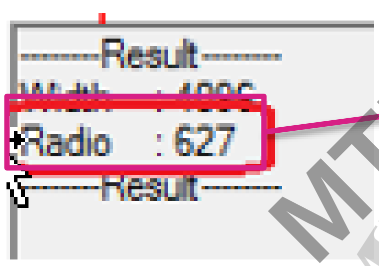
Zoom Effect Calibration – Generate parameters

- Step1: Load 2 images in CCT tool
- Step2: Press “Run” bottom
- Step3: Get match image and final zoom effect ratio back
  - Match image’s R & B channel come from macro image and G channel come from infinity image with crop and resize by final ratio.
  - Match image as below we need check match well or not (over half circle has color)
  - Due to image distortion, the dot around image can’t be matched well.



Zoom Effect Calibration – Apply parameters

1. Merge Zoom Effect parameter to source code
   - vendor/mediatek/proprietary/custom/$project$/hal/lens/$lens$/
     - lens_para_$lens$.cpp : for default value
     - lens_para_$lens$_cap.cpp : for full-size preview
     - lens_para_$lens$_pv.cpp : for binning-size preview
     - lens_para_$lens$_vdo.cpp : for full-size video record
     - lens_para_$lens$_cus3.cpp : for binning-size video record
2. Fill final zoom effect ratio to below




```
//==========================================================================/
  // Section: Zoom effect ROI compensation tuning data
  // Description: Zoom effect scale ratio. This parameters generated by tuning tool
  // [5] name: ZE_ratio
  // range: 400~800
  // default: 618
  // constraints:
  // effect: Need generate by tuning tool
  //--------------------------------------------------------------------------/
618,
},//i4ZoEffect[64]
```

Subjective Check - Flow

- Follow below steps, to make sure your calibration data is fine
  - Push new calibration data into FW
  - In normal camera, take images on the tripod using touch-AF
    - Switch to ZSD mode
    - Touch the center of preview frame
  - Subjective check AF results

Item	Test distance	Test target
HW threshold	15cm (ISO400)	Grid chart or low contrast scene
	15cm (ISO800)	
AF table	10cm	Star chart
	> 3M	Daylight Building

Subjective Check - Example

HW threshold

15cm grid-chart with iso 400

15cm grid-chart with iso 800

AF table

> 3m building

10cm star chart