

6797 CCT ISP tuning guide

Check List Q&A

- Is MTK module the same as target phone's?
 - Please provide module information to MTK, if the module is different. (Sensor and lens information)
- JPG parameter is invalid?
 - Please let us know.
- Is SWNR/MNR applied correctly?
 - Compare the images with SWNR/MNR ON and OFF. SWNR/MNR is enabled if these two images are different.

Check List Q&A

- Engineering mode output = Normal mode output?
 - They are not exactly the same. Just make sure they are not different dramatically.
- AE/AF/AWB influence on image quality
 - Make sure 3A has no obvious error.
- Is our scene brighter/darker than target phone?
 - Please send us log, raw, shading table, jpg, and reference phone picture.
 - If they are different, please tell us why shouldn't we make them the same in AE.
- Is our ISO setting similar with target phone's?
 - Please tell us the reason why we shouldn't align p-line with reference phone.
- OB, shading, gamma, CCM tuning finished?
 - Please run basic calibration for these items with CCT.

Overview

使用CCT可以调BPC、NR1(XTalk)、UDM(Demosaic)、ANR、ANR2、CCR、EE和MFB。

影响画面Detail和Noise表现的主要是UDM、ANR、ANR2和EE。

The screenshot displays the Mediatek CCT interface, which is used for camera calibration. The interface is divided into several sections:

- Action Page:** The top navigation bar, currently showing "Sensor Register", "Device Profile", "Shading Calibration", "AE P-line Calibration", "AE Calibration", and "AWB Calibration".
- Tuning Control:** A section on the left containing four dropdown menus: "Category" (set to BPC), "Profile" (set to Preview), "Mode" (set to Preview), and "ISO" (set to 100).
- NVRAM Control:** A section below Tuning Control with three buttons: "Read", "Apply", and "Save".
- Reg Control:** A section at the bottom left with a "Copy" button.
- BPC Settings:** A section on the right, highlighted with an orange border, containing a row of tabs: "BPC", "NR1", "UDM", "ANR", "ANR2", "CCR", "EE", and "MFB". The "BPC" tab is selected, showing a "BPC" sub-section with an "Enable" checkbox (checked) and a "Strength" slider set to 0.

Tuning preparation

原始的参数

1. 可以使用Easy Calibration生成。
关于Easy Calibration的使用请参考Tool中的文档。
2. 如果方案1无法得到参数，请使用default 参数

Tuning Scene

建议场景中包括：

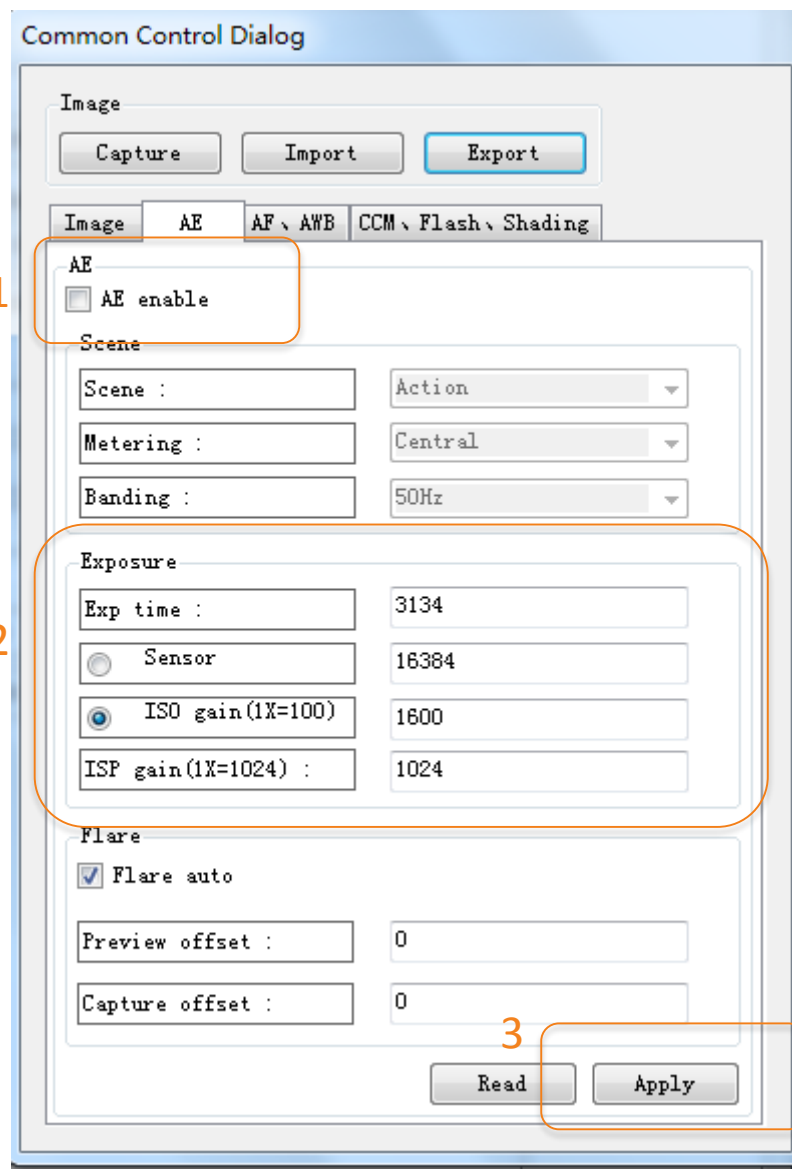
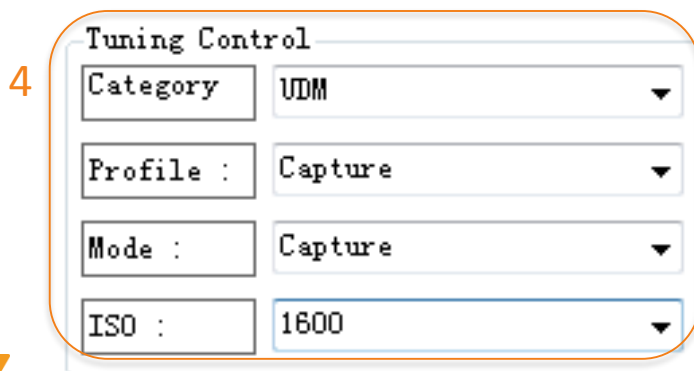
1. 中心区色卡，每个色块相当于平坦区
2. 头发看高频处理。
3. 毛绒娃娃看低频细节
4. 绿叶看纹路。
5. 红花看纹路。



Tuning configuration

调试前设置:

1. Disable AE;
2. 设置Exp time和ISO;
3. 设置结束后点击Apply;
4. Tuning Control部分设置对应的Category, Profile, Mode以及ISO。



Tuning flow



Tuning flow

1. 先调试画面中心平坦区，在保留一定的细节前提下，让平坦区的Noise表现与target接近，这部分主要调试UDM和ANR；
2. 调试EE，使边缘表现与target接近，这部分主要调试EE和ANR2；
3. 使用Corner NR和Corner EE调试画面四角。

Tuning procedure

首先调试画面中心平坦区，让平坦区的Noise表现与target接近。
影响Noise表现的有UDM中的NR和ANR中的所有参数。

The screenshot displays the ANR (Adaptive Noise Reduction) tuning interface. At the top, a series of tabs includes BPC, NR1, UDM, ANR (selected), ANR2, CCR, EE, and MFB. The ANR tab is active, showing several configuration sections:

- Global:** Includes checkboxes for ☒ Luma NR and ☒ Chroma NR.
- Impulse NR:** Features a **Detect Sensitivity** slider set to 76 and a **Strength** slider set to 100.
- Corner NR:** Includes an ☒ **Enable** checkbox and a **Strength** slider set to 42.
- Luma NR Gain:** Contains four input fields for Y0, Y1, Y2, and Y3, all of which are set to 0.
- Edge Preserve NR:** Includes sliders for **Y Strength (High Freq.)**, **Y Strength (Mid Freq.)**, **Kernel Size (High Freq.)**, **C Strength** (set to 64), **Y Noise** (set to 1), and **C Noise** (set to 32).
- Edge Smooth:** Features a **Strength** slider set to 100.
- Color Bledging Suppression:** Includes a **Strength** slider set to 100.
- Kernel Size:** Includes checkboxes for ☒ Luma Size 2X and ☒ Chroma Size, along with **Min Size** and **Max Size** sliders, both set to 6.

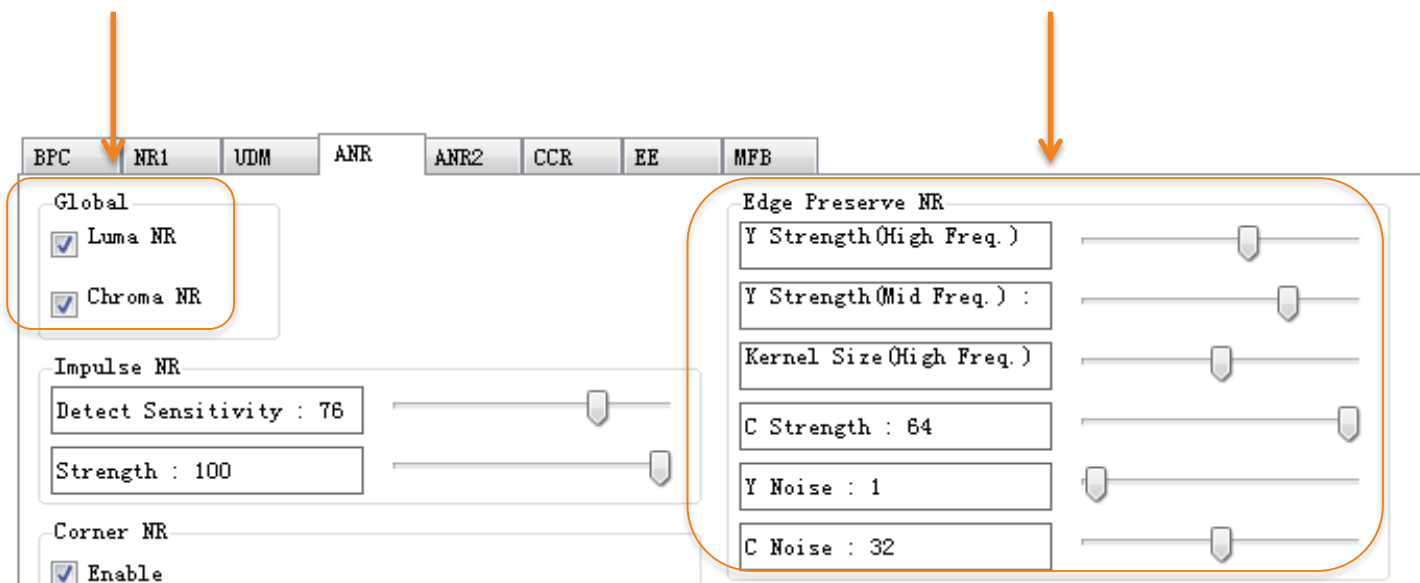
Edge Preserve NR (Luma)

Luma NR针对亮度做denoise，
Chrome NR针对色彩做denoise，
必须勾选才能生效

粗调ANR，使用Edge Preserve NR。

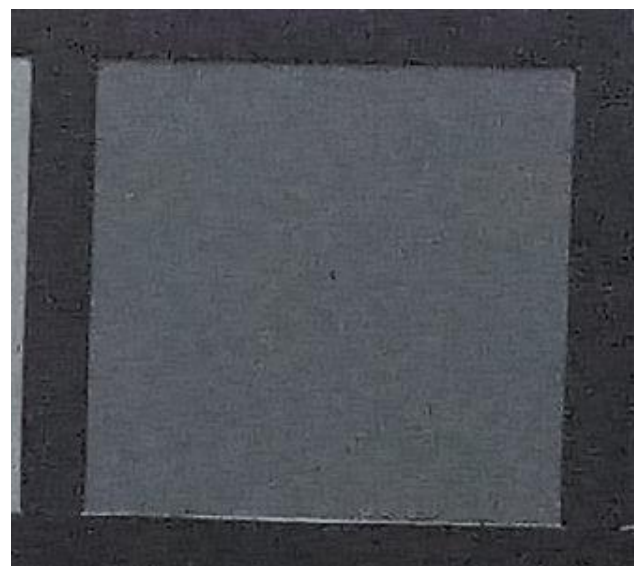
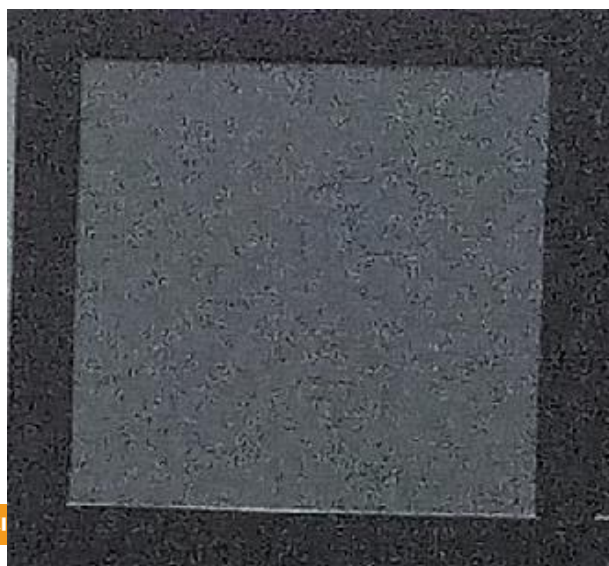
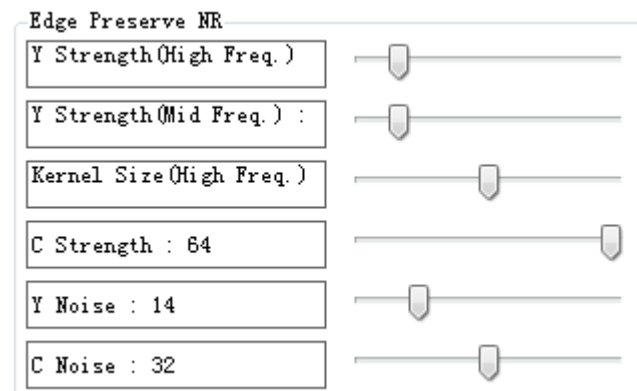
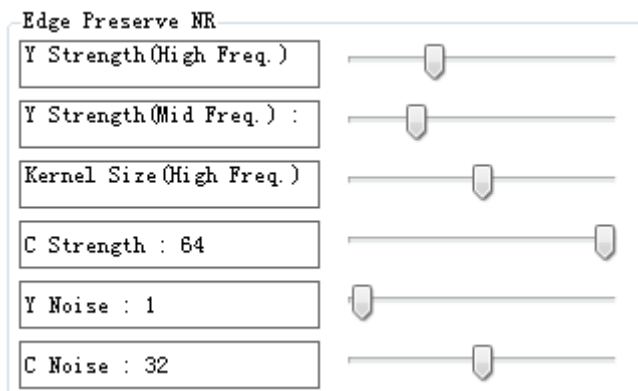
1. Y Noise针对Luma Noise，是控制判断Noise的门限，值越大被认为是Noise的pixel越多
2. Y Strength控制NR的强度。

注意：6797上Y Strength越往左拉效果越强。



Edge Preserve NR (Luma)

平坦区的Noise通过调大Y Noise和Y Strength可以去除。

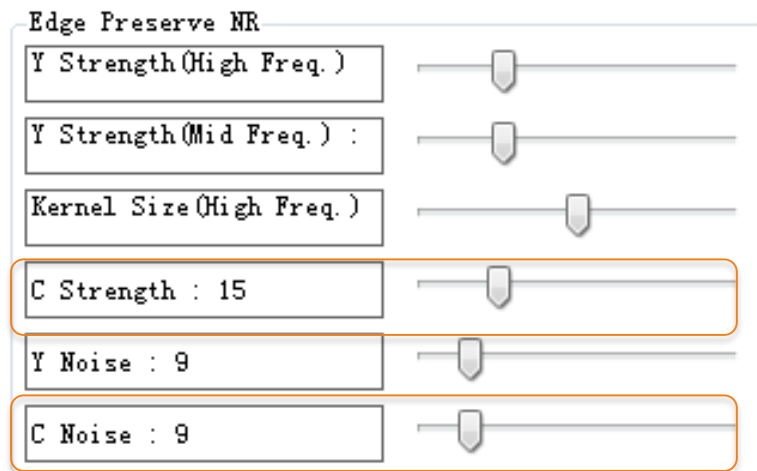


Edge Preserve NR (Color)

ANR可以针对Chroma Noise进行Denoise操作。

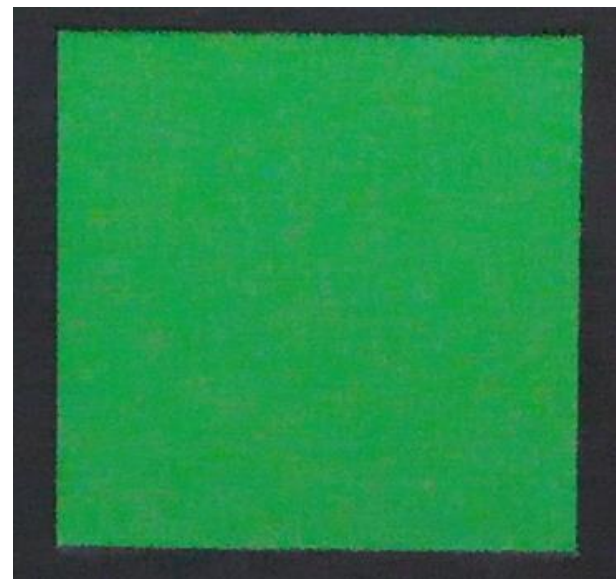
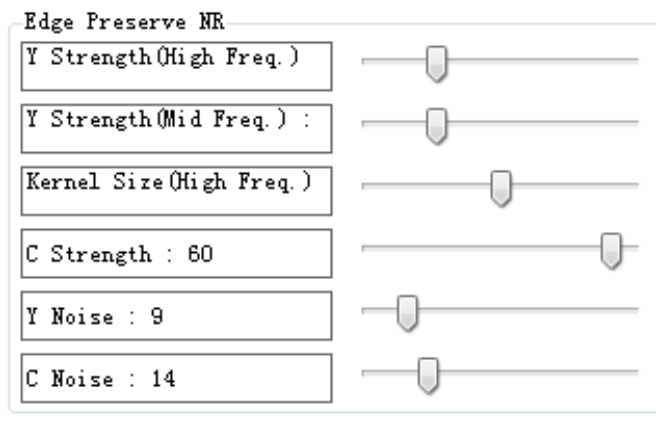
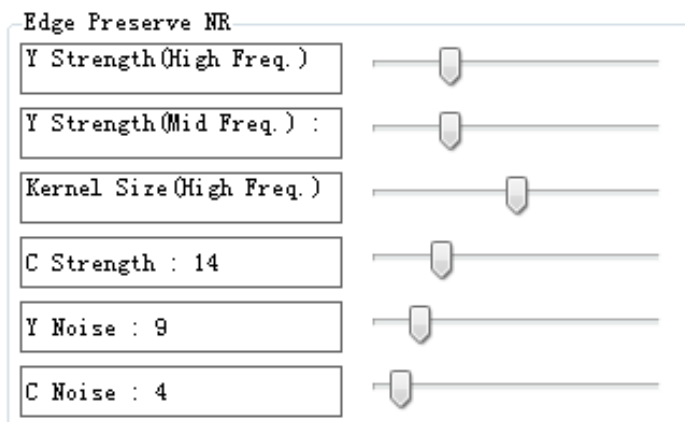
C Noise控制判断为Chroma Noise的门限， C Strength控制Denoise的强度。

注意： C Noise和C Strength设太强会引起Color Bleeding现象。



Edge Preserve NR (Color)

提高C Noise和C Strength，可以去除Color Noise。



Color Bleeding Suppression

对于Color Bleeding现象，可以使用Color Bleeding Suppression进行抑制。
Strength越大表示抑制Color Bleeding的强度越大，同时彩色去噪能力变弱。
如果设为最大还不能解决色彩溢色，那要降低C Noise和C Strength。



UDM EE Strength

假如调节Y Noise和Y Strength导致细节丢失。可以调节UDM中的EE增加细节。

BPC	NR1	UDM	ANR	ANR2	CCR	EE	MFB
Connectivity							
Detail : 51							
Edge Suppression							
White : 13							
Dark : 100							
Start Suppression Thd :							
EE Noise LV							
Detail : 36							
Edge : 36							
Corner NR							
Strength : 124							
Cross Talk (GrGb Mismatch)							
Threshold : 12							
Strength : 12							
EE Strength							
Detail : 8							
Edge : 8							
Strong Edge : 8							

UDM EE Strength

将EE Strength调大可以增强画面Edge表现。

EE Strength

Detail : 2

Edge : 2

Strong Edge : 2



EE Strength

Detail : 8

Edge : 8

Strong Edge : 8



Kernel Size

ANR的效果开得太强会导致画面细节的丢失。

可以减弱ANR的强度，增加Kernel Size。

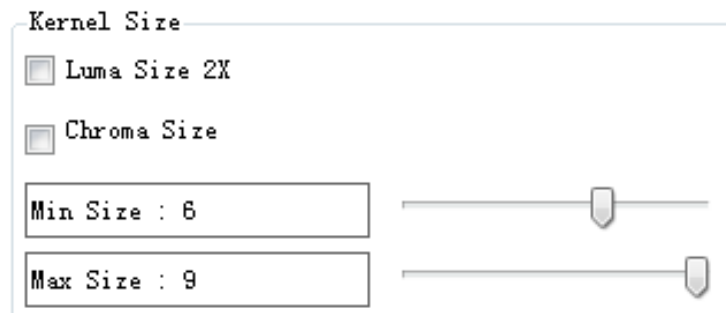
Size越大，NR效果越强。

Luma Size 2X针对Luma Noise，勾选才能生效。

Chroma Size针对Chroma Noise，勾选才能生效。

Min Size和Max Size设置了Kernel Size的范围。

注意要让Min Size \leq Max Size



The image shows a UI control panel titled "Kernel Size". It contains two checkboxes: "Luma Size 2X" and "Chroma Size", both of which are currently unchecked. Below these are two input fields for "Min Size" and "Max Size". The "Min Size" field contains the value "6" and has a slider to its right. The "Max Size" field contains the value "9" and also has a slider to its right. The sliders are positioned to match the values in the input fields.

Kernel Size

☐ Luma Size 2X

☐ Chroma Size

Min Size : 6

Max Size : 9

Kernel Size

Kernel Size变大，画面Noise表现比之前要好。

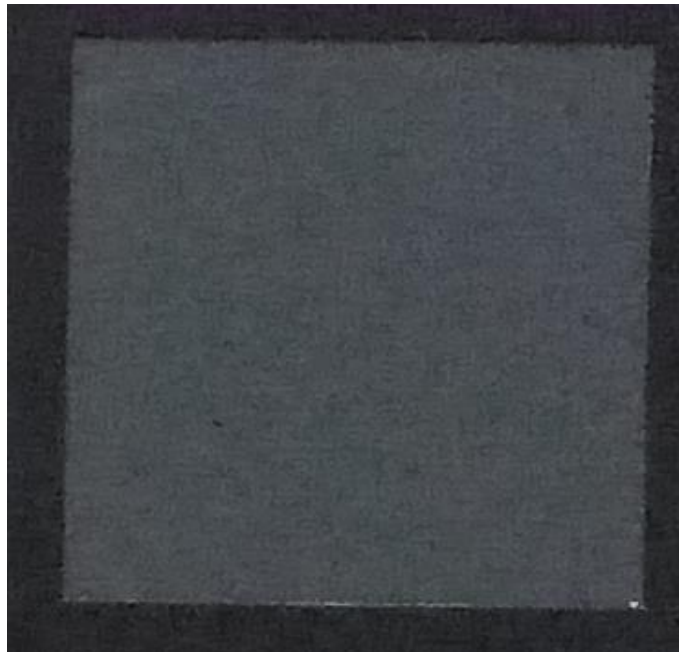
Kernel Size

☐ Luma Size 2X

☐ Chroma Size

Min Size : 6

Max Size : 9



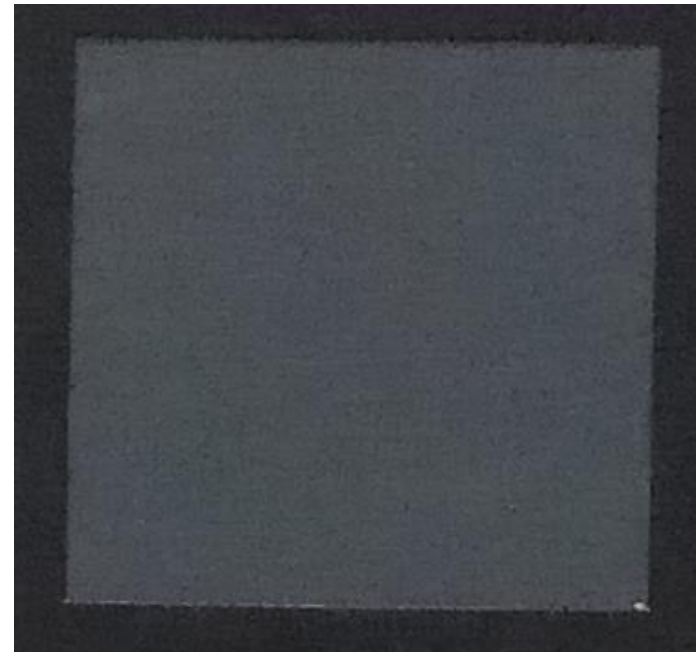
Kernel Size

☒ Luma Size 2X

☐ Chroma Size

Min Size : 6

Max Size : 9

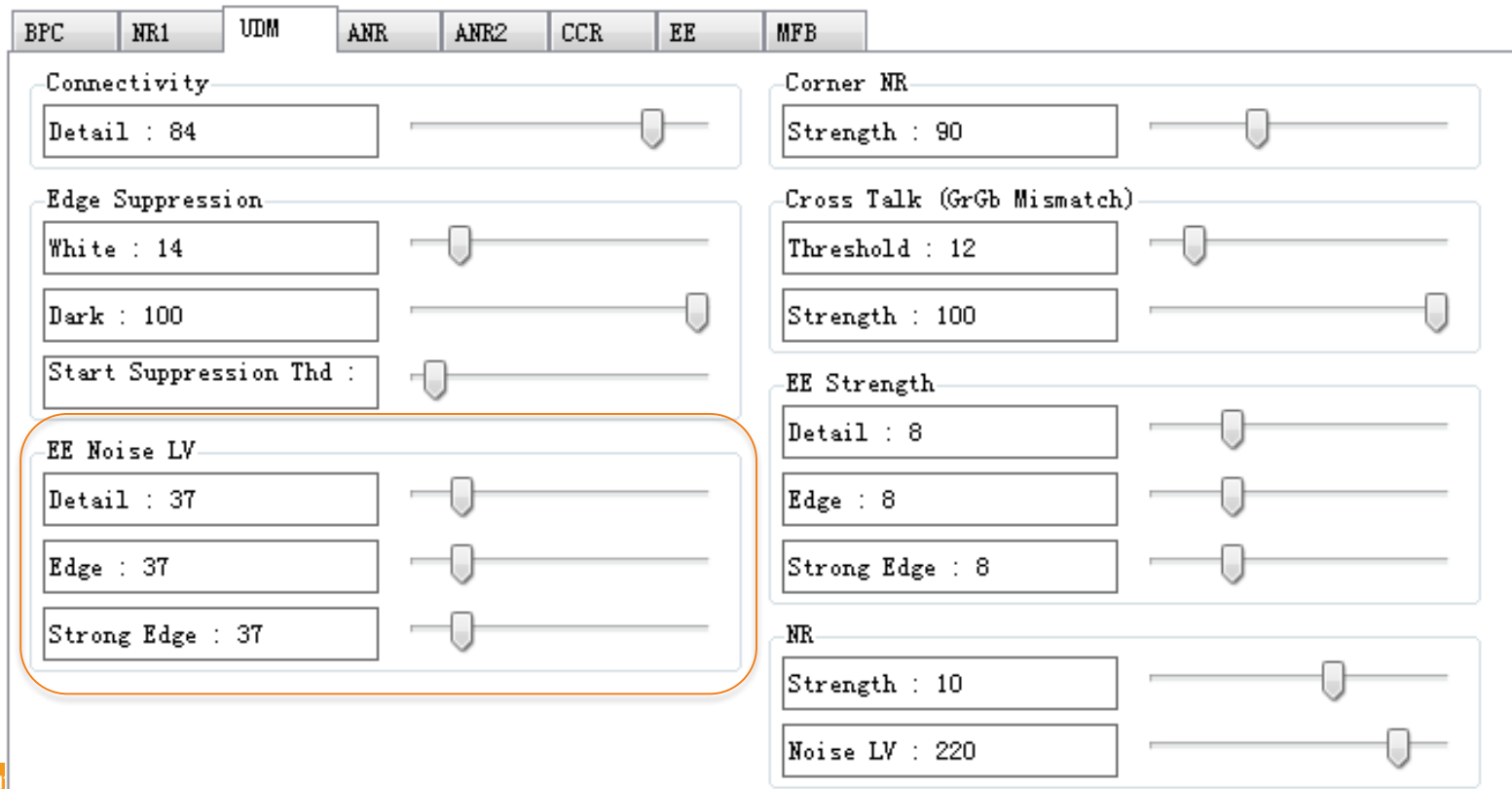


UDM EE Noise LV

UDM部分的EE可以增加图片细节。

EE Noise LV控制EE的门限，大于对应数值的才会做EE。

在高ISO情况下，如果UDM的EE门限比较低，可能会产生蠕虫状的Noise。
将Noise LV提高消除Noise，但画面会变比之前模糊。

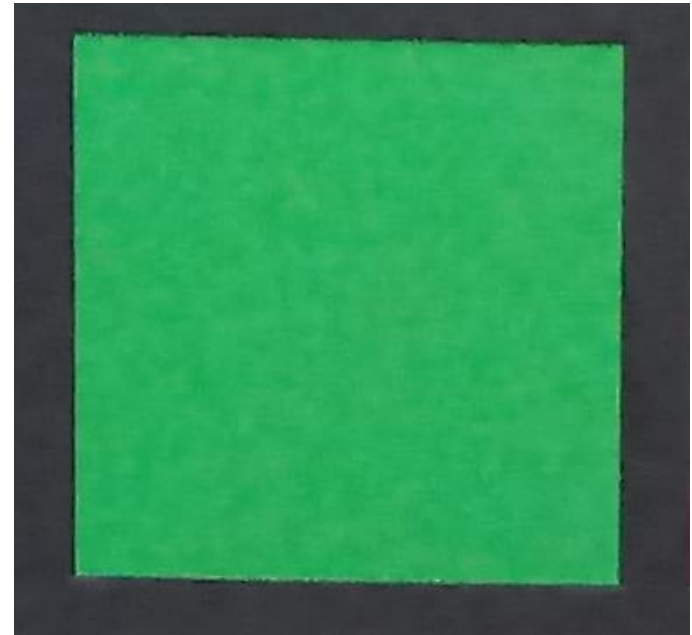
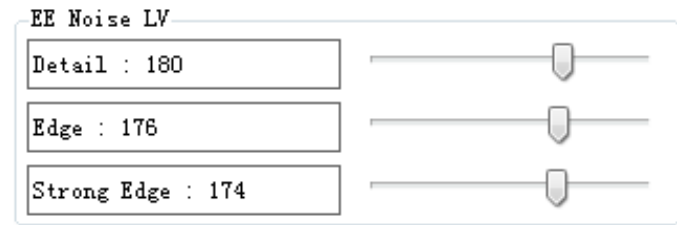
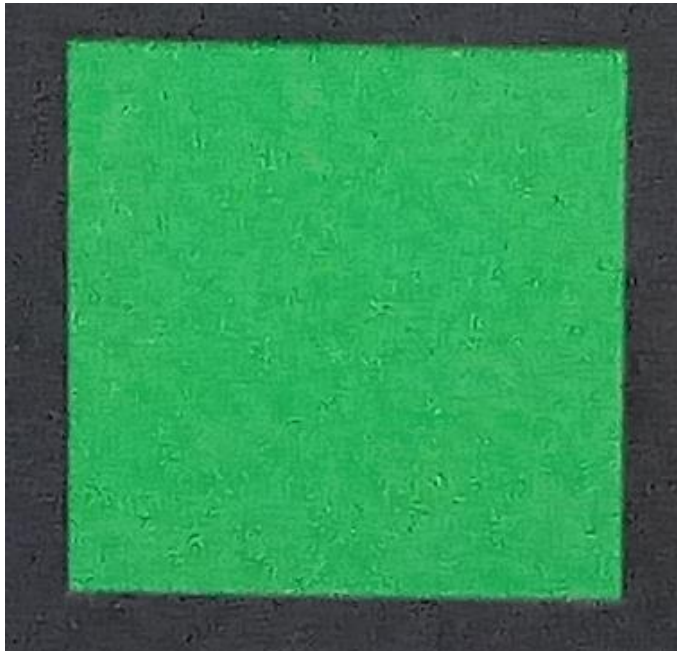
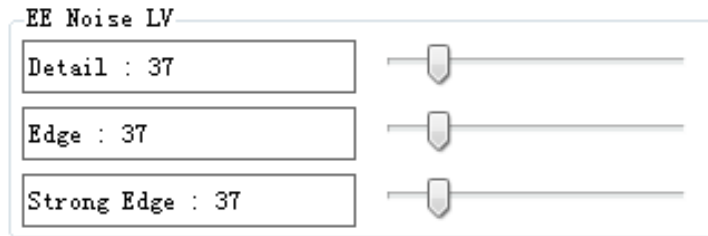


The image shows a camera's menu interface with various settings tabs. The 'UDM' tab is selected. Within this tab, the 'EE Noise LV' section is highlighted with an orange border. This section contains three sliders: 'Detail : 37', 'Edge : 37', and 'Strong Edge : 37'. Other visible settings include 'Connectivity' (Detail: 84), 'Edge Suppression' (White: 14, Dark: 100, Start Suppression Thd), 'Corner NR' (Strength: 90), 'Cross Talk (GrGb Mismatch)' (Threshold: 12, Strength: 100), 'EE Strength' (Detail: 8, Edge: 8, Strong Edge: 8), 'NR' (Strength: 10, Noise LV: 220), and 'MFB'.

Setting	Value
Connectivity Detail	84
Edge Suppression White	14
Edge Suppression Dark	100
Edge Suppression Start Suppression Thd	
EE Noise LV Detail	37
EE Noise LV Edge	37
EE Noise LV Strong Edge	37
Corner NR Strength	90
Cross Talk (GrGb Mismatch) Threshold	12
Cross Talk (GrGb Mismatch) Strength	100
EE Strength Detail	8
EE Strength Edge	8
EE Strength Strong Edge	8
NR Strength	10
NR Noise LV	220

UDM EE Noise LV

EE Noise LV提高了，蠕虫状Noise去除了，但画面比之前要模糊。



Impulse Noise

画面中如果存在Impulse Noise，可以调整Detect Sensitivity和Strength去消除。

建议优先调整ANR2中的Impulse NR。

The image displays two screenshots of the ANR2 settings interface, showing the 'Impulse NR' section highlighted with an orange box.

Top Screenshot:

- Global: ☒ Luma NR, ☒ Chroma NR
- Impulse NR: Detect Sensitivity : 7, Strength : 75
- Edge Preserve NR: Y Strength (High Freq.) (slider), Y Strength (Mid Freq.) (slider), Kernel Size (High Freq.) (slider), C Strength : 64, Y Noise : 14

Bottom Screenshot:

- Global: ☐ Luma NR, ☒ Chroma NR
- Impulse NR: Detect Sensitivity : 23, Strength : 31
- Color Bledging Suppression: Strength : 100
- Edge Preserve NR: C Strength : 64, C Noise : 32
- Corner NR: ☒ Enable, Strength : 0
- Kernel Size: ☒ Luma Size 2X, ☒ Chroma Size

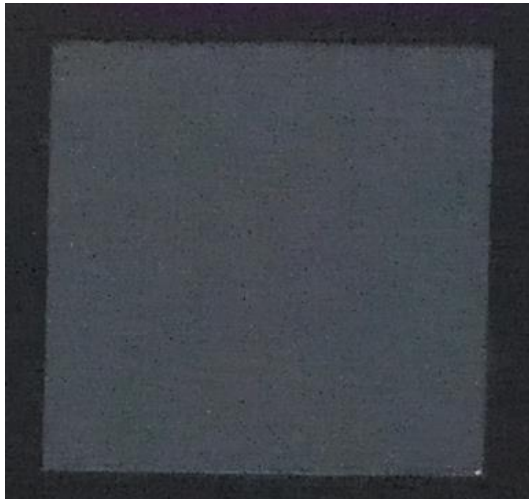
Impulse Noise

Impulse NR

Detect Sensitivity : 10



Strength : 11

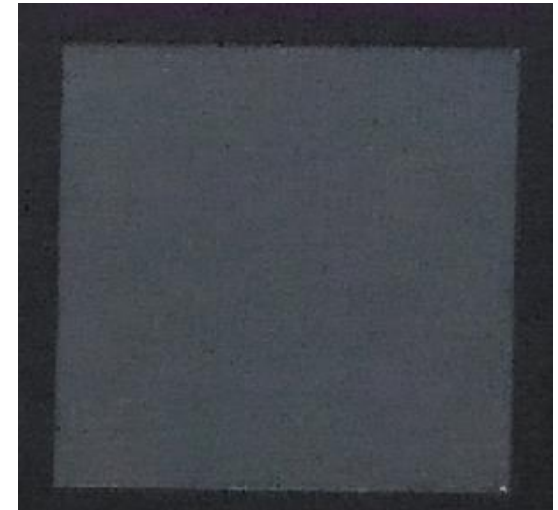


Impulse NR

Detect Sensitivity : 20



Strength : 88



Edge Enhancement

画面中心平坦区Noise表现达到要求后，调试EE，增强边缘表现。
注意EE调试后会有一些Noise产生，再微调ANR2的参数。

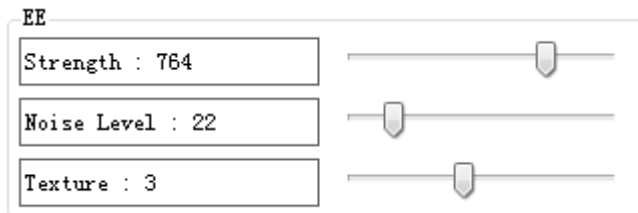
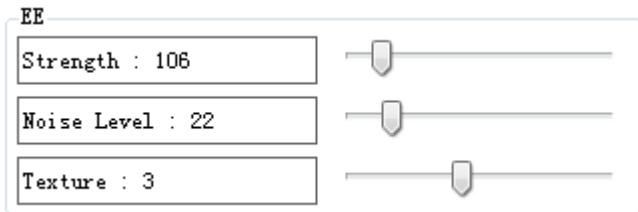
BPC	NR1	UDM	ANR	ANR2	CCR	EE	MFB
EE							
Strength : 500							
Noise Level : 50							
Texture : 4							
Freq. Division EE							
Detail : 8							
Texture : 10							
Edge : 6							
Edge Suppression							
White : 100							
Dark : 150							
Start Suppression Thd :							
Max Enhance Bound : 106							
Line Pattern Reduction							
Detail Noise LV : 0							
Texture Noise LV : 0							
Edge Noise LV : 0							
Strength : 0							
Corner EE							
<input type="checkbox"/> Enable							
Strength : 0							
Dot Noise Suppression							
Strength : 0							
Threshold : 97							

EE Strength

Strength控制EE的强度， Noise Level控制EE的门限， 高于该门限才会做EE。

Texture可以增强纹理区的EE表现。

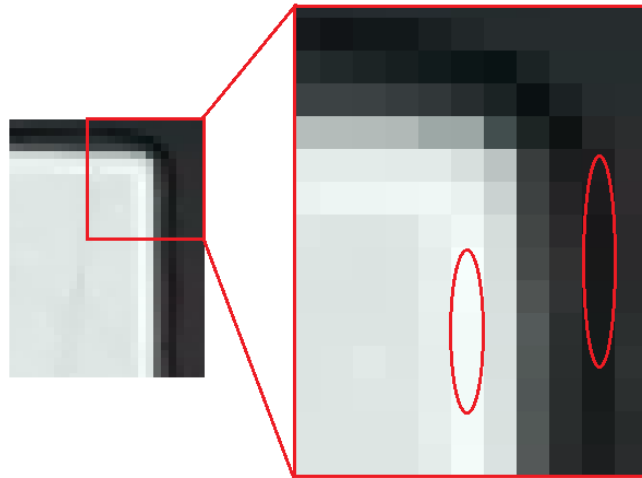
Strength提高， Edge加强。



Edge Suppression

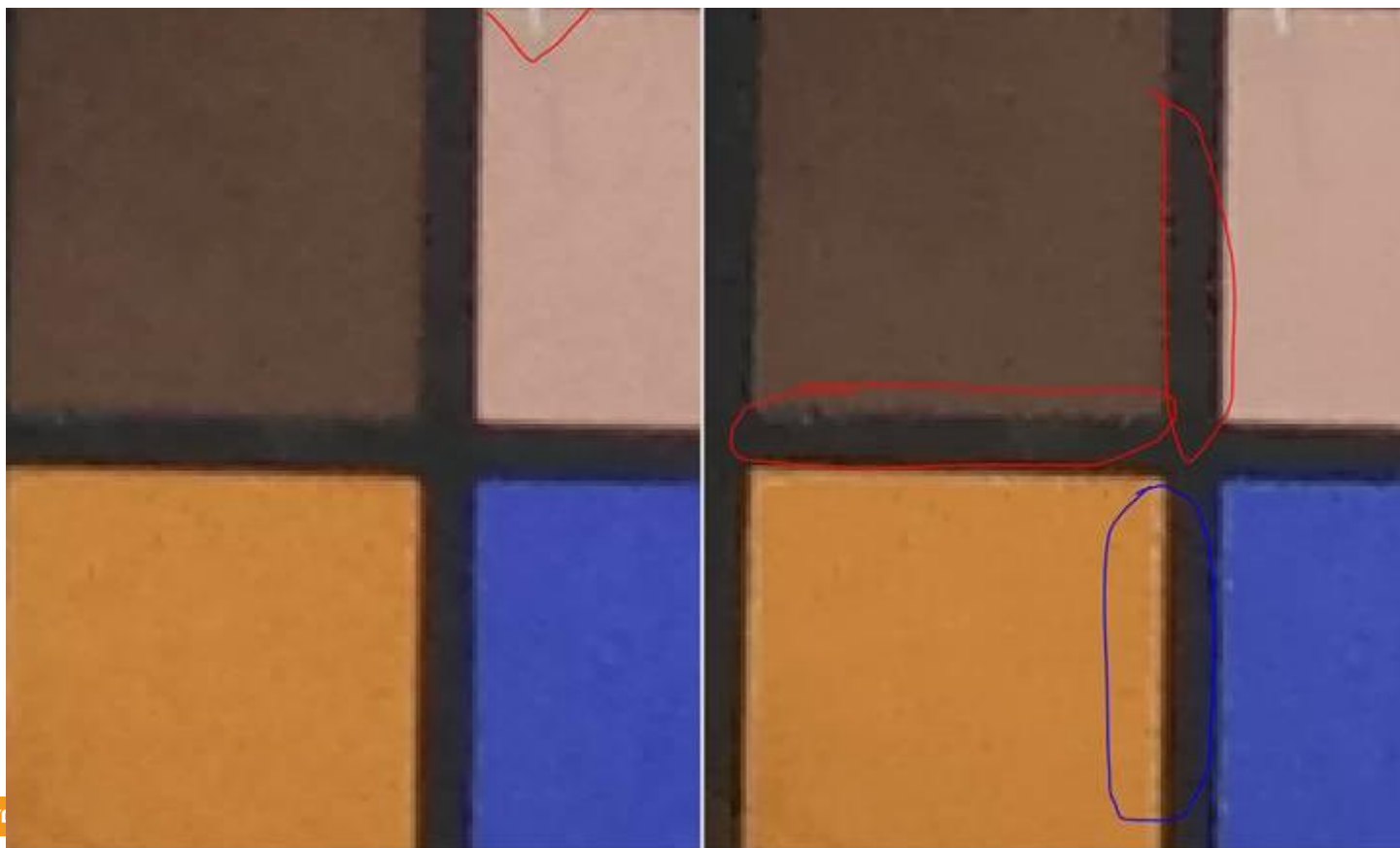
经过EE后，在边缘过渡的地方可能会出现偏亮和偏暗的pixel。
可以通过Edge Suppression来抑制这种现象。
UDM和EE页面的Edge Suppression都可以尝试。

White抑制偏亮pixel的亮度， Dark提高偏暗pixel的亮度。



Edge Suppression(UDM)

下图蓝框，白边稍微明显一些

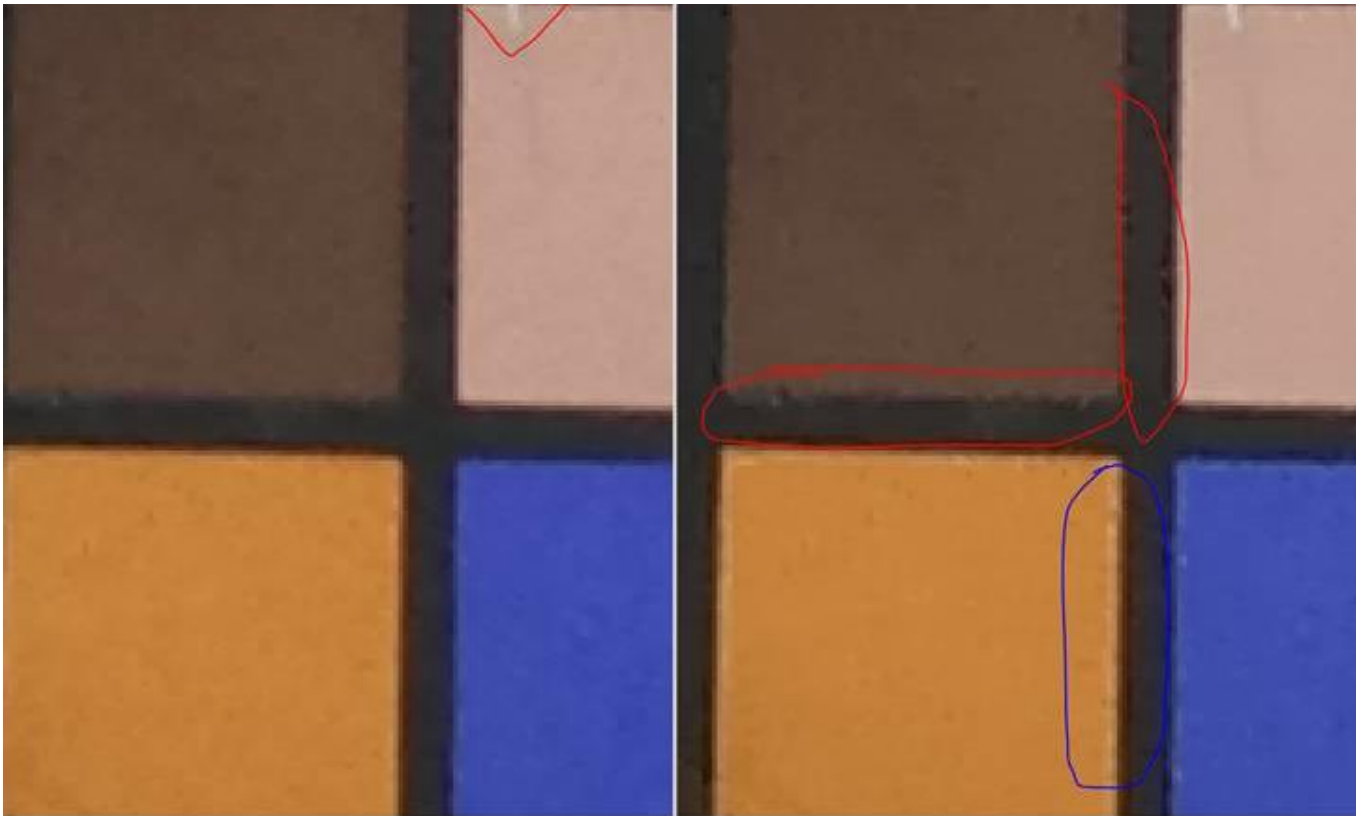


Dirty Edge

Dirty Edge的改善方法如下：

1. 先检查UDM的EE strength和EE 里的strength是否太强，若太大，可以降低一些
2. 高ISO的话，可以将ANR中Edge Smooth的值加大一点。

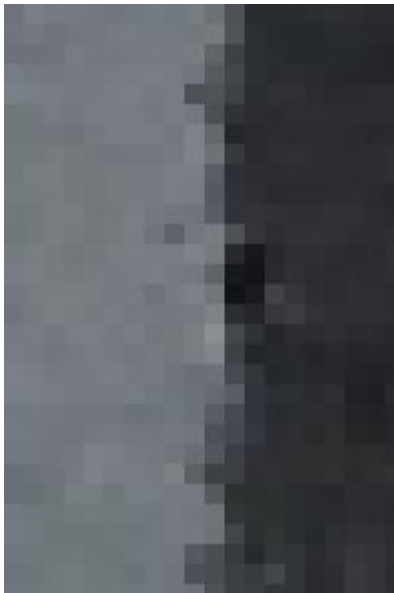
下图红框， edge看起来比较脏



Edge Suppression(EE)

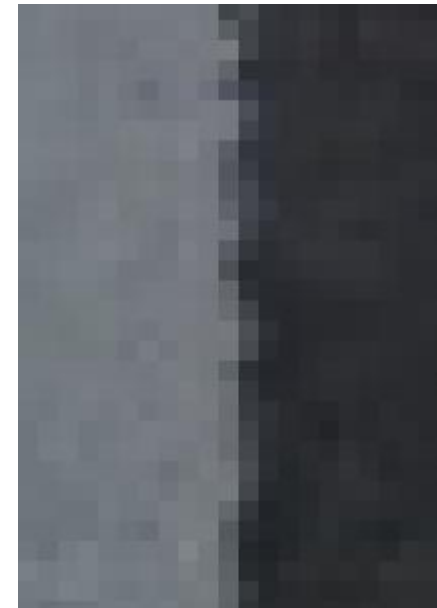
Edge Suppression

White : 37	<input type="range"/>
Dark : 39	<input type="range"/>
Start Suppression Thd :	<input type="range"/>
Max Enhance Bound : 32	<input type="range"/>



Edge Suppression

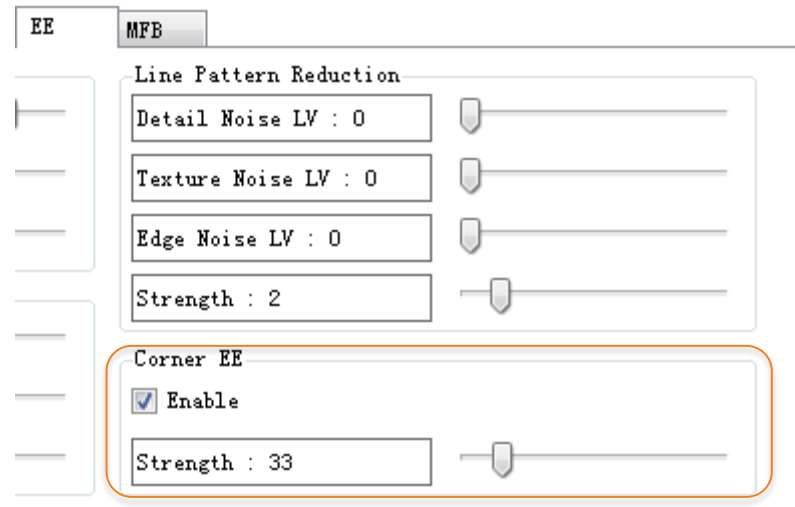
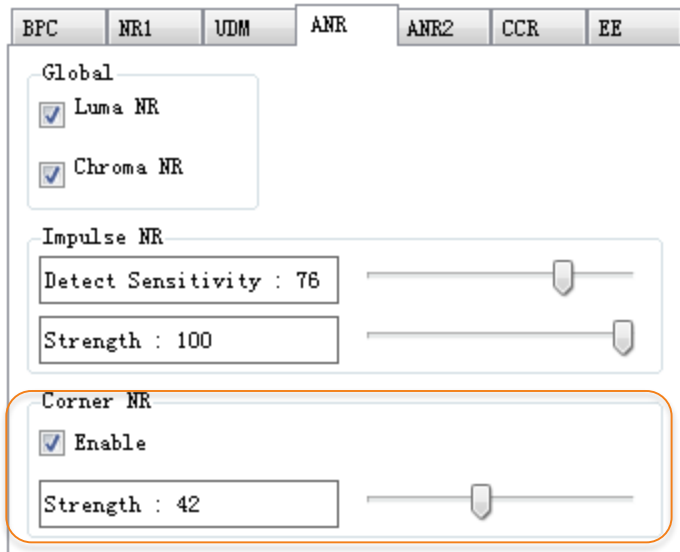
White : 211	<input type="range"/>
Dark : 195	<input type="range"/>
Start Suppression Thd :	<input type="range"/>
Max Enhance Bound : 32	<input type="range"/>



Corner NR

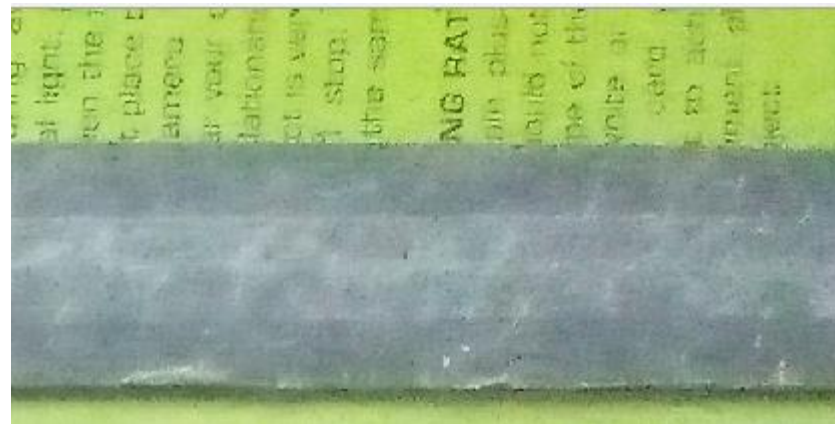
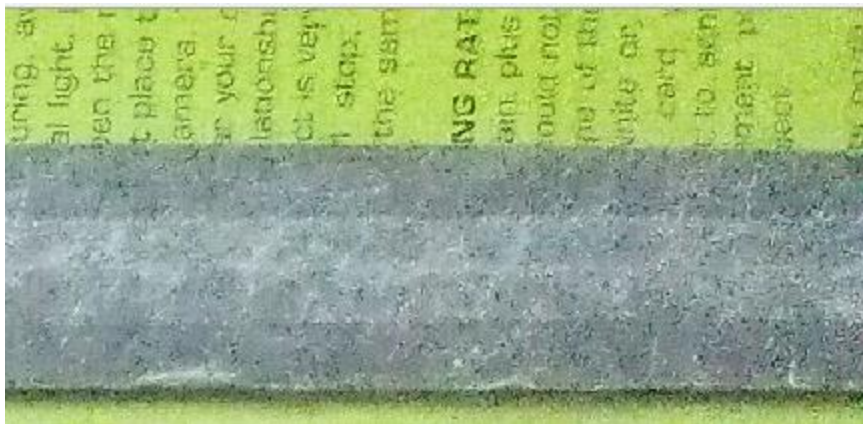
在中心区调试后，开始调试图像四周，先使用Corner NR，对四周做Denoise。Corner NR必须Enable才能生效。

Corner NR调试后再根据需求添加Corner EE。



Corner NR

Corner NR Strength加强，可以去除四周的Noise。



Detail Enhancement

低频细节少，比如毛线球，增加细节的方法有三，但需要tradeoff的是noise是否变多：

1. 降低UDM里EE的noise level的值
2. 增加UDM里EE的strength值
3. 降低ANR里面的Y Noise和提高Y Strength





everyday genius

The Mediatek logo consists of the word "MEDIATEK" in white, uppercase, sans-serif font, centered within an orange parallelogram with a slight 3D effect.

MEDIATEK

Noise Reduction v4.1

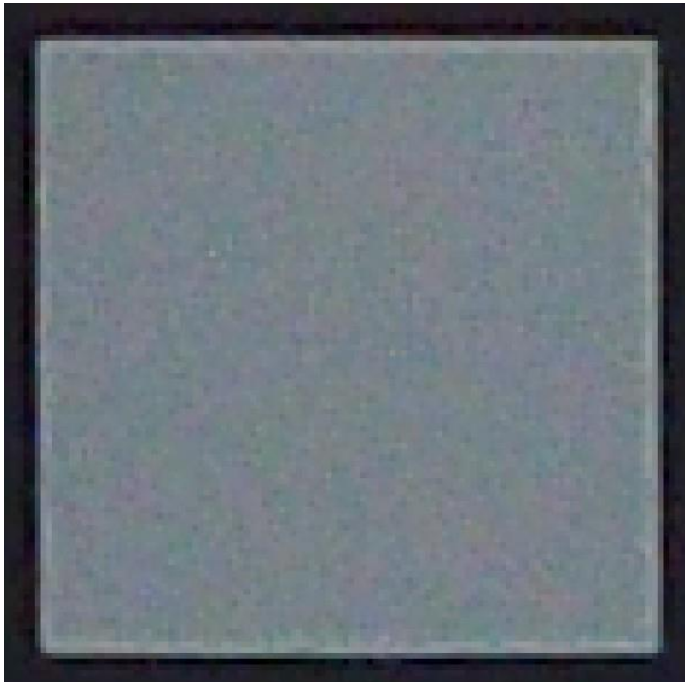
Support Chip

- MT6797

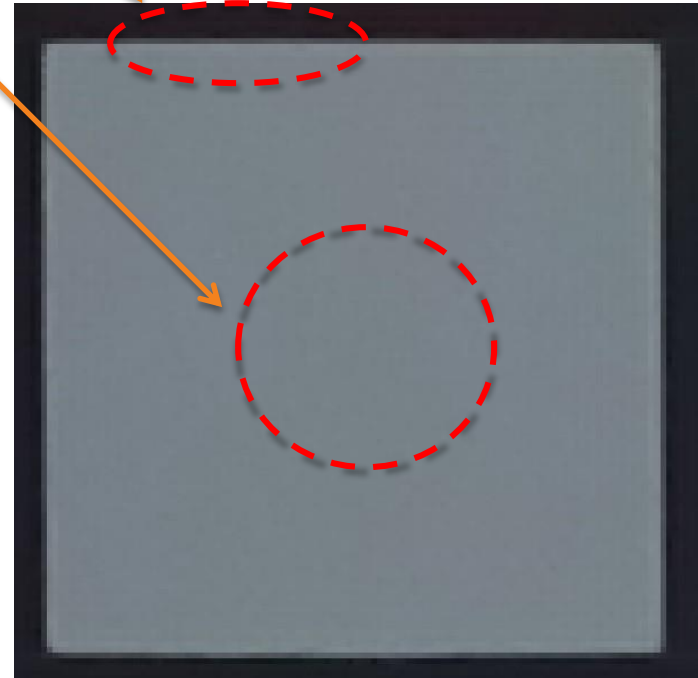
What is Noise Reduction

A function to **remove noise** and **preserve edge** while removing noise.

Before Noise Reduction

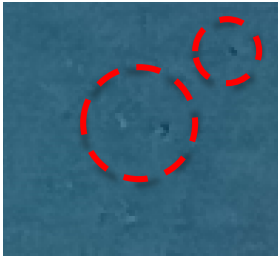


After Noise Reduction

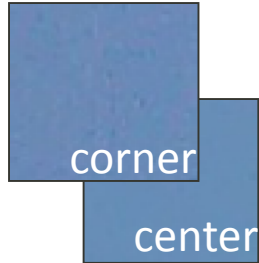


What issue might meet

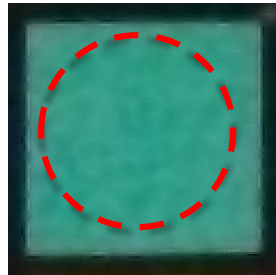
Impulse Noise



Corner Noise



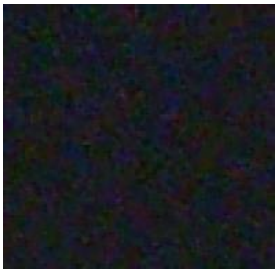
Luma Noise



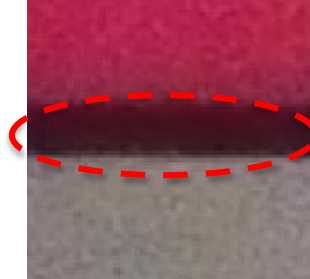
Detail Lost



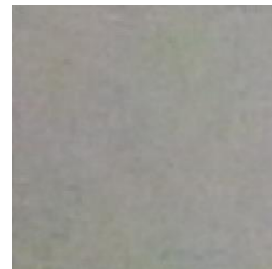
Color Noise



Color Bleeding



Low Frequency Color Noise

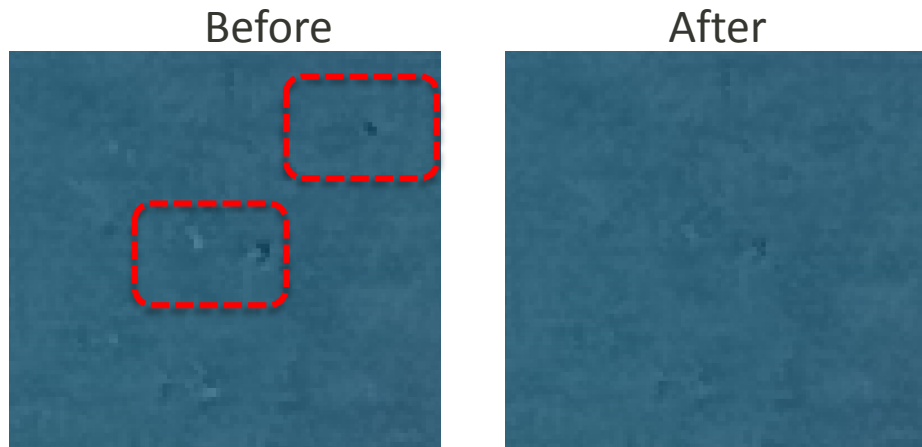


Dirty Edge



Impulse noise

- Target
 - Remove dot and impulse noise



BPC (Bad Pixel Correction)



① Set “Strength” to maximum.

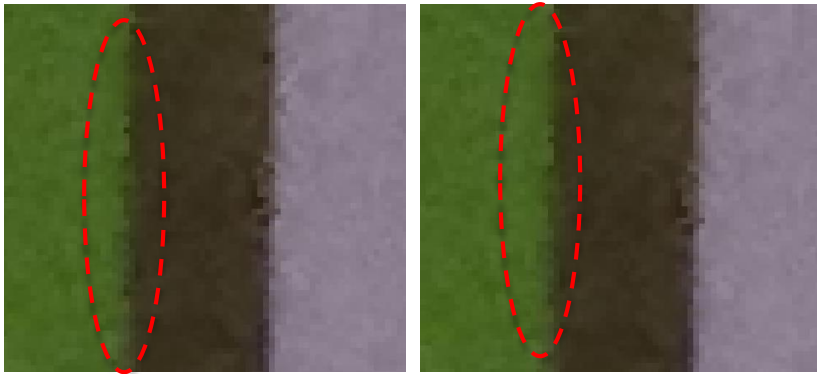
② Move “Detect sensitivity” slider to right, until all impulse noise are disappear.

③ Move “Strength” slider to left to make impulse noise and detail balance.

Edge NR

- Target
 - Remove noise without considering edge
 - Make **edge more smooth**

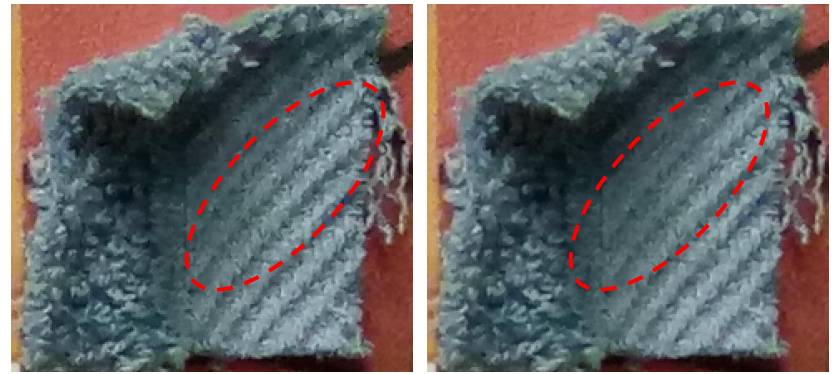
Effect



Before

After

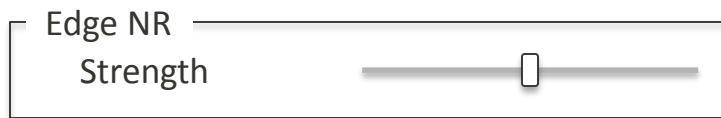
Side Effect



Before

After

Edge NR



→ Edge more smooth

Edge Preserve

- Remove noise and preserve edge

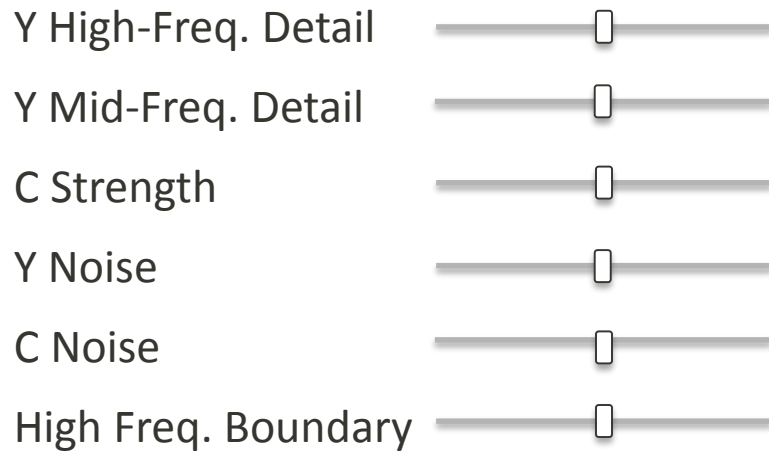
Before



After



Edge Preserve

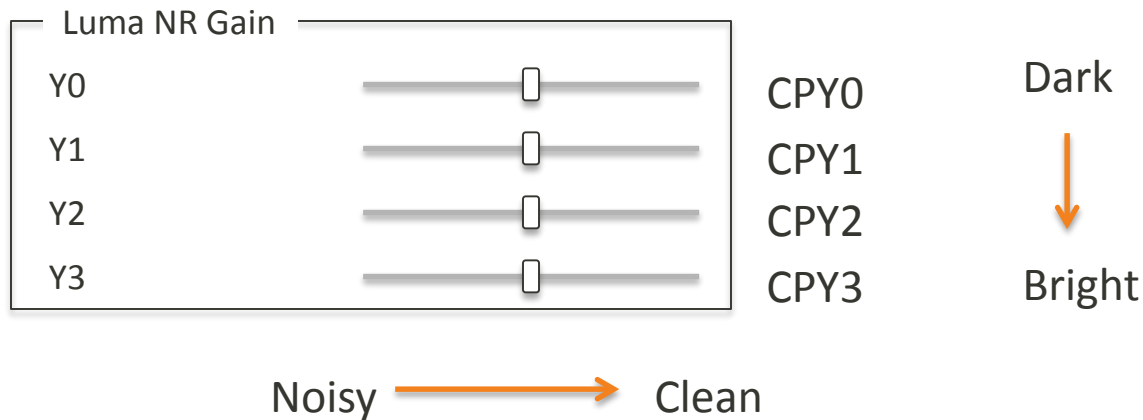


① Set “Detail” to minimum.

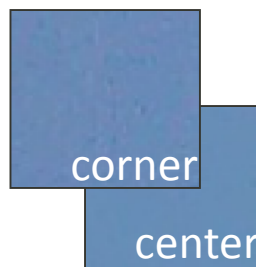
② Move “noise” slider to right, until all noise on flat area are disappear.

③ Move “Detail” slider to right to make noise and detail balance.

Set different adaptive NR strength for the area with different brightness

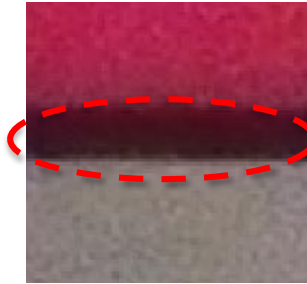


Corner Noise Reduction



Noisy  Clean

Color bleeding



C strength

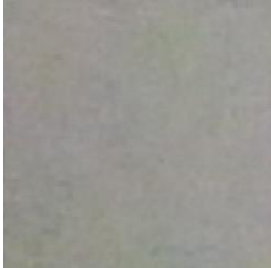


Less bleeding



More bleeding


Low frequency chroma noise



There are three post NR modules to deal with low frequency chroma noise.

Low Freq. Chroma Noise

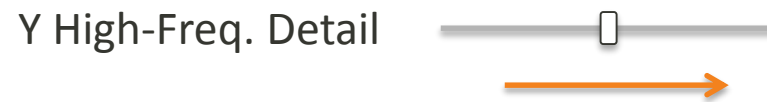
- ☐ Fastest but weak NR
- ☐ Mid
- ☐ Slow but strong NR

Strength 

Noisy  Clean

	Speed rank	NR Strength rank
MNR	1	3
Fast SWNR	2	2
SWNR	3	1

Add High-freq. Detail

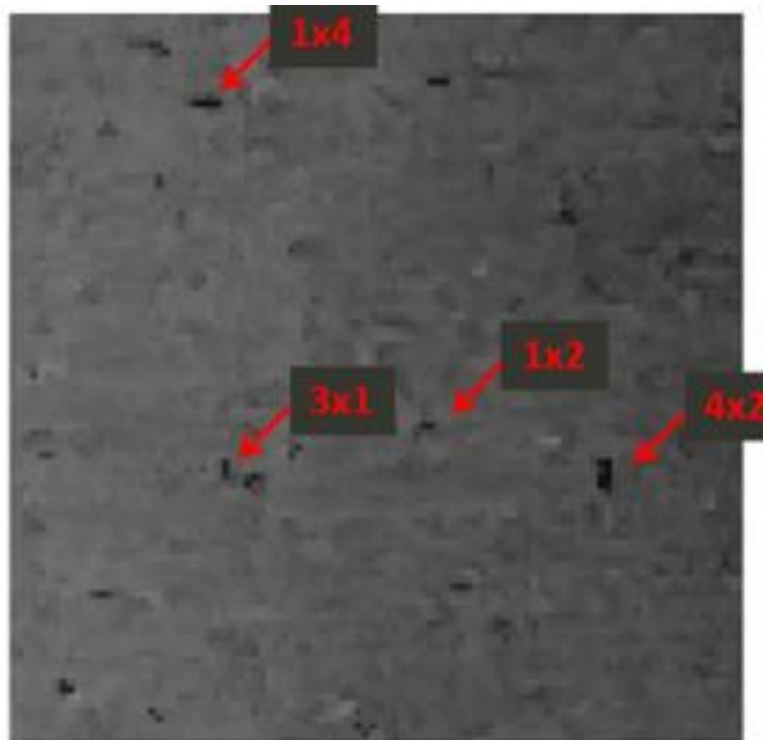




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What is Impulse Noise

- What is Impulse noise



Edge

