# 大话成像之

# 数字成像系统 32讲

## 自动曝光

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staff image quality engineer

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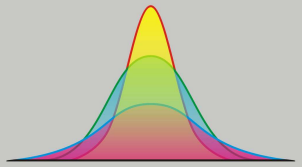


AE 自动曝光 ？ 亮度

感光度　　光圈　　快门速度　　gamma　　Tone mapping　　Multi frame HDR ..

Sensor Analog gain

Sensor Digital gain

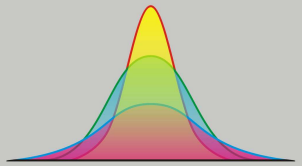
ISP digital gain

Exposure time

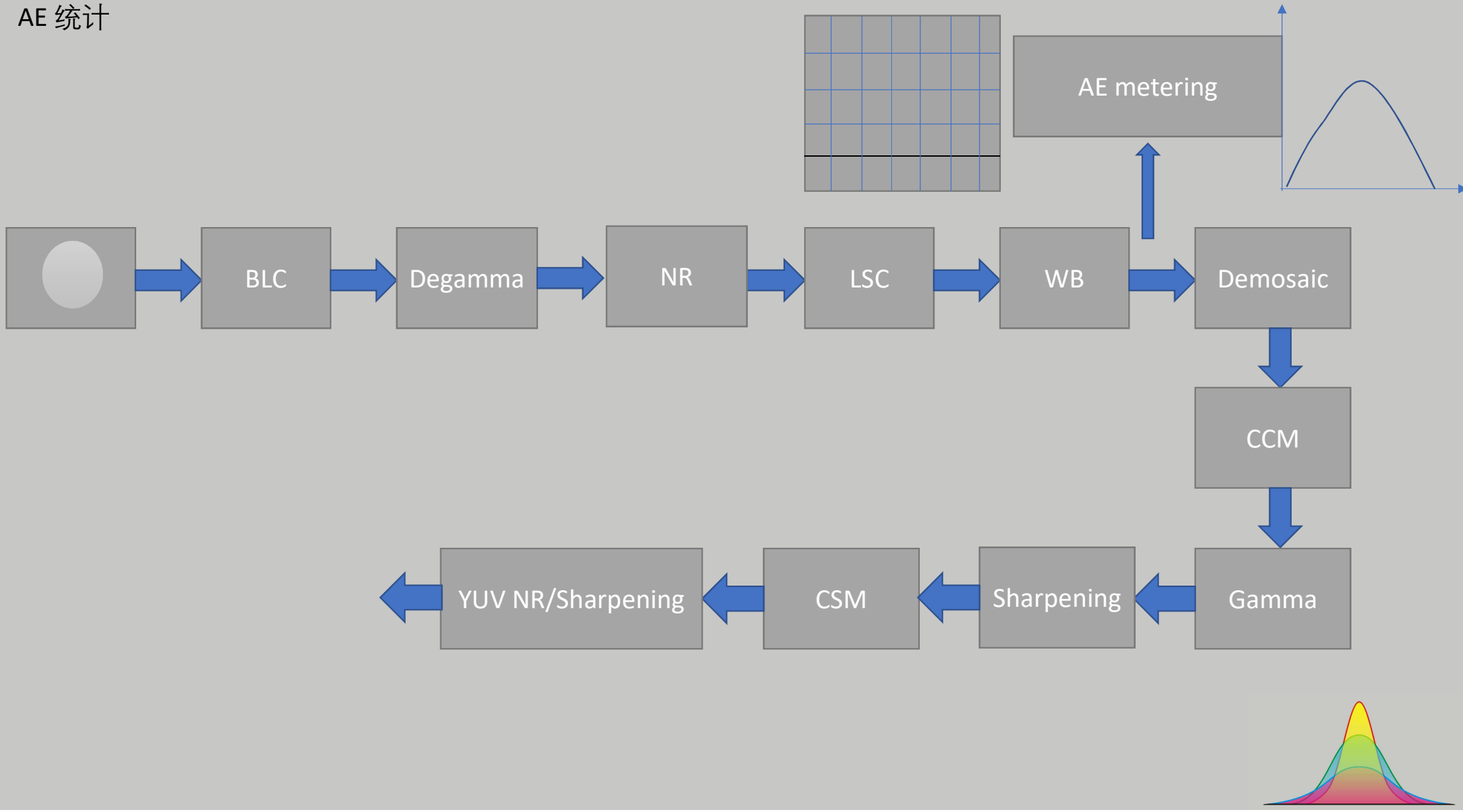
Integration time: lines

global　　local

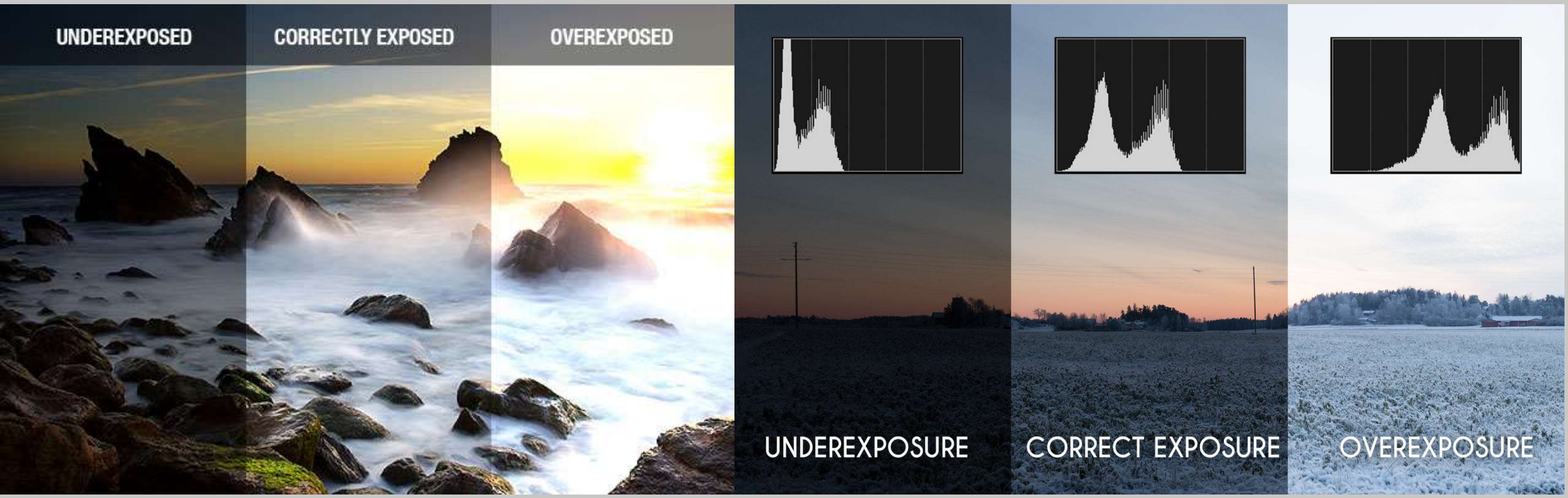
曝光 = ISO X 光圈 x 曝光时间 ；

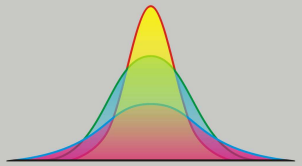


AE 统计


AE metering
BLC
Degamma
NR
LSC
WB
Demosaic
CCM
Gamma
Sharpening
CSM
YUV NR/Sharpening

什么是合适的曝光？


UNDEREXPOSED
CORRECTLY EXPOSED
OVEREXPOSED
UNDEREXPOSURE
CORRECT EXPOSURE
OVEREXPOSURE



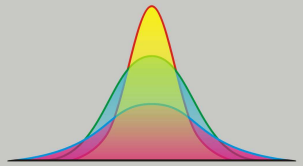
曝光误差的量化


| | | | | | |
|---|---|---|---|---|---|
| 243，243，242 | 200，200，200 | 160，160，160 | 122，122，121 | 85，85，85 | 52，52，52 |

曝光误差 = ($\log_{10}$(实际像素值) – $\log_{10}$(像素参考值)) gamma$^{-1}$

曝光误差 =（曝光误差21+曝光误差22+曝光误差23）/3

曝光误差 = 曝光误差22



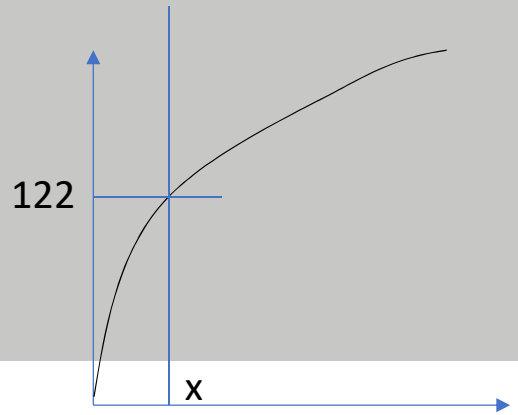
AE target：均值法

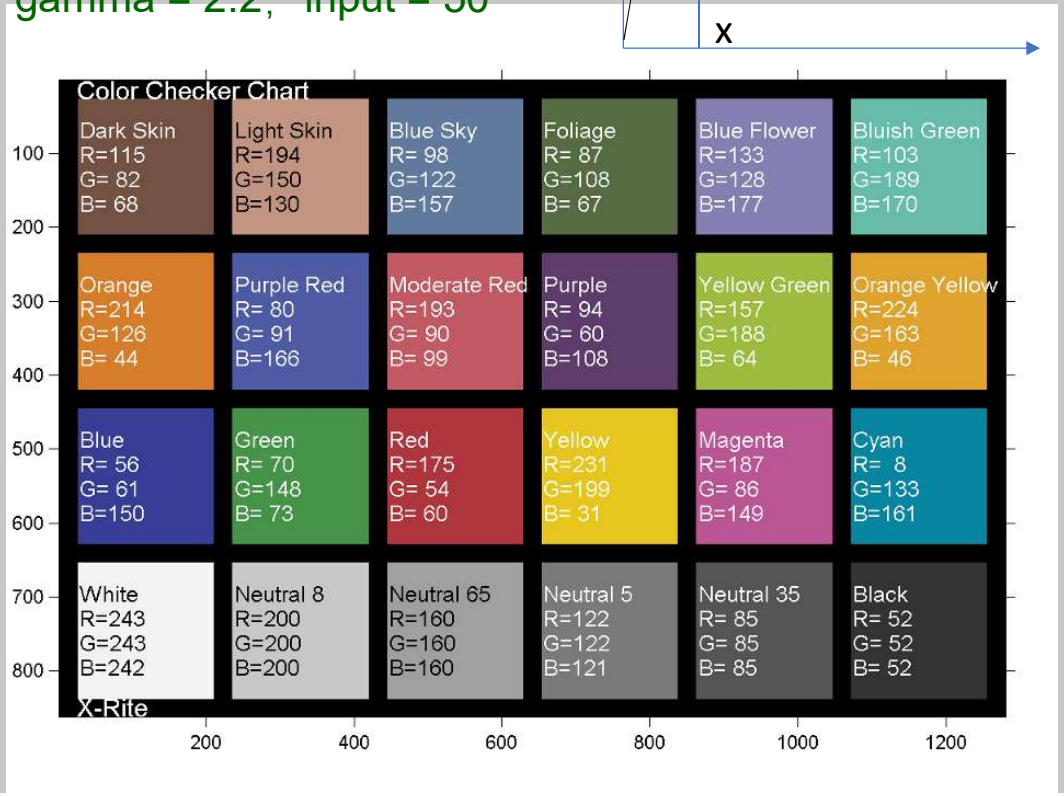
曝光误差 = 曝光误差22

Input = 255 x (Output/255)$^{gamma}$

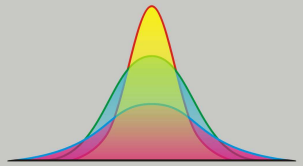
Output = 122， gamma = 2.2， input = 50

18% reflection rate hypothesis



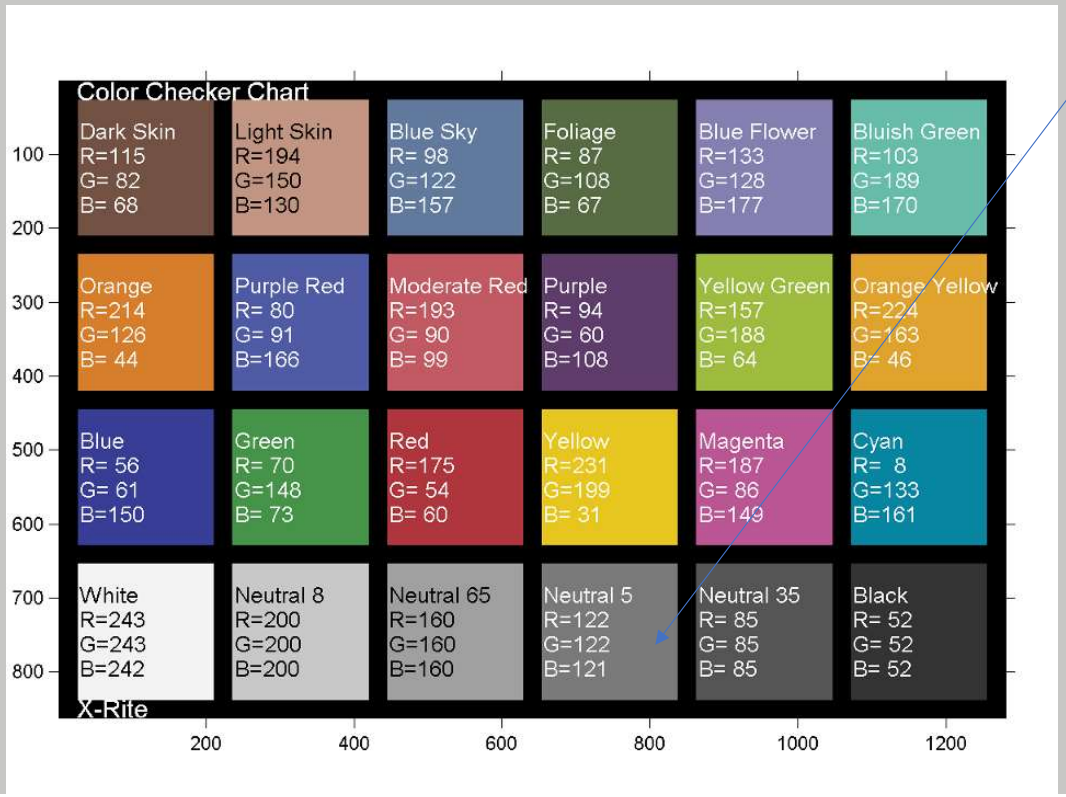



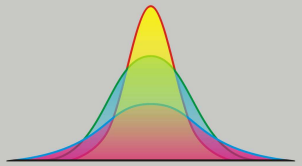




18% reflection rate hypothesis failure

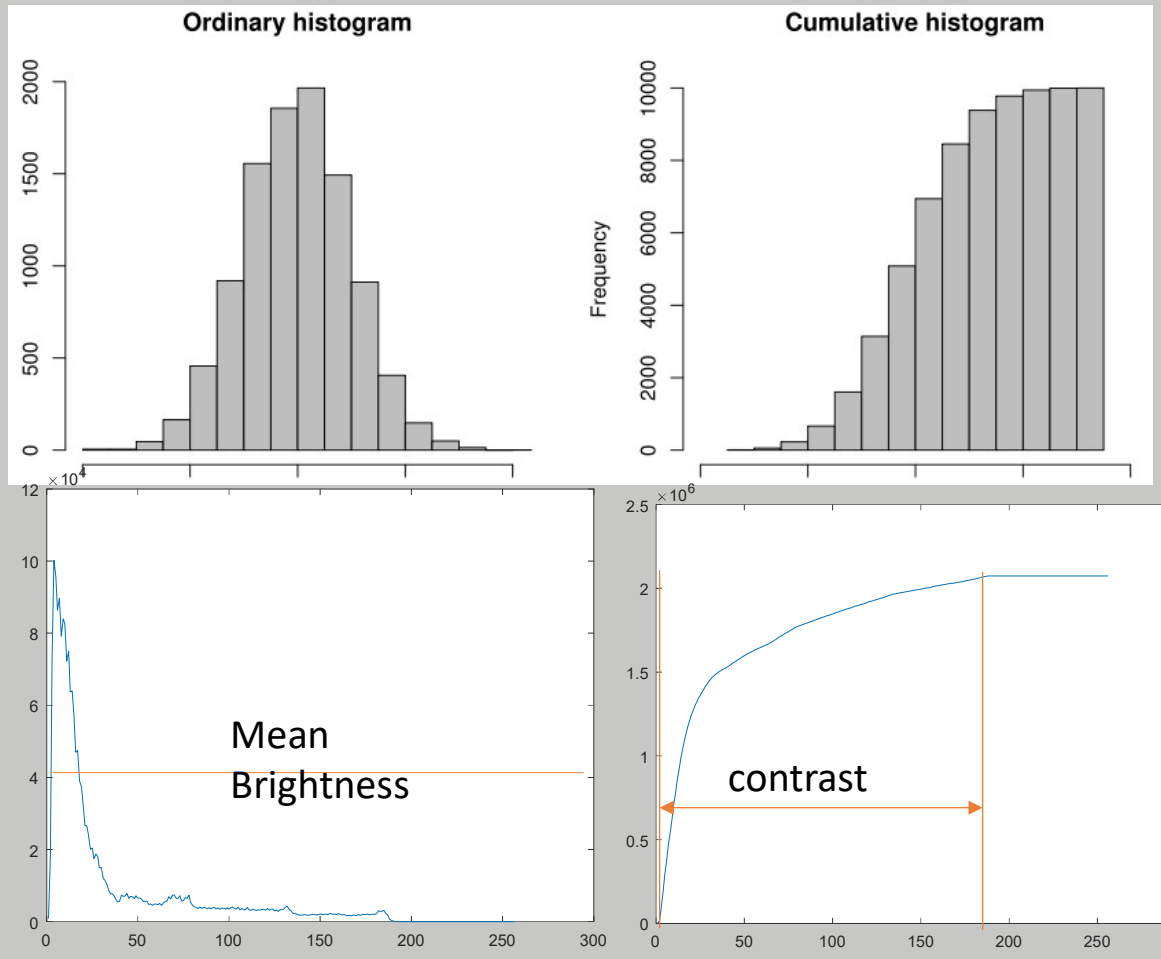
18% neutral grey card

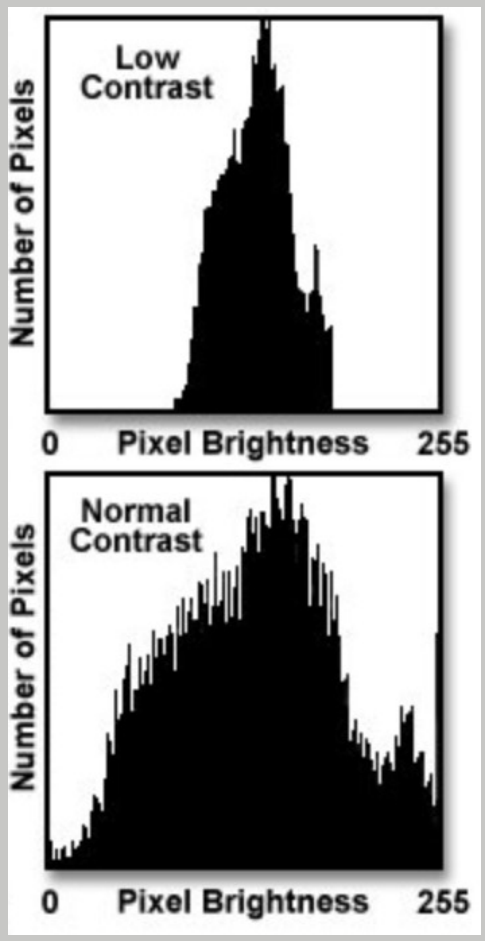


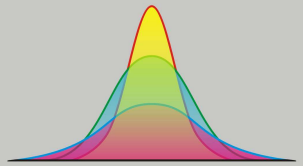
均值法AE 的改进：

# 直方图 histogram 与 积分直方图 Cumulative histogram




https://en.wikipedia.org/wiki/Image_histogram



AE loop

感光度　　光圈　　快门速度

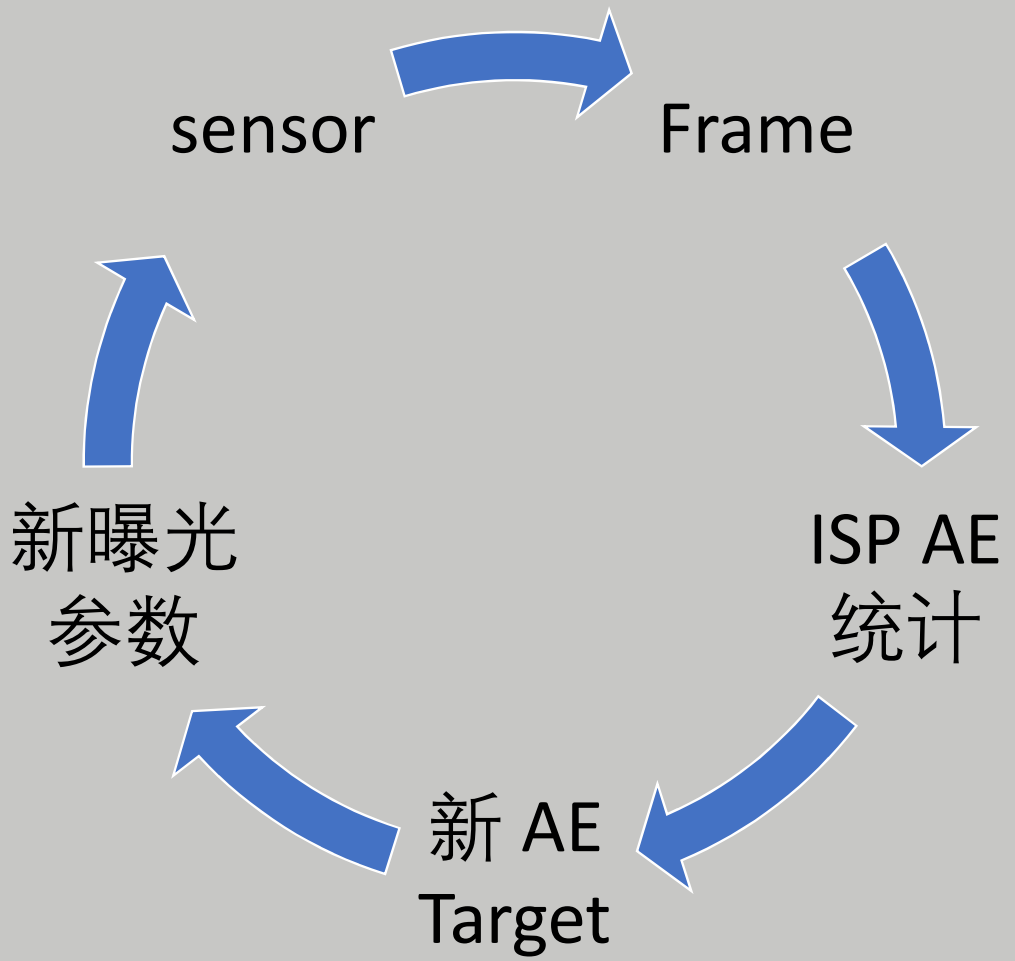
Sensor Analog gain

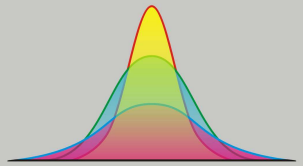
Sensor Digital gain

ISP digital gain

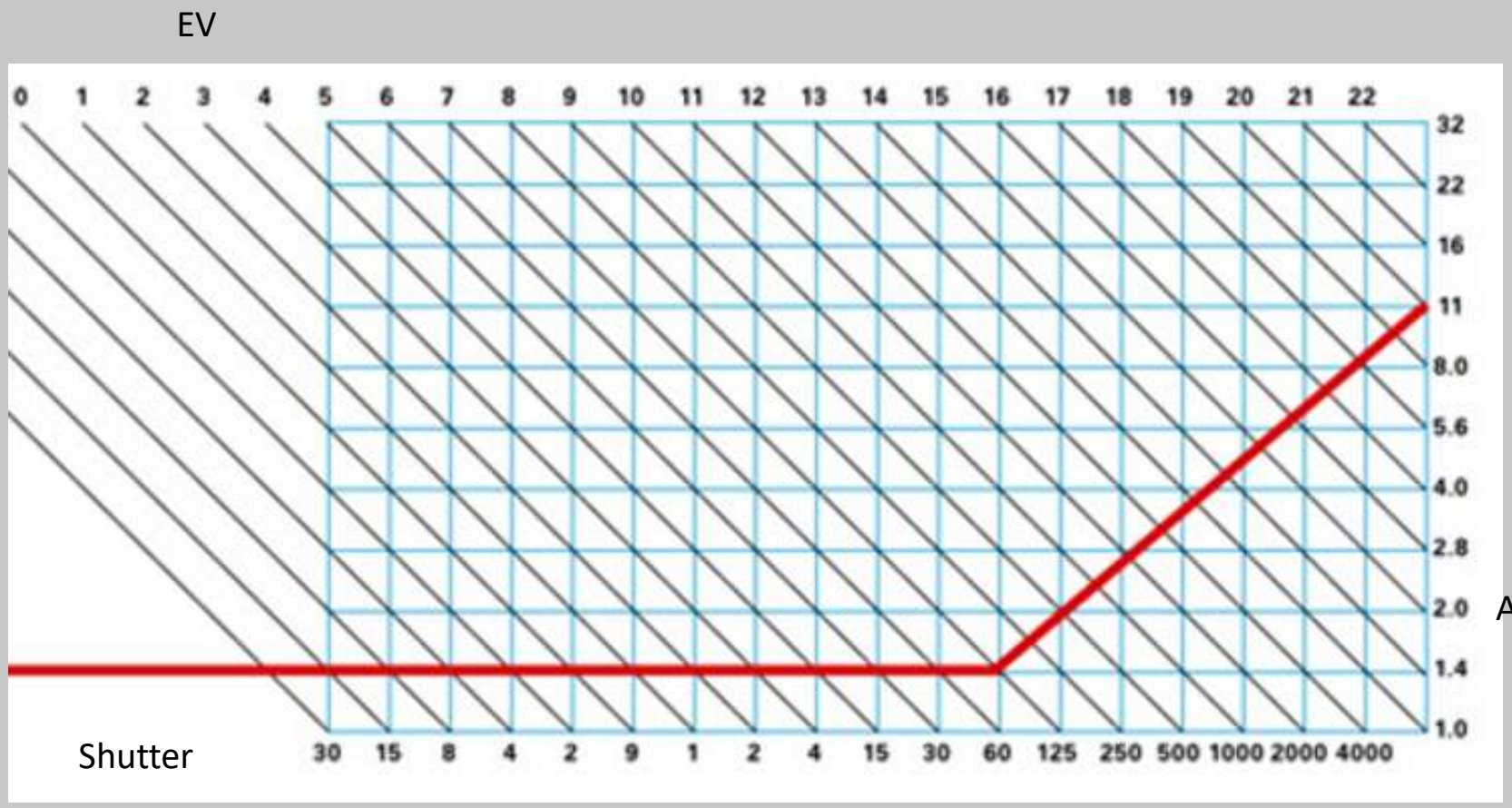
Exposure time

Integration time: lines

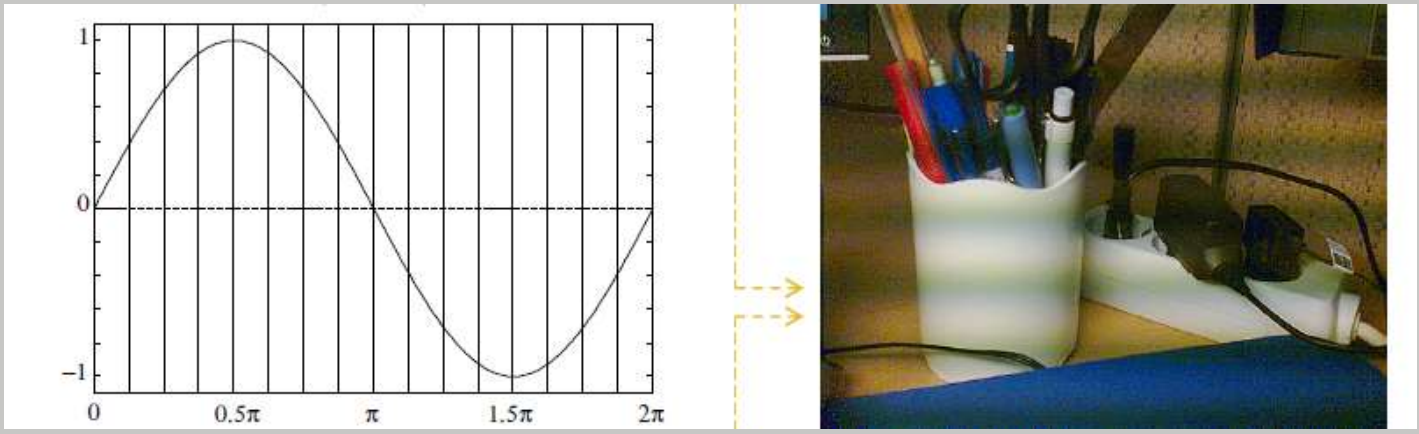


AE program：

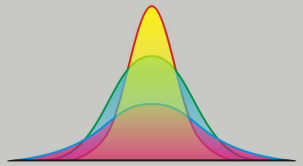

EV
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
32
22
16
11
8.0
5.6
4.0
2.8
2.0
1.4
1.0
Aperture
Shutter
30 15 8 4 2 9 1 2 4 15 30 60 125 250 500 1000 2000 4000

# Flickering Reduction



# THANKS

本课程由 Maver Jiang提供



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