Requirement for graphic arts display

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LCD Monitor的轉換

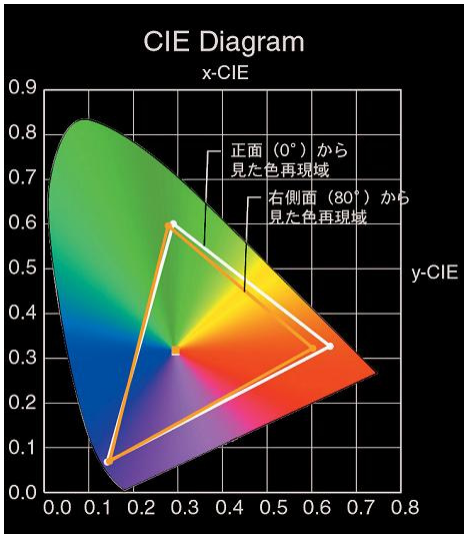
一般 LCD 與 CRT的比較

- 優點
  - 節省空間與能源
  - 非常靈活使用的底座
  - 數位化處理是可能的
  - 超平面畫面
  - 沒有幾何失真
  - 沒有失焦和色收斂錯誤
- 缺點
  - 狹窄的色空間
  - 來自與對比和顏色附屬的可視角度
  - 缺乏平滑的Gamma特性
  - 顏色的一致性和穩定性是不夠水準的

For Perfect Color Management

Monitor Required Features:

1. 平滑的色階特性
2. 寬廣的色域
3. 亮度 & 顏色的一致性
4. 亮度的穩定
5. 準確的混色能力
6. 較少失真的可視角度
7. 硬體校準能力



1.平滑且可調整的 Gamma 值

原始圖片

Gamma = 2.2 for each color

圖片的變化

如果顯示器的階調特性(gamma 曲線)可以改變每個顏色的變化(R,G,B)，可以讓圖片看起來會與原始圖片不同。

Different gamma curve for each color

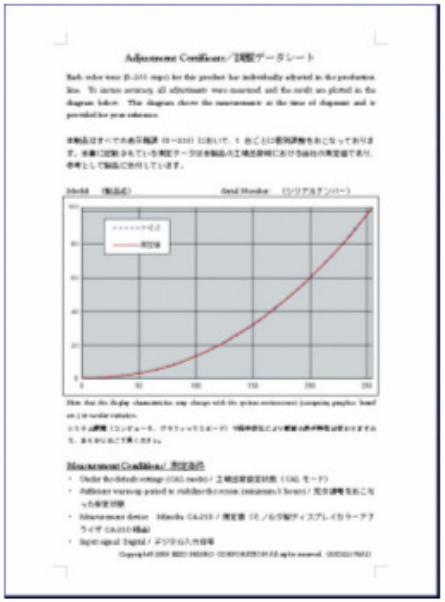
1.平滑且可調整的 Gamma 值

Eizo ColorEdge Series

12-Bit LUT控制器 內建在 EIZO LCD 顯示器

Actual adjustments is performed in a darkroom

工廠調整每個RGB的256階調Gamma值



Adjustment Certificate

每台顯示器都會有正確的 Gamma 特性

1.平滑且可調整的 Gamma 值

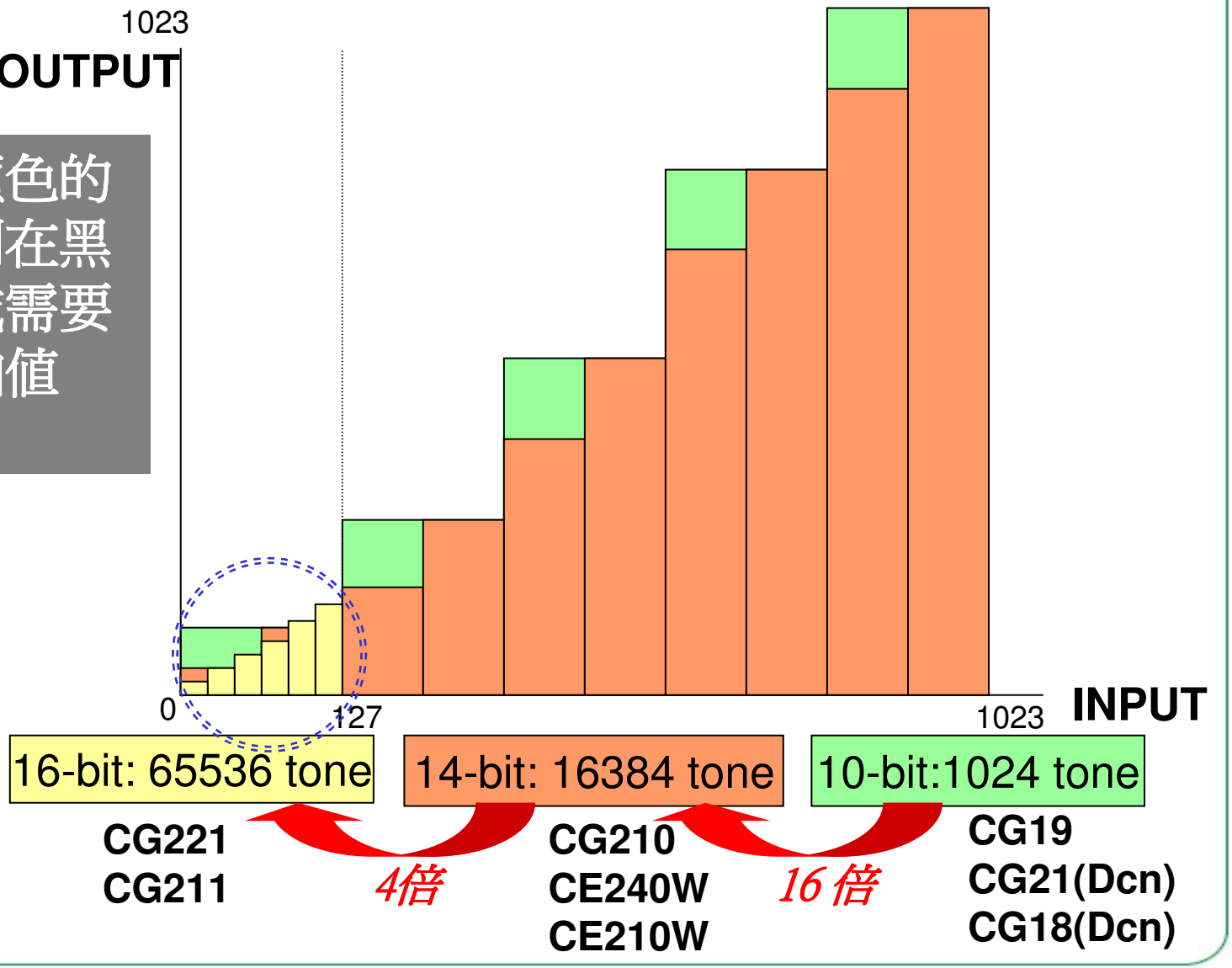
- 灰階顯示 (Tone characteristics)
  - 工廠直接校正螢幕 (e.g. Eizo ColorEdge)
    擁有平滑的灰階顯示。

  - 一般螢幕
    在灰階顯示底下有明顯的色調和不均勻

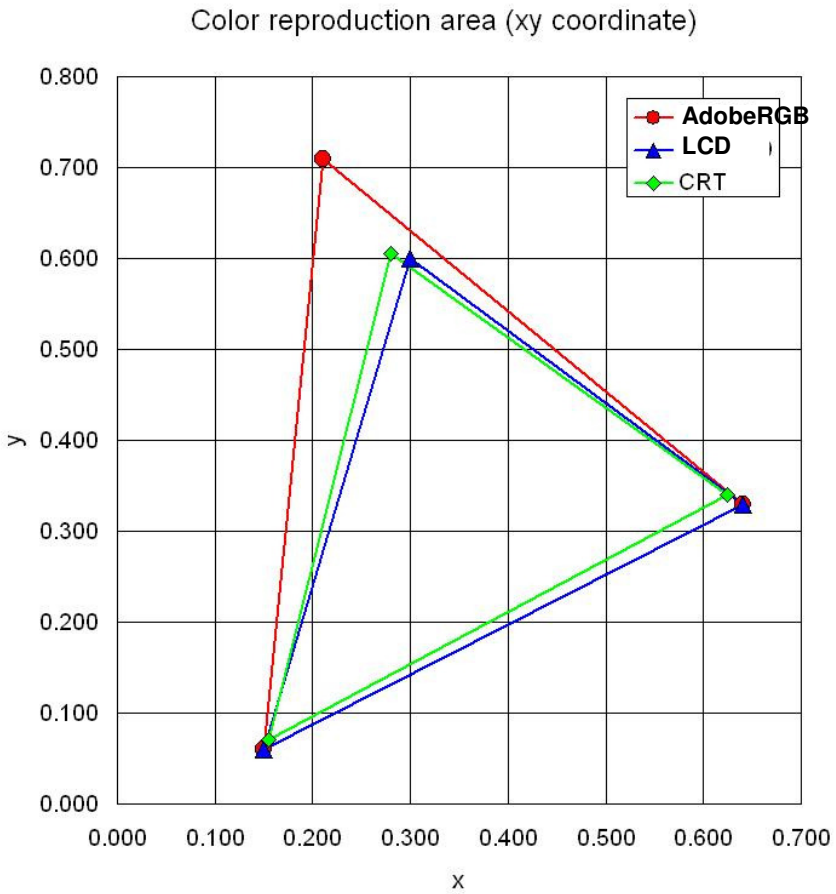
工廠預先的調整能減少每個顏色之間的誤差

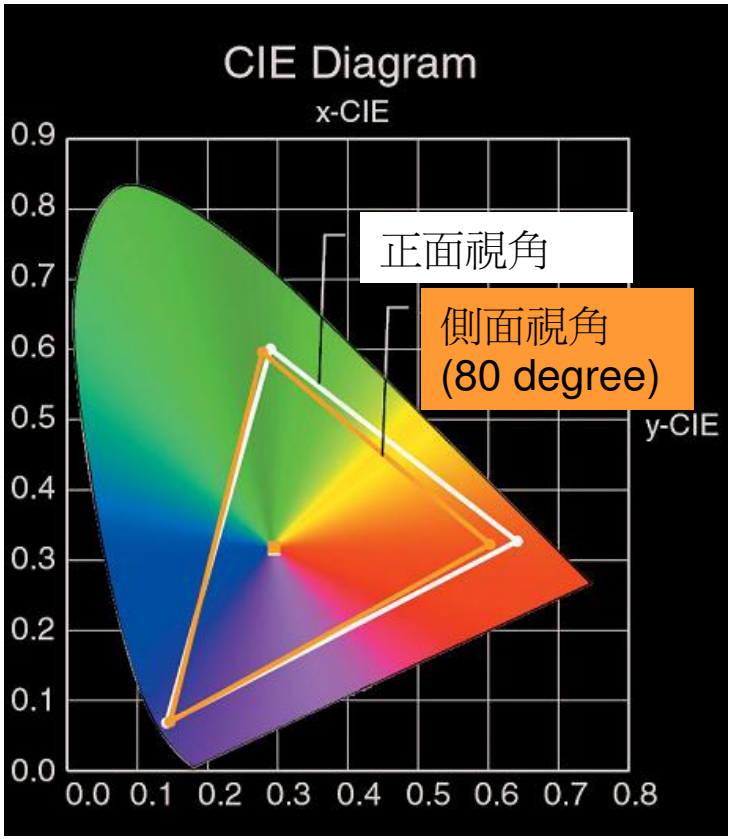
16-bit Color Processing

針對準確顏色的再現性特別在黑色階調區域需要更小的增加值



2.寬廣的色域





➢與CRT相同的色域空間

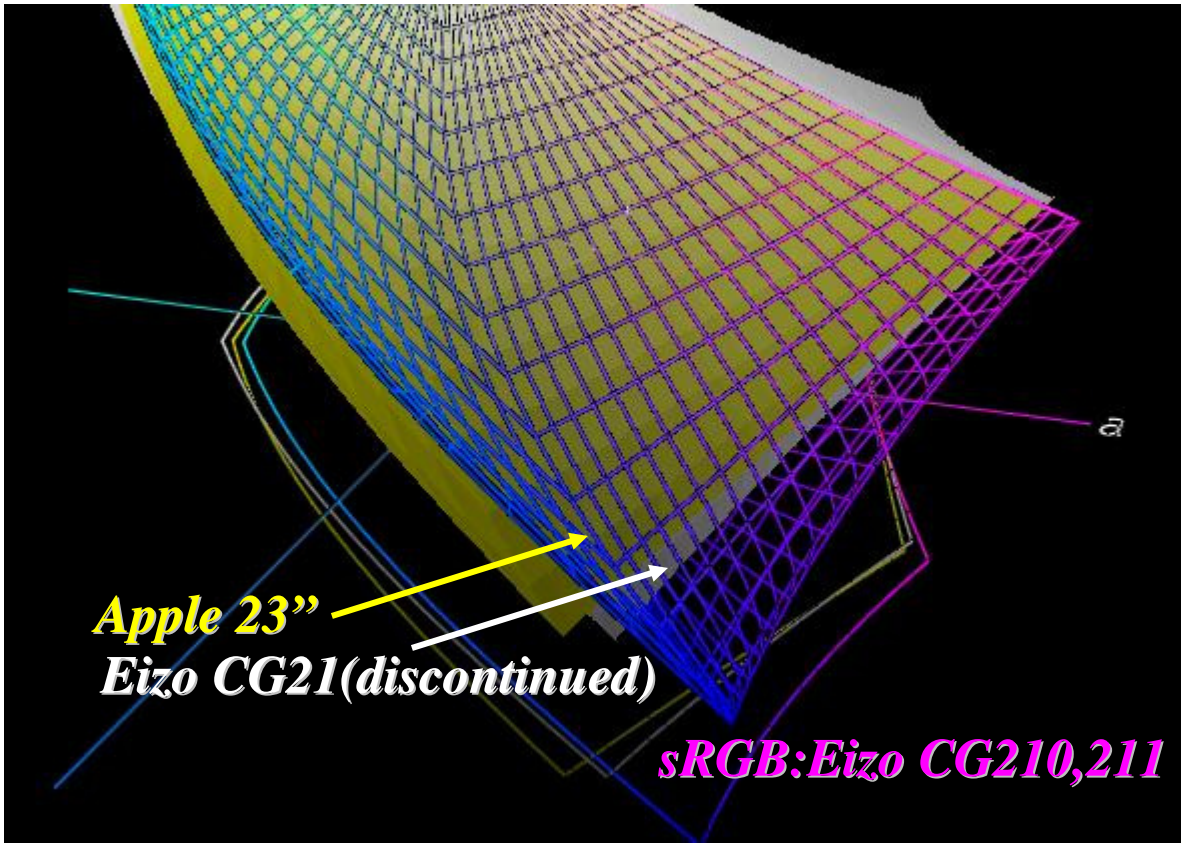
➢較少失真的可視角度

•Reference: Adobe RGB→ Eizo CG221, LCD→ Eizo CG211,
CRT→ Eizo High-end 21"CRT T966

2.寬廣的色域

sRGB Blue

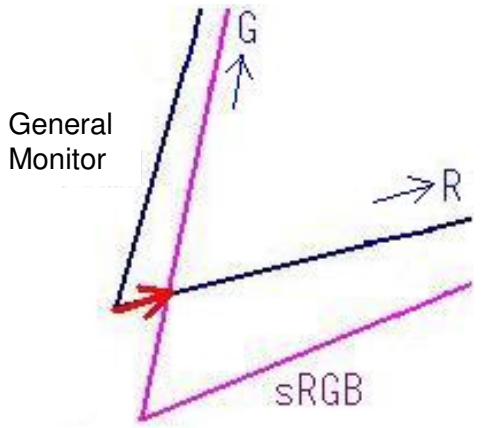
不論是LCD/CRT，只有少數的顯示器能夠涵蓋 100% sRGB 的曲線



2.寬廣的色域

- Mapping是指色域空間壓縮。
- 在sRGB 和與顯示器藍色階調的差距，同等於經過色域對應（Color mapping）造成藍色帶淡紅色。

	Before	After
一般螢幕		NG
CG211 CG210		



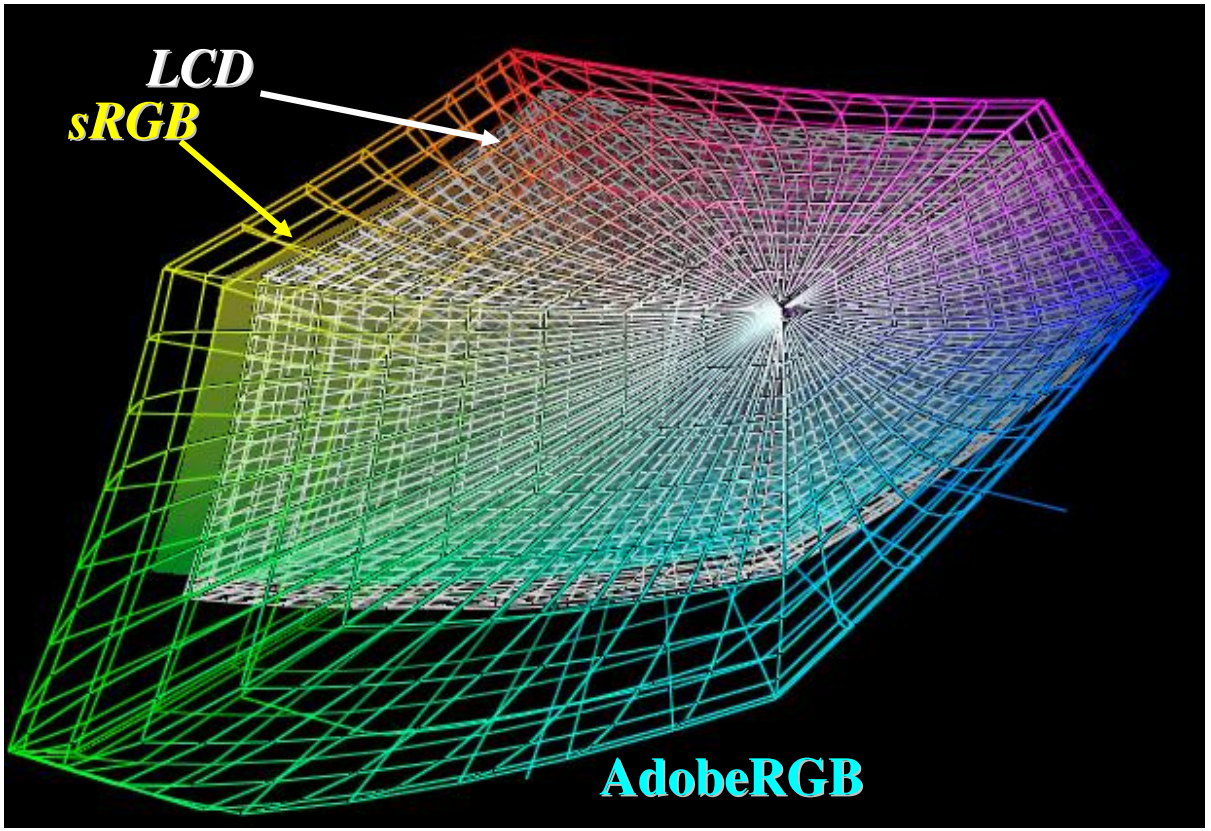
Mapping image

2.寬廣的色域

AdobeRGB

對於完美的軟體打樣而言，sRGB 無法在印刷上印刷出青綠色、黃色、洋紅色的特別色域。

→next page

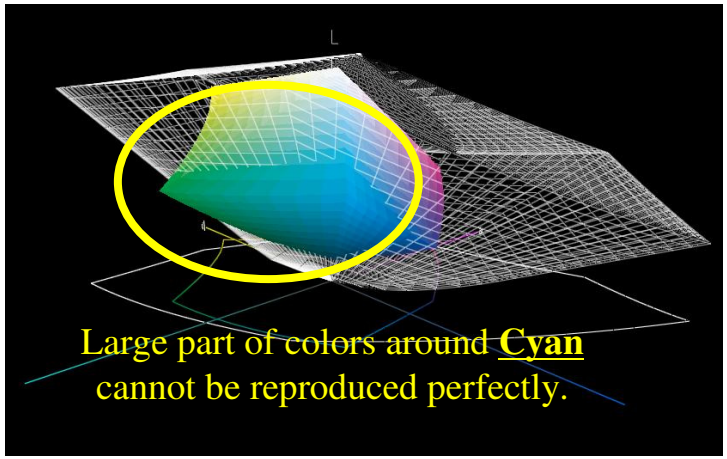


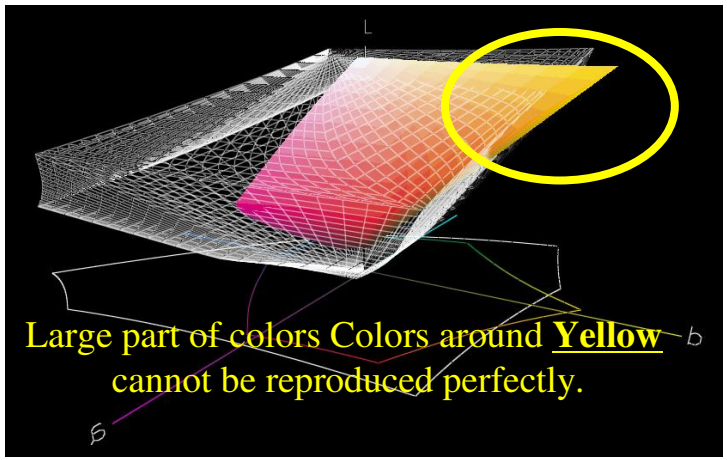
•Reference: Adobe RGB→ Eizo CG221, LCD→ Eizo CG19

2.寬廣的色域

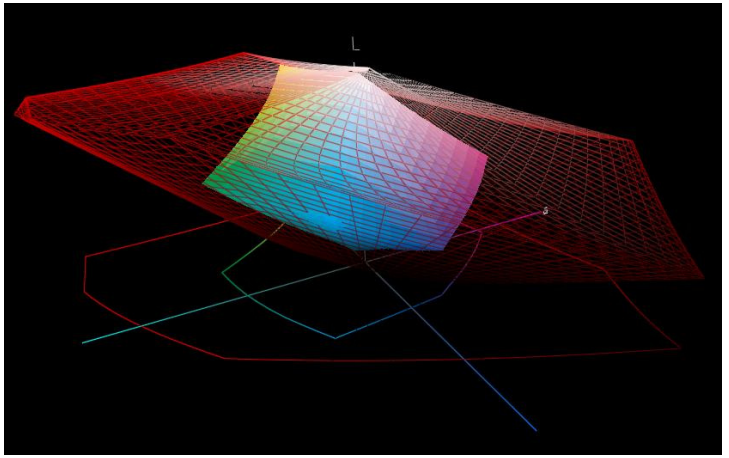
與 ISO Coated Paper 比較色域

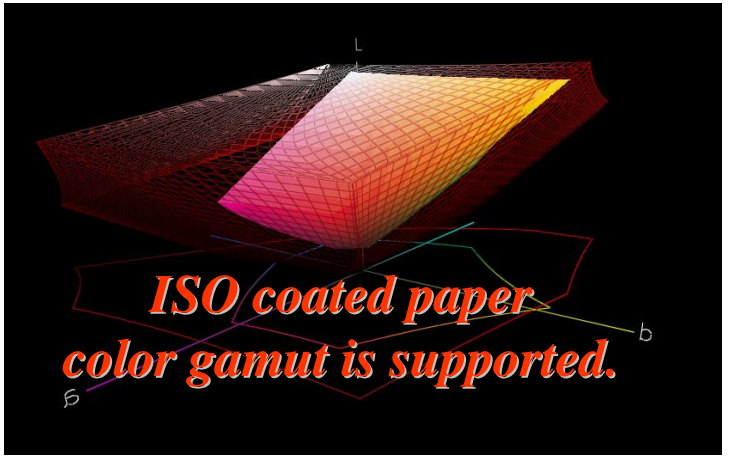
sRGB: Traditional LCD/CRT Monitor





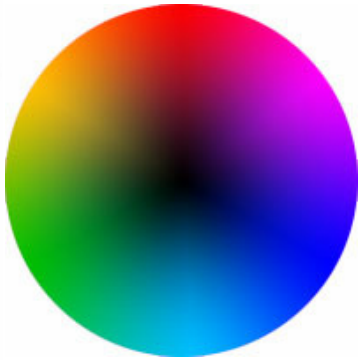
AdobeRGB





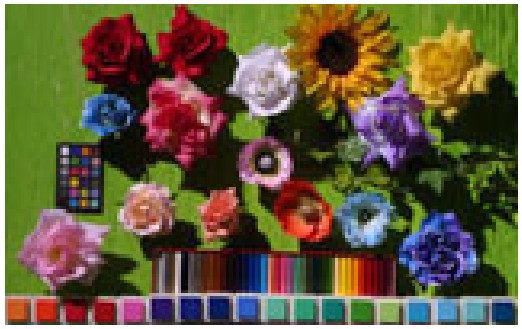
•Reference: Adobe RGB→ Eizo CG221

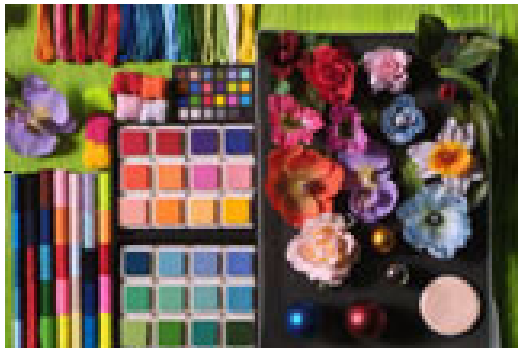
2.寬廣的色域

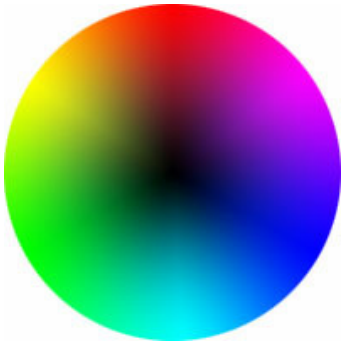


sRGB

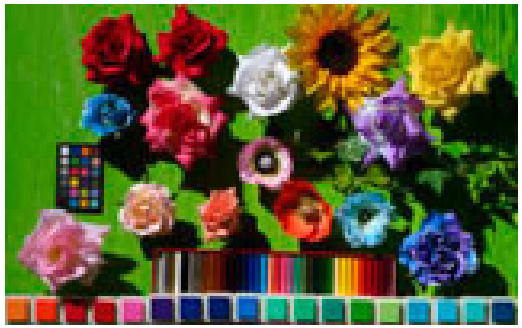
- General LCD Monitors -

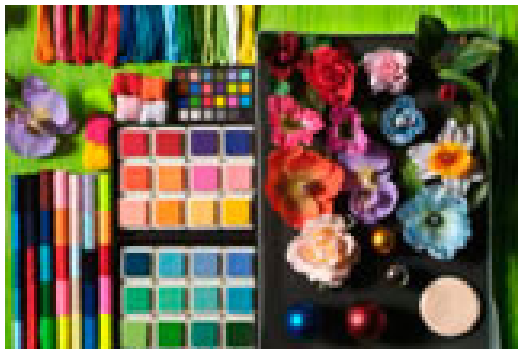






AdobeRGB





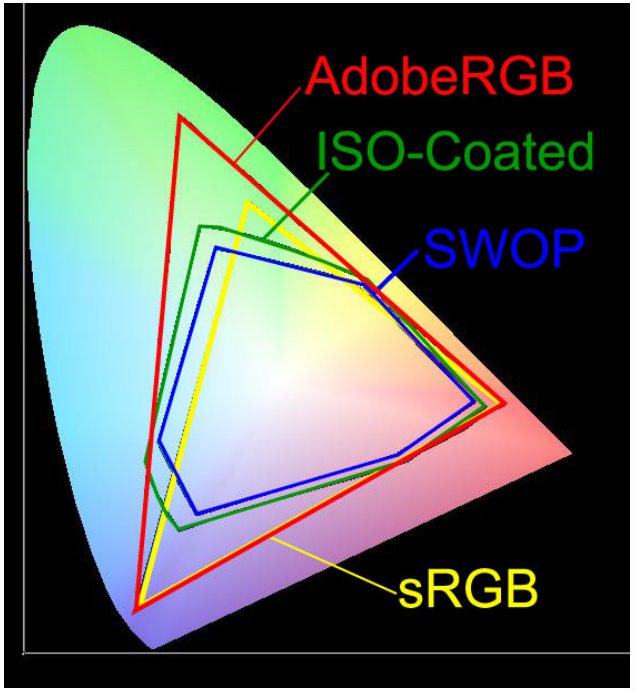
Saturated color especially Cyan and Yellow is compressed.

Deep tone color around Cyan and Yellow is displayed.

2.寬廣的色域

- 參考顯示器關於 AdobeRGB 的規範圖片資料 .
  - AdobeRGB是高階數位相機和掃瞄器的市場標準，但是卻沒顯示器可以忠實承現影像色彩。

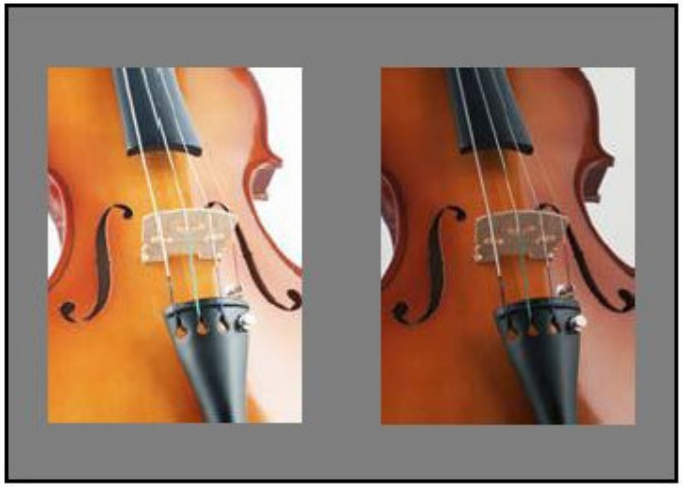
- **可實現software proofing的顯示器**
  - 一致性的色彩呈現
  - 支援“ISO coated”, “SWOP”, “Japan color”, “Euroscale”的標準.

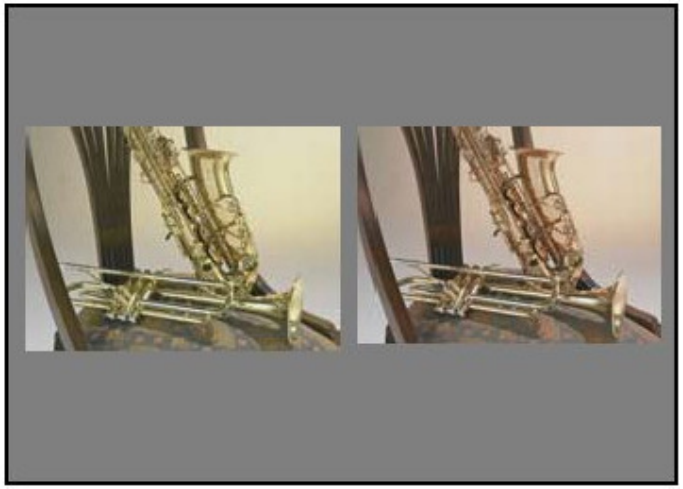


AdobeRGB的廣域色域能增加色彩管力的效率。

3.亮度 &顏色的一致性

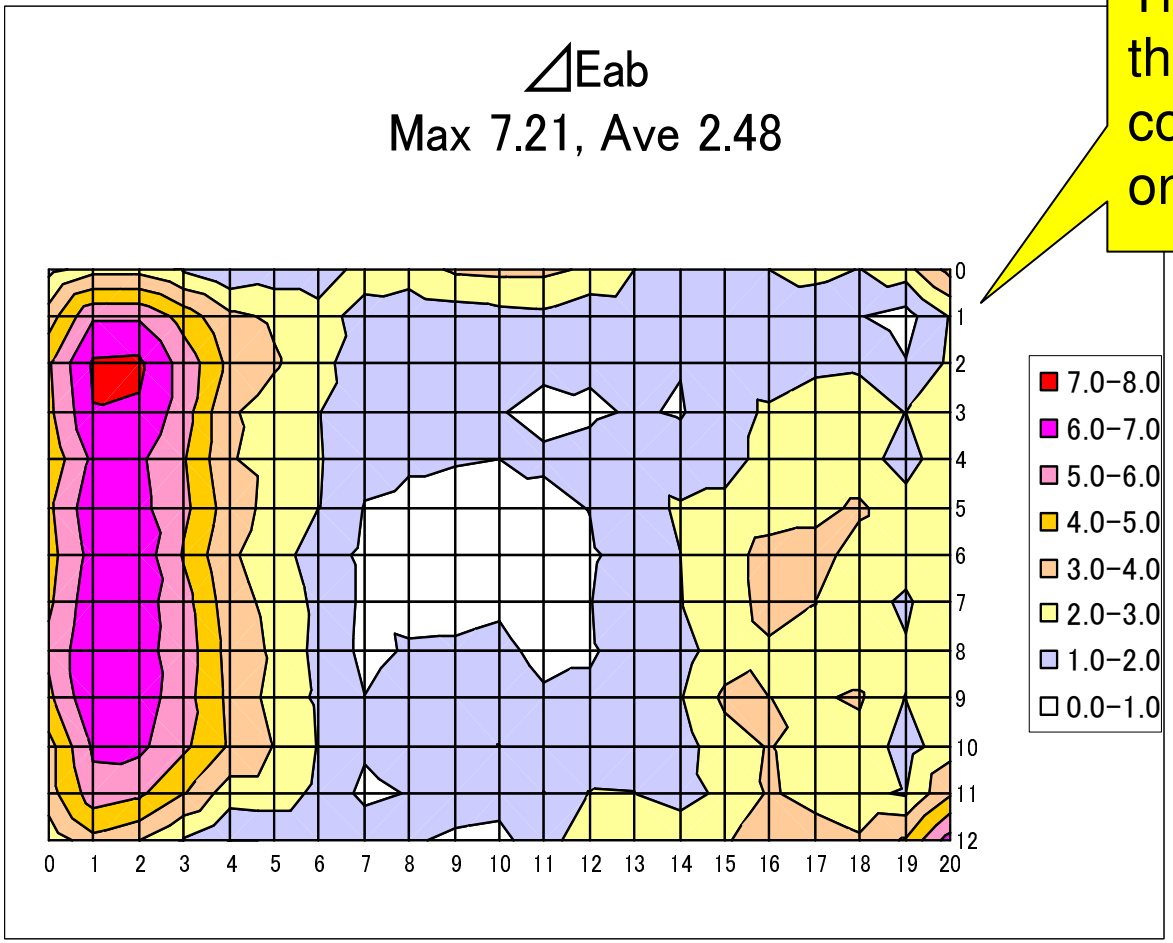
- 螢幕一致性是能簡單造成影響顏色工作的關鍵





3.亮度 &顏色的一致性

- 實際上的螢幕一致性

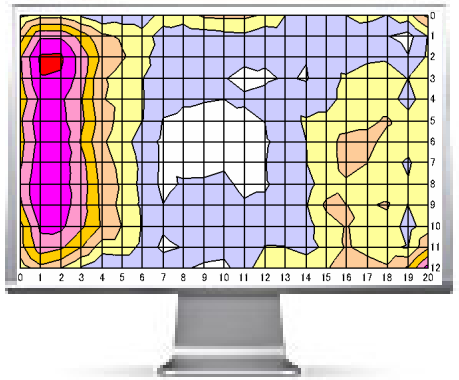


This is a usual case there are validation of color and brightness on an entire screen.

3.亮度 &顏色的一致性

- 螢幕一致性

	Average	Maximum
Eizo w/t DUE	ΔE=1.0	ΔE=3.5
Eizo w/o DUE	ΔE=2.5	ΔE=6.0
Apple Cinema 23”	ΔE=3.5	ΔE=7.4



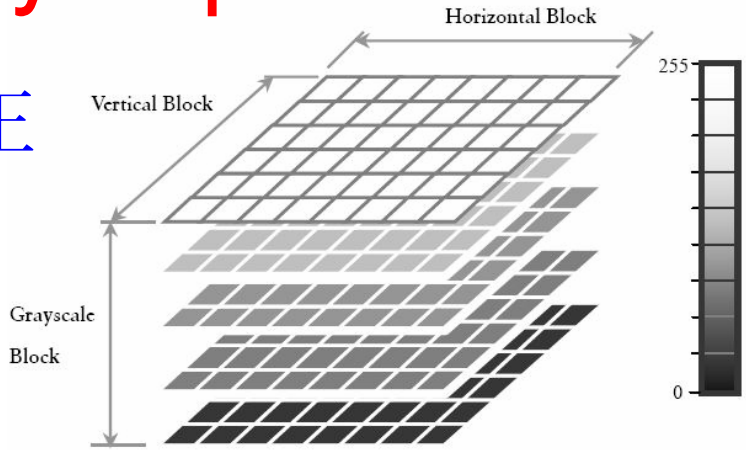
At 5000K, Video Level 255

* DUE: “Digital Uniformity Equalizer” function

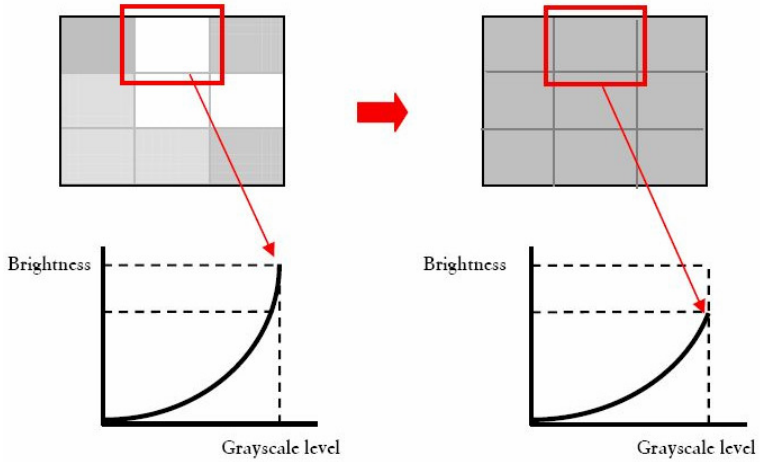
*The above value is based on Eizo own test

Digital Uniformity Equalizer

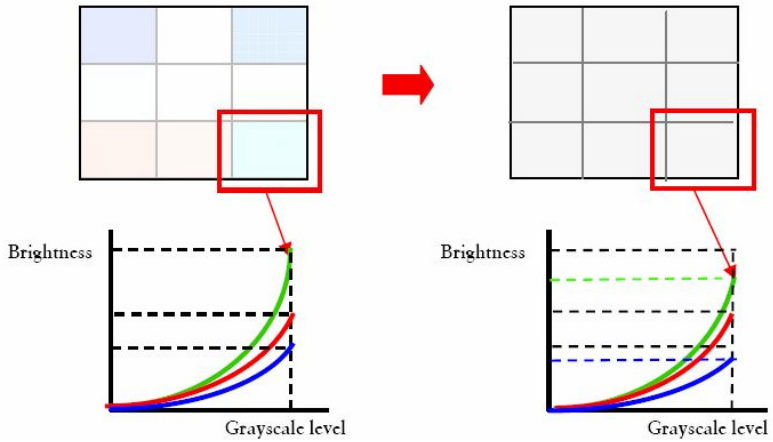
- 在EIZO生產線上擁有新的補正技術
  - 針對整個畫面的亮度和色度能夠在425個點上進行調整



Compensations are made on various grayscale levels



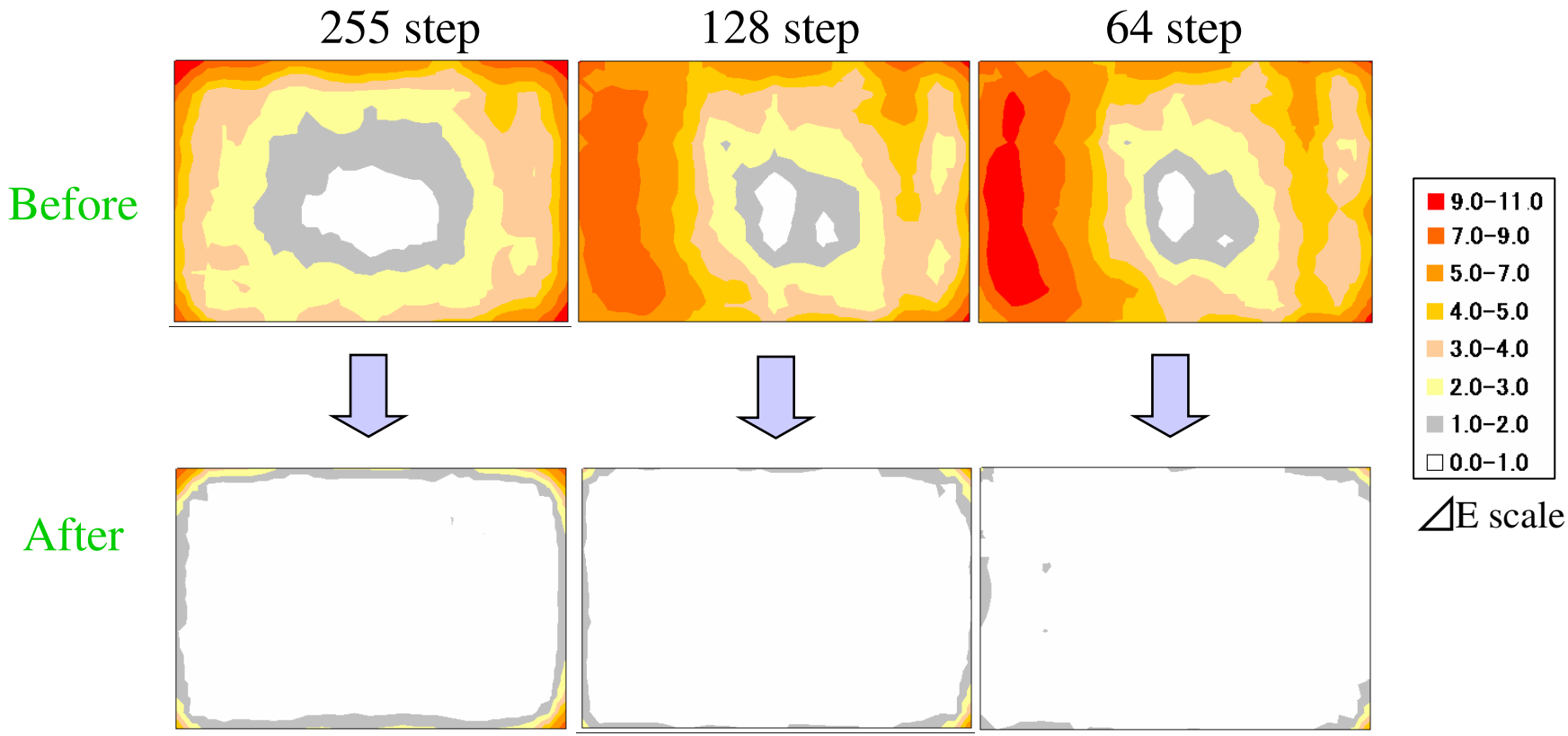
Brightness uniformity compensation



Chromaticity uniformity compensation

Measurement example

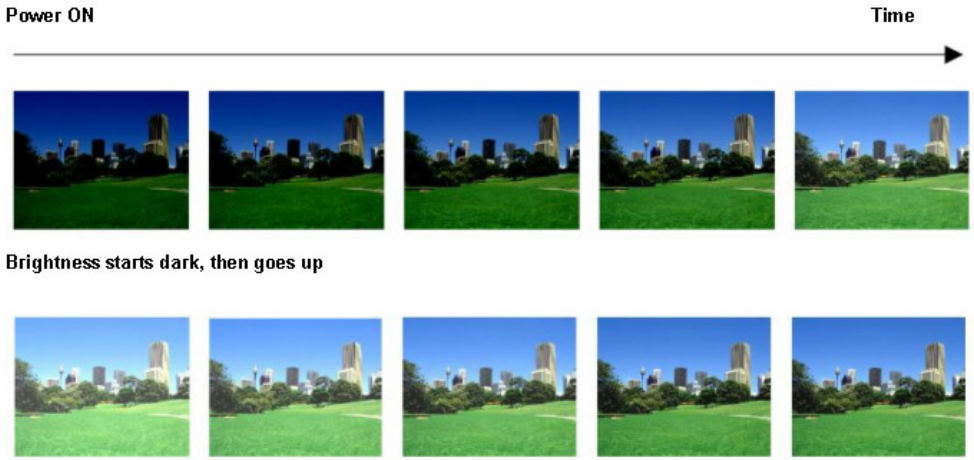
- 在灰階底下顏色的一致性能夠擁有新的delta E 1 to 2 或是更低的數值



4.亮度穩定

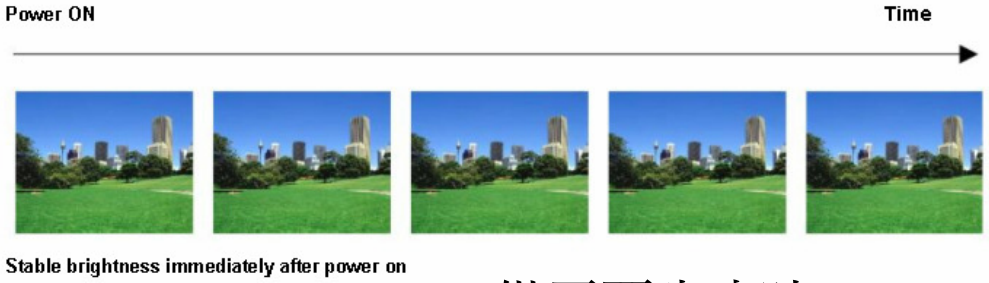
- 亮度穩定

• 一般 LCD 和 CRT顯示器



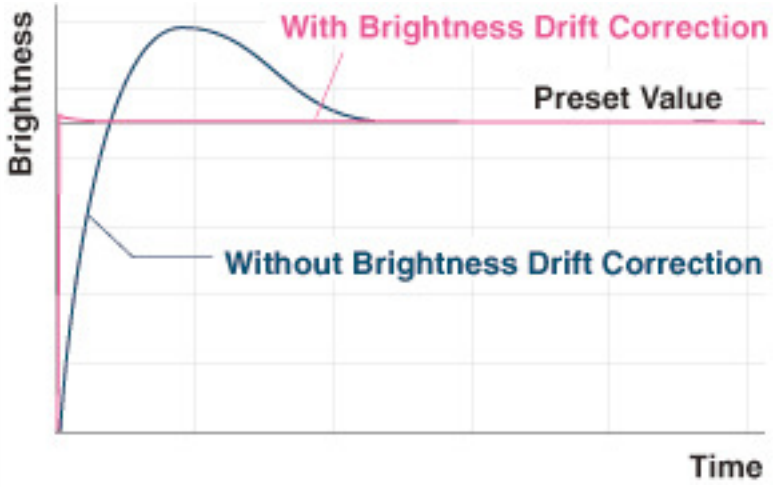
需要1、2小時

•Eizo Monitors



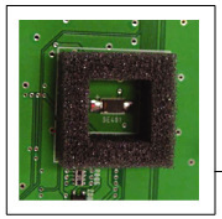
僅需要半小時

Brightness Transition

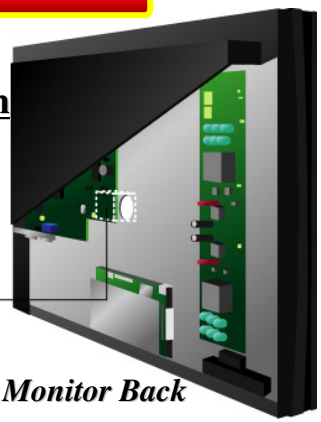


Eizo 專利技術

Eizo Backlight Control System



Backlight sensor

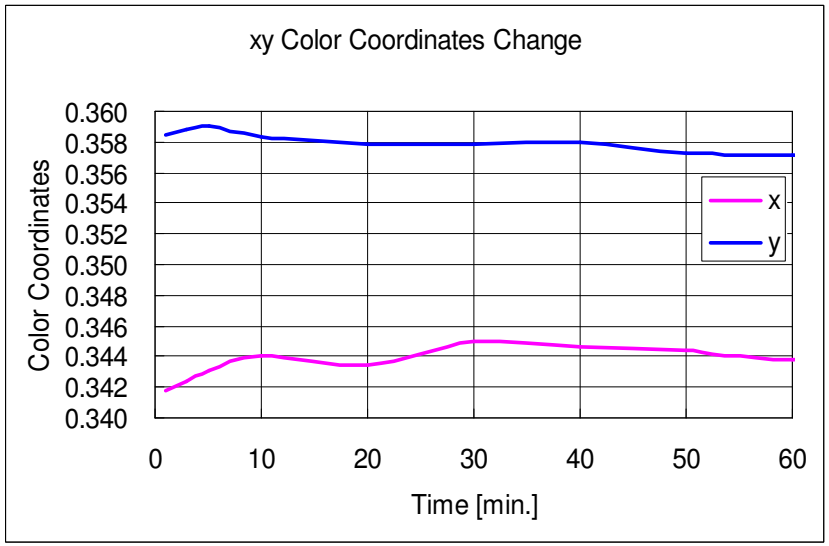


Monitor Back

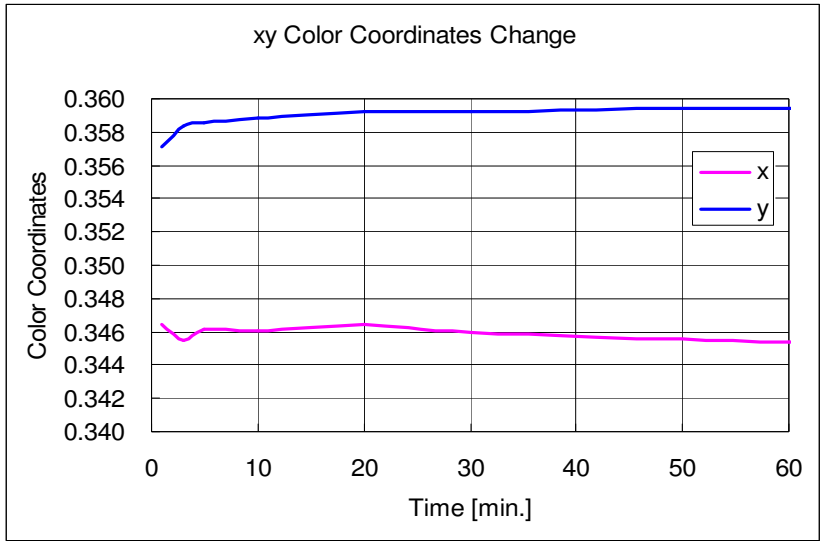
4.亮度穩定

- 穩定性比較圖

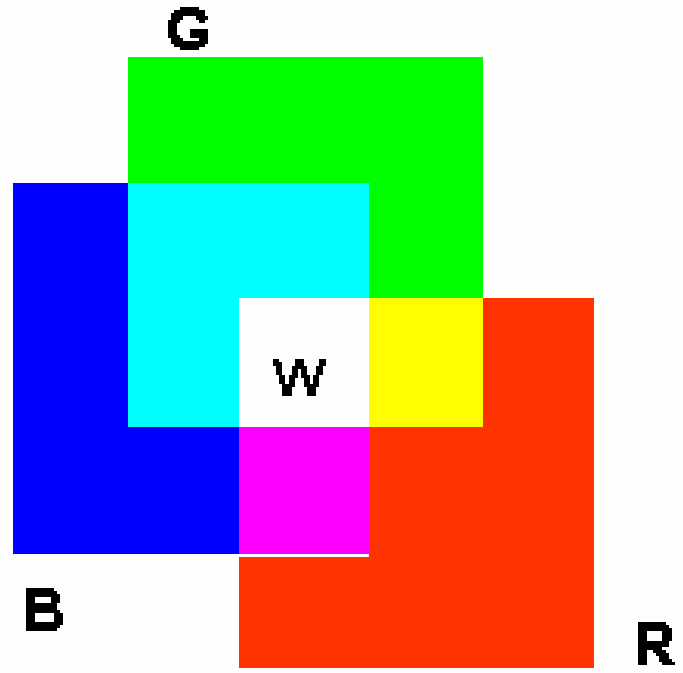
Normal



w/t Eizo brightness stabilizer



5.準確的混色能力

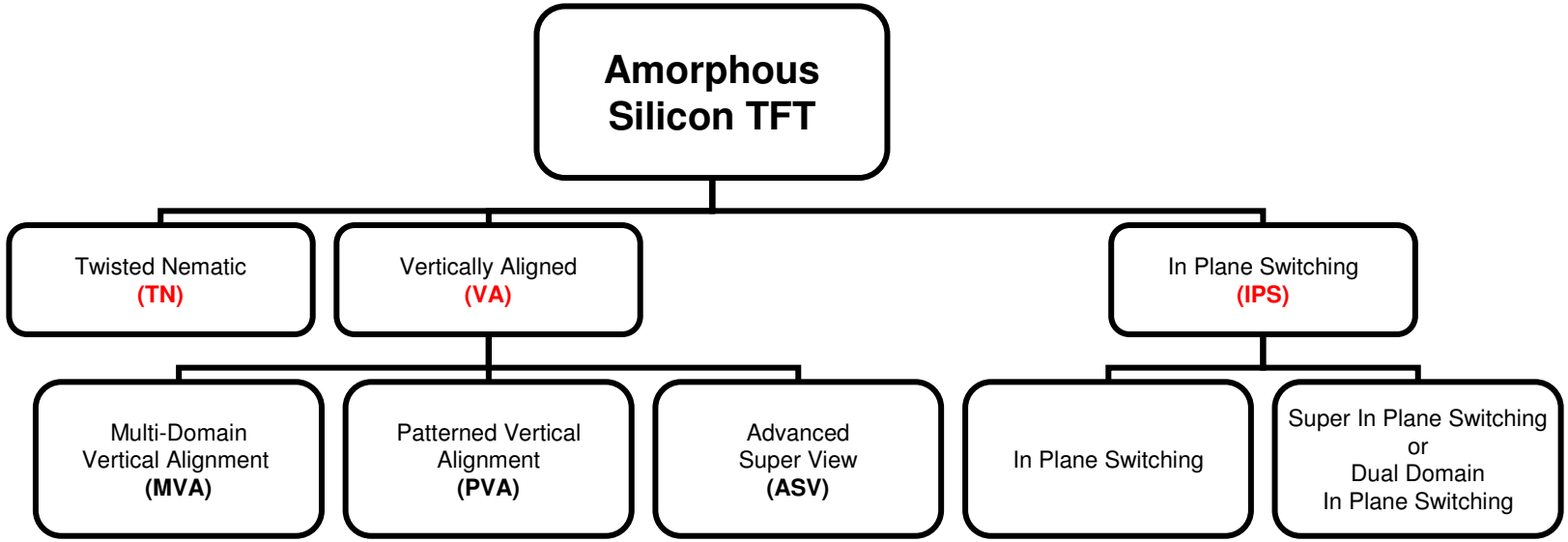


R+G+B = W

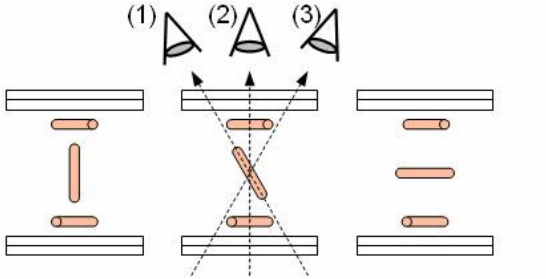
大多數的 LCDs 無法完成

ColorEdge 擁有非常相近 CRTs 顏色特性

TFT Liquid Crystal Mode

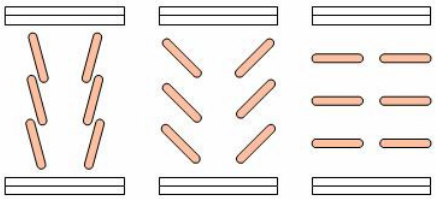


TN+Film



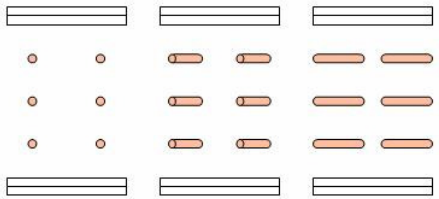
(a) Dark [ON] (b) Intermediate (c) Bright [OFF]

VA



(a) Dark [OFF] (b) intermediate (c) Bright [ON]

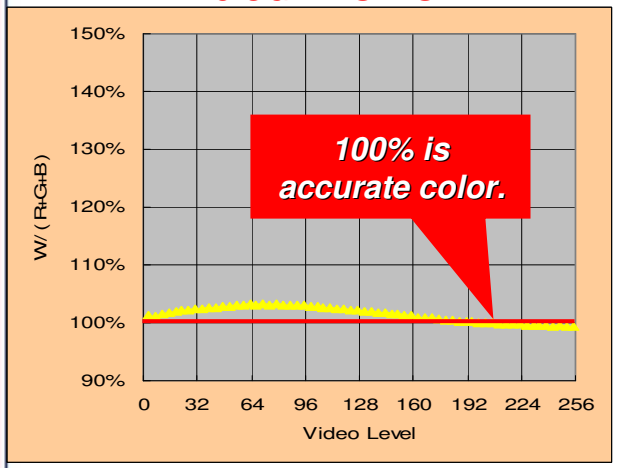
IPS



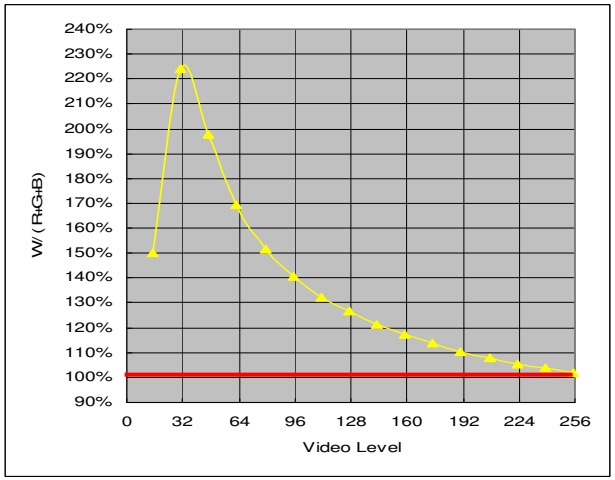
(a) Dark [OFF] (b) Intermediate (c) Bright [ON]

現況不足的混合能力

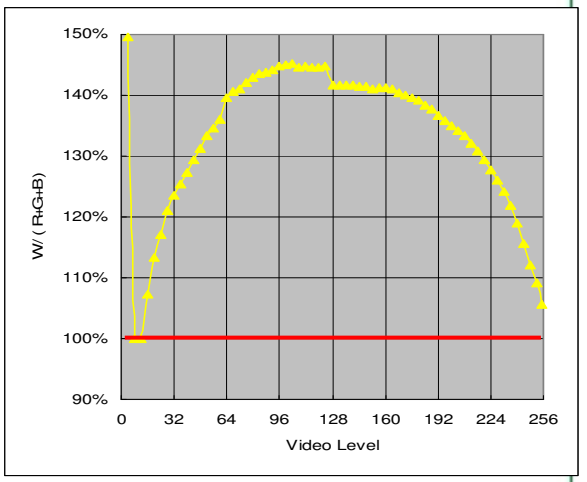
Eizo CG211 S-IPS



Company SH: 18”, ASV



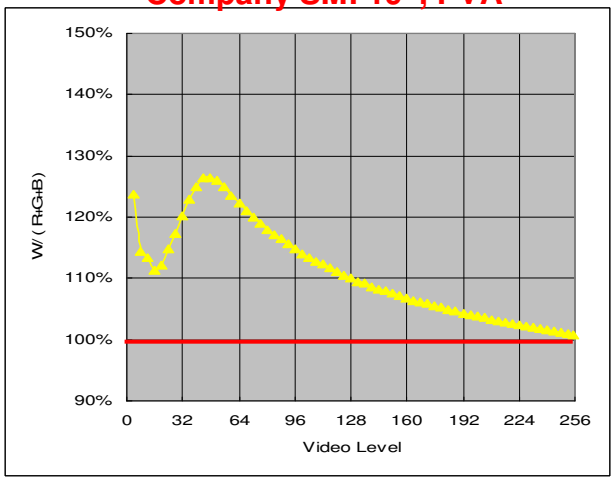
Company SH: 19.6”, TN



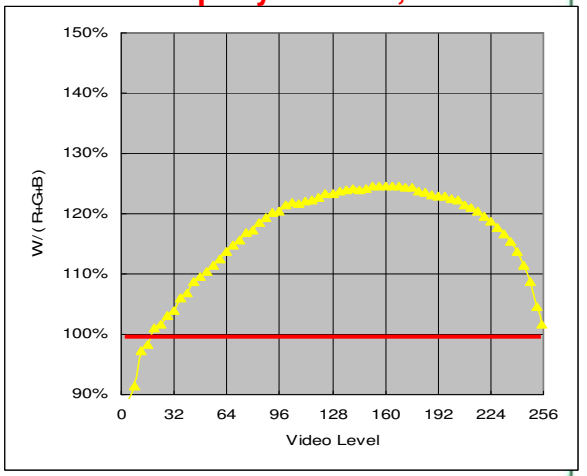
Vertical value is how close to accurate color.
100% is accurate color.

equation: Y=W/(R+G+B)

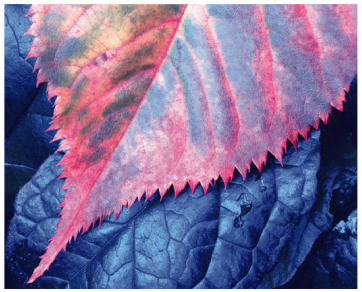
Company SM: 19”, PVA



Company SH: 16”, TN



6.較少失真的可視角度



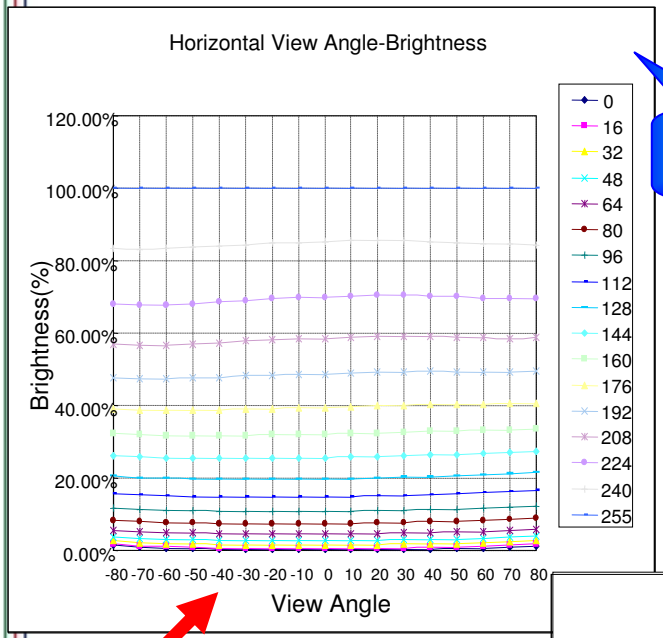
Original Image

ColorEdge　　Typical LCD Monitor

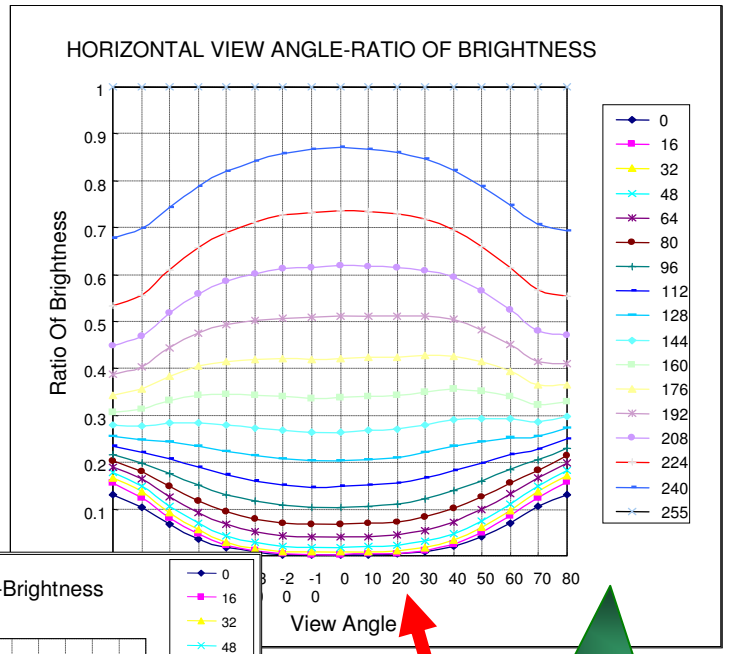
即使從規格表上說明170度的可視角度，但一般的LCD顯示器從側邊看起來還是會褪色

ColorEdge 擁有非常好的可視角度是來自於可使顏色變化非常少的S-IPS 面板技術。

水平可視角度特性

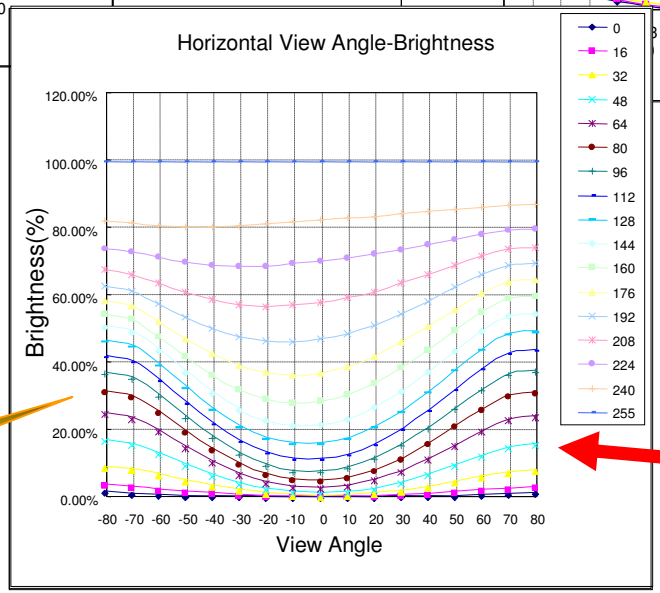


S-IPS



TN+Film

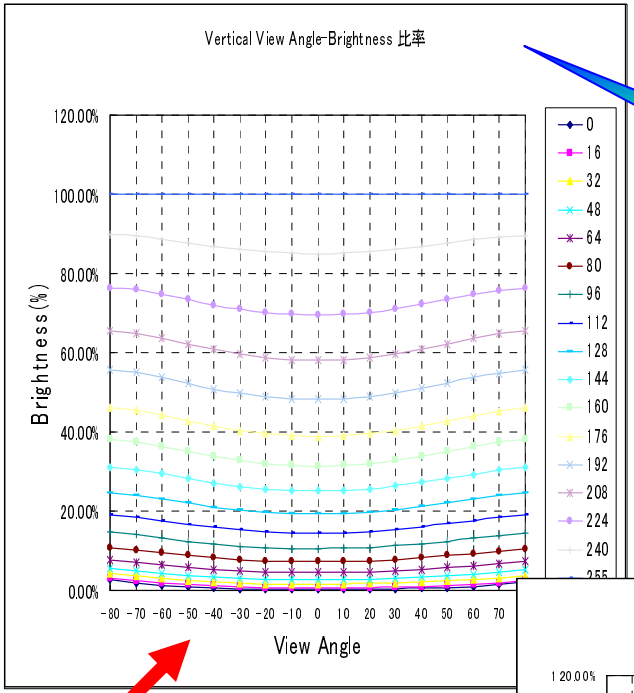
與中央視角相比較，側邊視角的階調特性與中央視角幾乎相同。



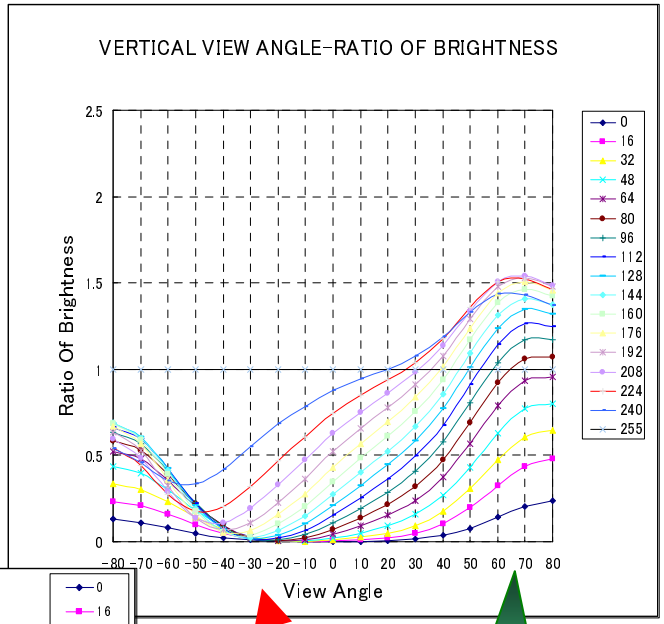
VA

與中央視角相比較，側邊視角的階調特性與中央視角是有差異性的。

垂直可視角度特性

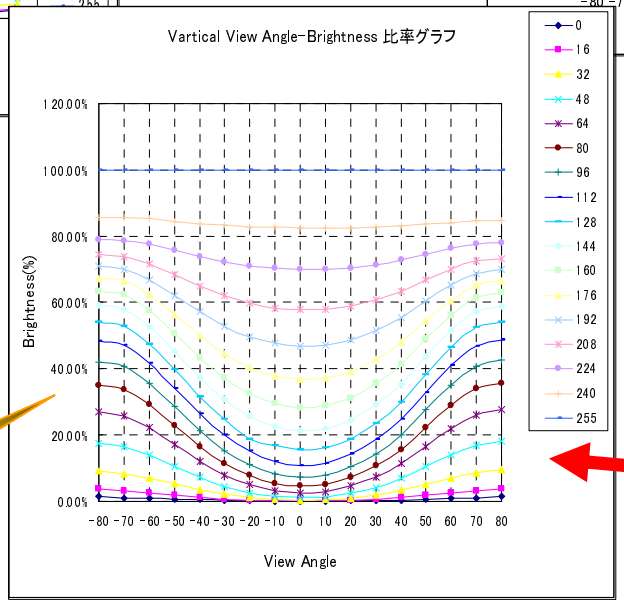


S-IPS



TN+Film

與中央視角相比較，側邊視角的階調特性與中央視角幾乎相同.



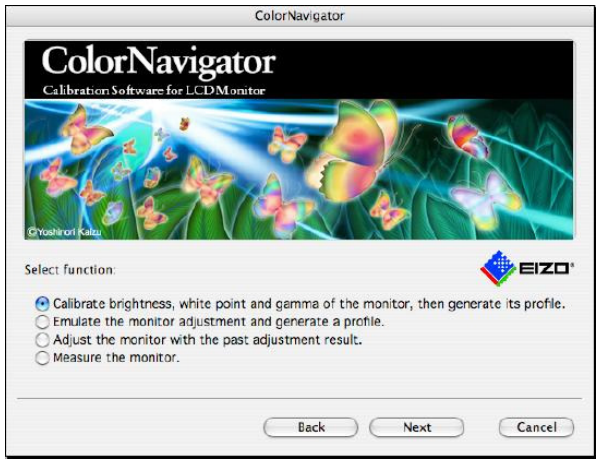
VA

與中央視角相比較，側邊視角的階調特性與中央視角是有差異性的

7.硬體校準能力

顯示器校準可達成的目的

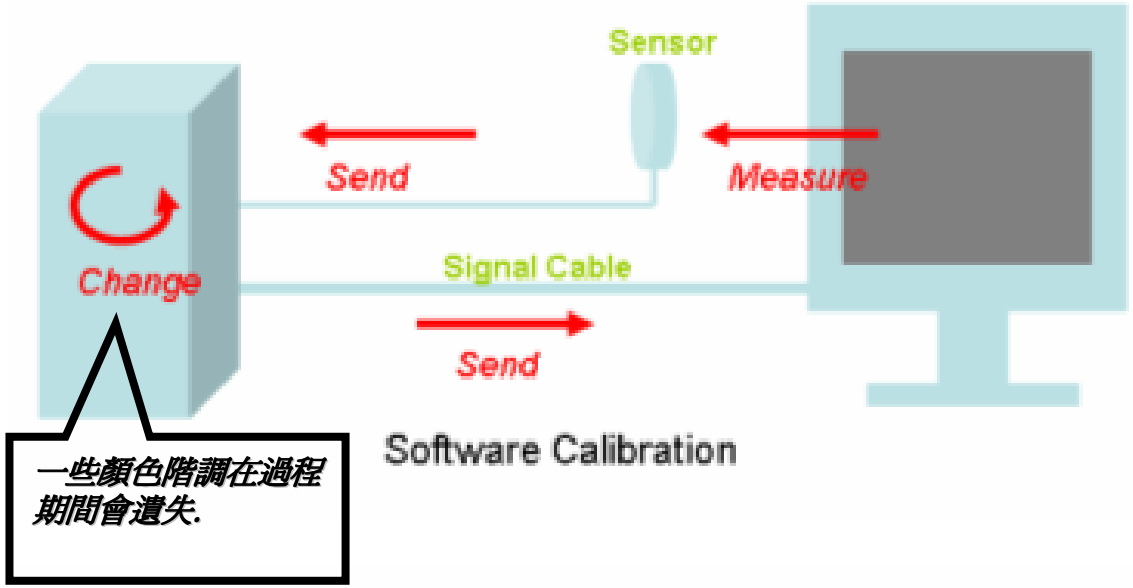
1. 準確的測量與校正
   - ✓ 亮度
   - ✓ 色溫
   - ✓ Gamma 值
2. 與其它裝置顏色一致



Point:

- ➢顯示器能得到準確的顏色
- ➢每個使用者有相同的結果

一般顯示器+校正軟體

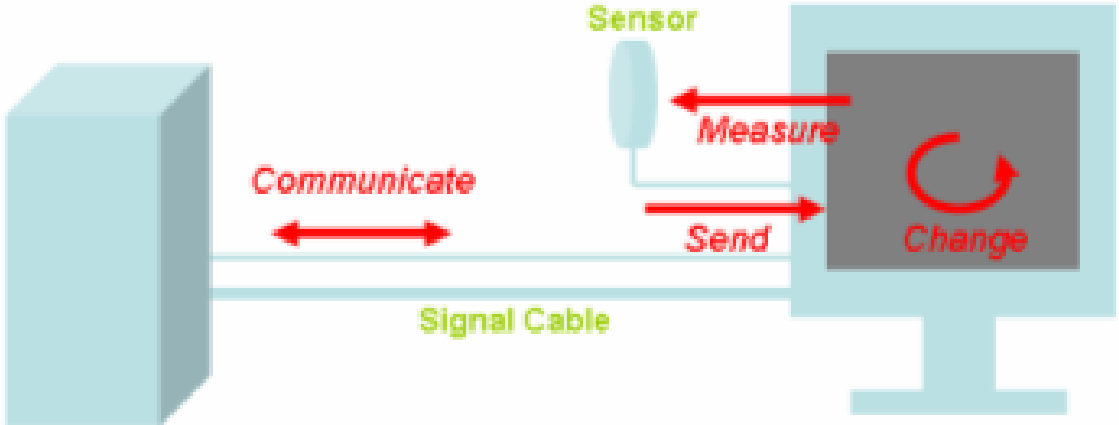


Software Calibration

改變顯示卡特性

大部分顯示卡只擁有 8-bit 顯示能力

硬體校正顯示器



Hardware Calibration – EIZO

改變顯示器特性

ColorEdge 擁有內部 12-bit LUT

12-bit 階調

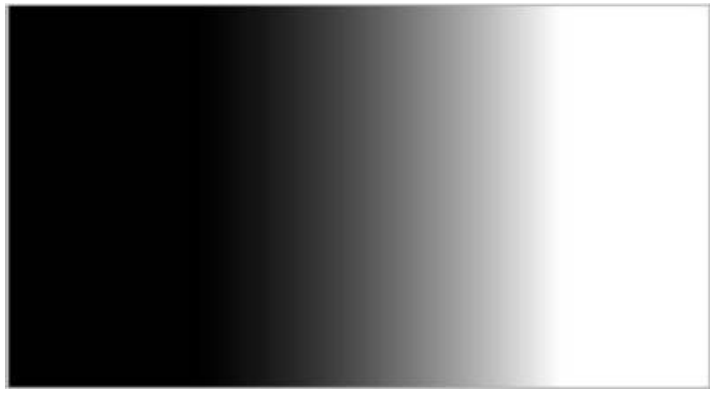
- 比8-bit多16倍

一般螢幕8-bit:

16.7百萬色

R: 256, G: 256, B: 256

256^3 = 16,777,216



8-bit with software calibration
Some tonality breakups

Eizo ColorEdge: 從 8-bit 到 12-bit LUT

從4.4 億色中選擇16.7百萬色

R: 4,096, G: 4,096, B: 4,096

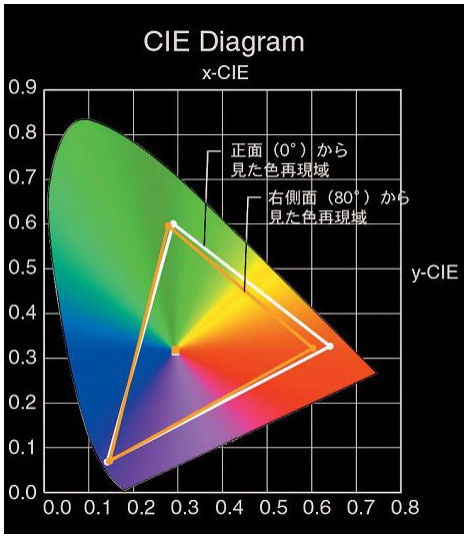
4,096^3 = 68,719,476,736

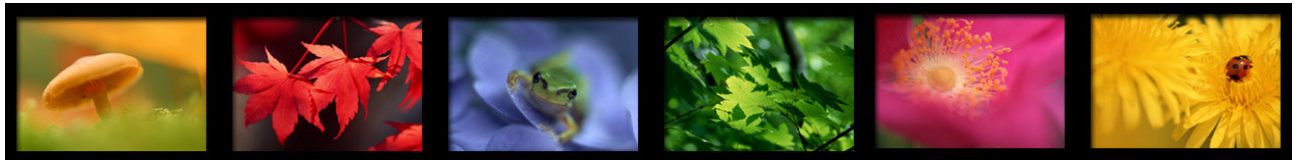
12-bit with hardware calibration
Very smooth gradation

For Perfect Color Management

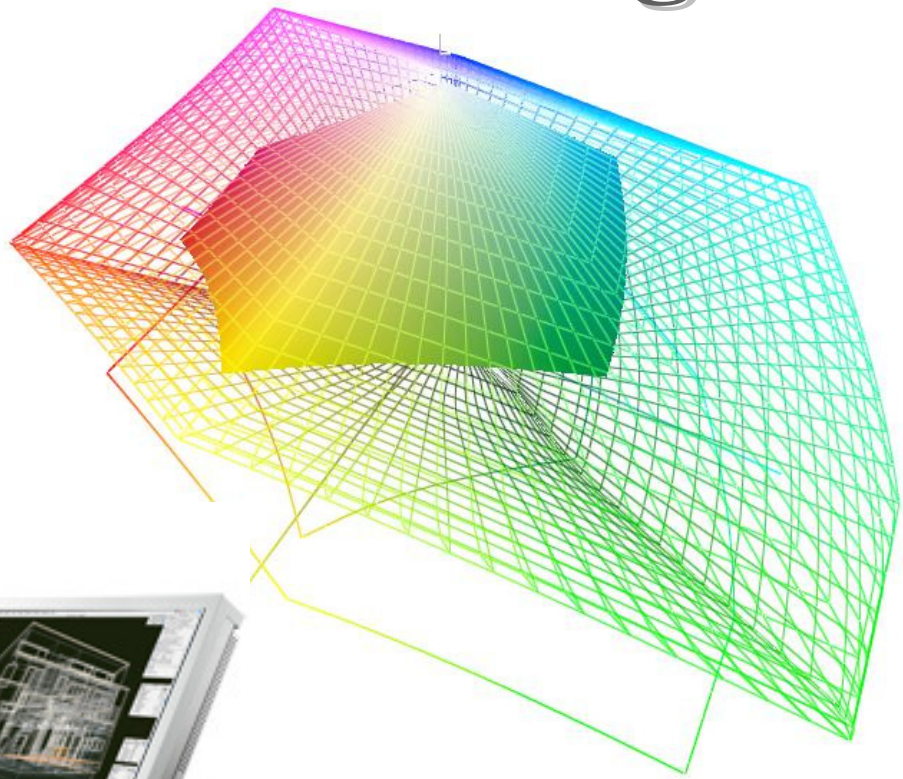
Monitor Required Features:

1. 平滑的色階特性
2. 寬廣的色域
3. 亮度 & 顏色的一致性
4. 亮度的穩定
5. 準確的混色能力
6. 較少失真的可視角度
7. 硬體校準能力





Eizo ColorEdge Series

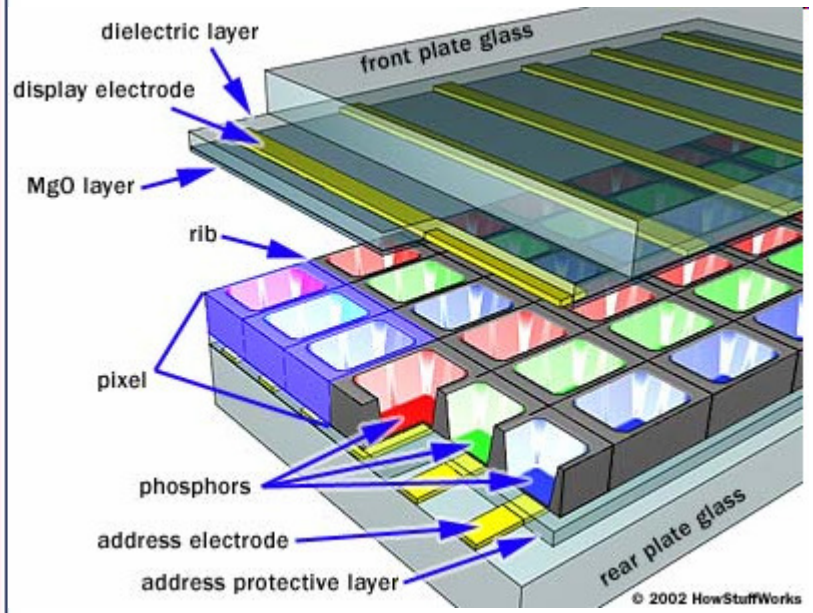


Reference Information: Monitor Technology Today & Tomorrow

Is LCD best for graphics use?

PDP

- Plasma Display Panel
  - Lights is created by prospers excited by plasma discharge



http://electronics.howstuffworks.com/plasma-display3.htm

Pros:

Wide viewing angle, response time, color saturation

Cons:

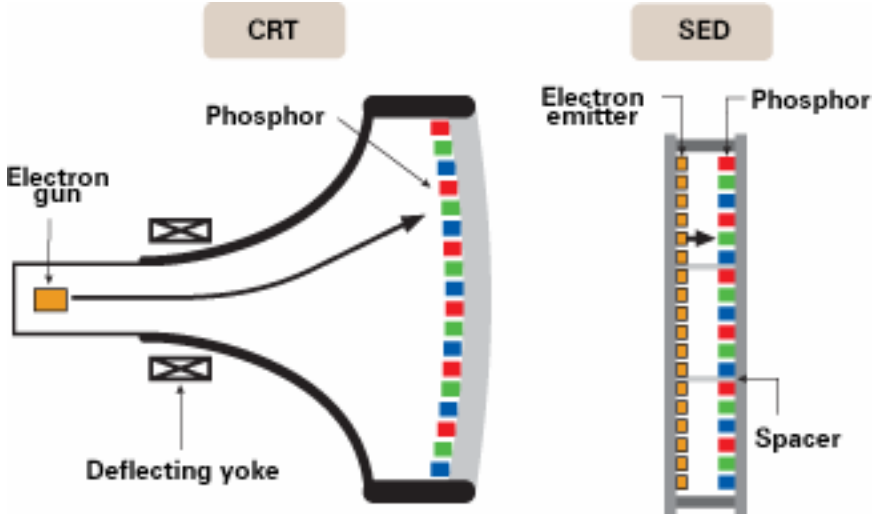
DPI, large screen only, ambient light reflection, after image

Applications:

TV

SED

- Surface-conduction Electron-emitter Display
  - Very small CRTs are aligned
  - Developed by Canon & Toshiba, Production in 2007



http://www.canon.com/technology/display/

Pros:

Wide viewing angle, black level, response time, color saturation

Cons:

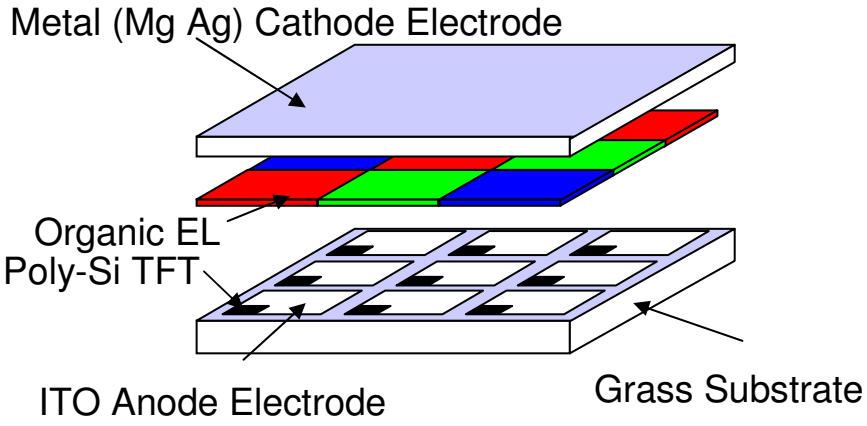
DPI, large screen only, production cost

Applications:

TV

OLED

- Organic Light Emitting Diode
  - LED in which emissive layer is organic compound



Pros:

Wide viewing angle, black level, response time, color saturation, thinner than LCD

Cons:

Longevity, small screen only

Applications:

Cell phone, PDA

Comparison

	CRT	LCD	PDP	OLED	SED
Color gamut	☆☆☆	☆☆☆	☆☆	☆☆☆	☆☆
Moving image process	☆☆☆	☆☆	☆☆☆	☆☆☆	☆☆☆
Viewing angle	☆☆☆	☆☆	☆☆☆	☆☆☆	☆☆☆
Black level / Contrast	☆☆☆	☆☆	☆☆	☆☆☆	☆☆☆
DPI	☆☆	☆☆☆	☆	☆☆☆	☆☆
Longevity	☆☆	☆☆☆	☆☆	★	☆☆
Power consumption	★	☆☆	☆☆	★	☆☆☆
Production cost	☆☆☆	☆☆	☆☆	★	★
Typical screen sizes	~ 36"	~ 65"	37" ~ 100"	~ 15"	36" ~ 55"
Typical applications	Computer monitor, TV	Mobile phone, PDA, Computer monitor, TV	TV	Mobile phone, PDA	TV

END

Thank you very much for your attention.