



Requirement for graphic arts display

Content Development Division
of National Digital Archives
Program, Taiwan

Date: 95/12/5

中島賢人: Masato Nakashima

Product Manager, Graphic Solutions

Overseas Sales & Marketing

Eizo Nanao Corporation



EIZO means “**IMAGE**” in Japanese

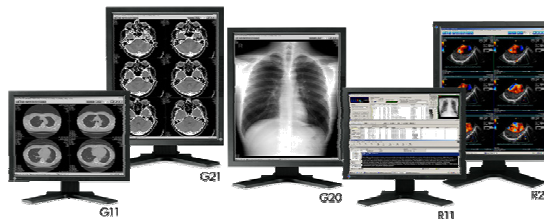
EIZO is the dedicated company manufacturing display products for more than 30 years.



ColorEdge CG220



RadiForce™
MEDICAL DISPLAY SYSTEMS





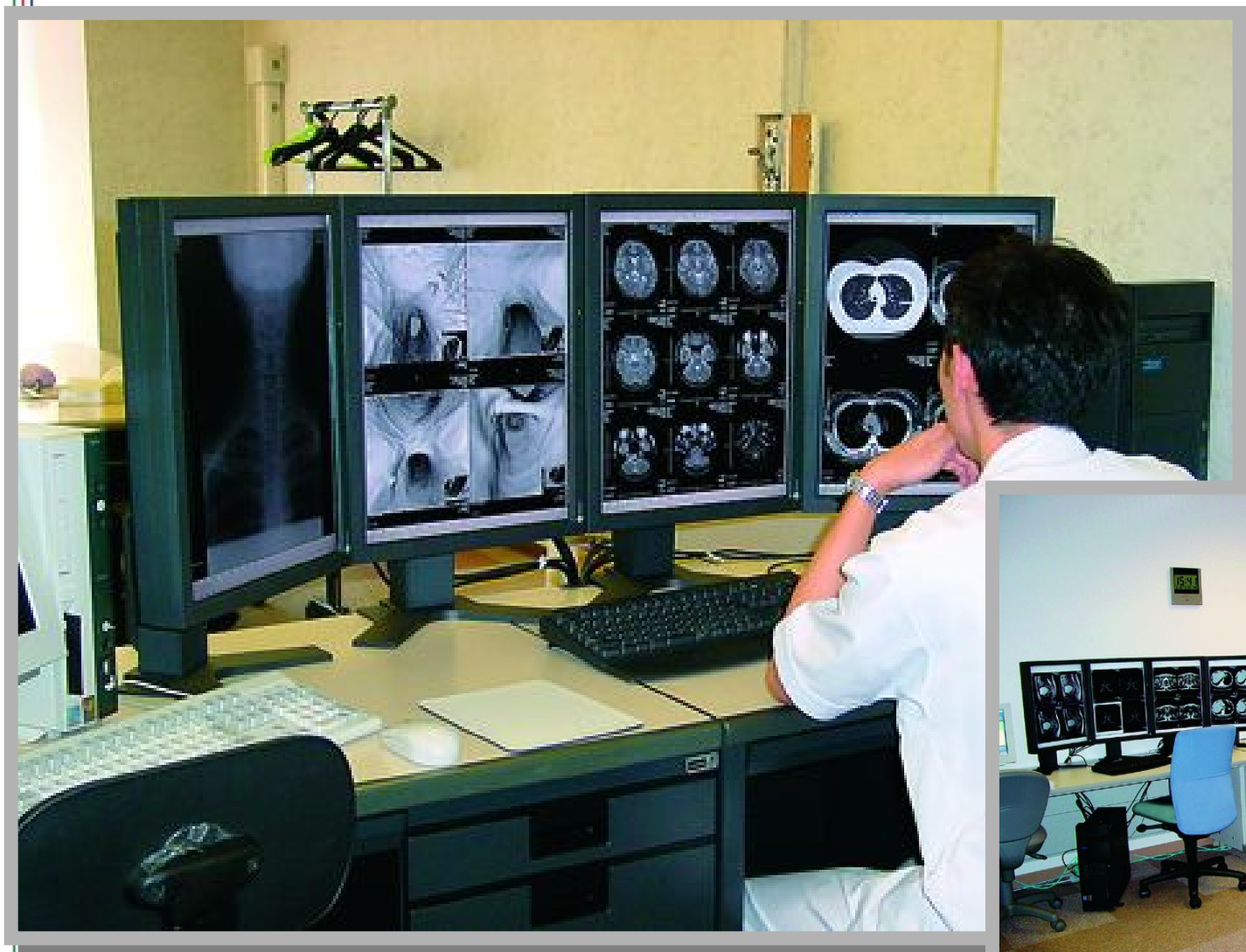
Installation Example



Trading Room: UBS (Zurich)



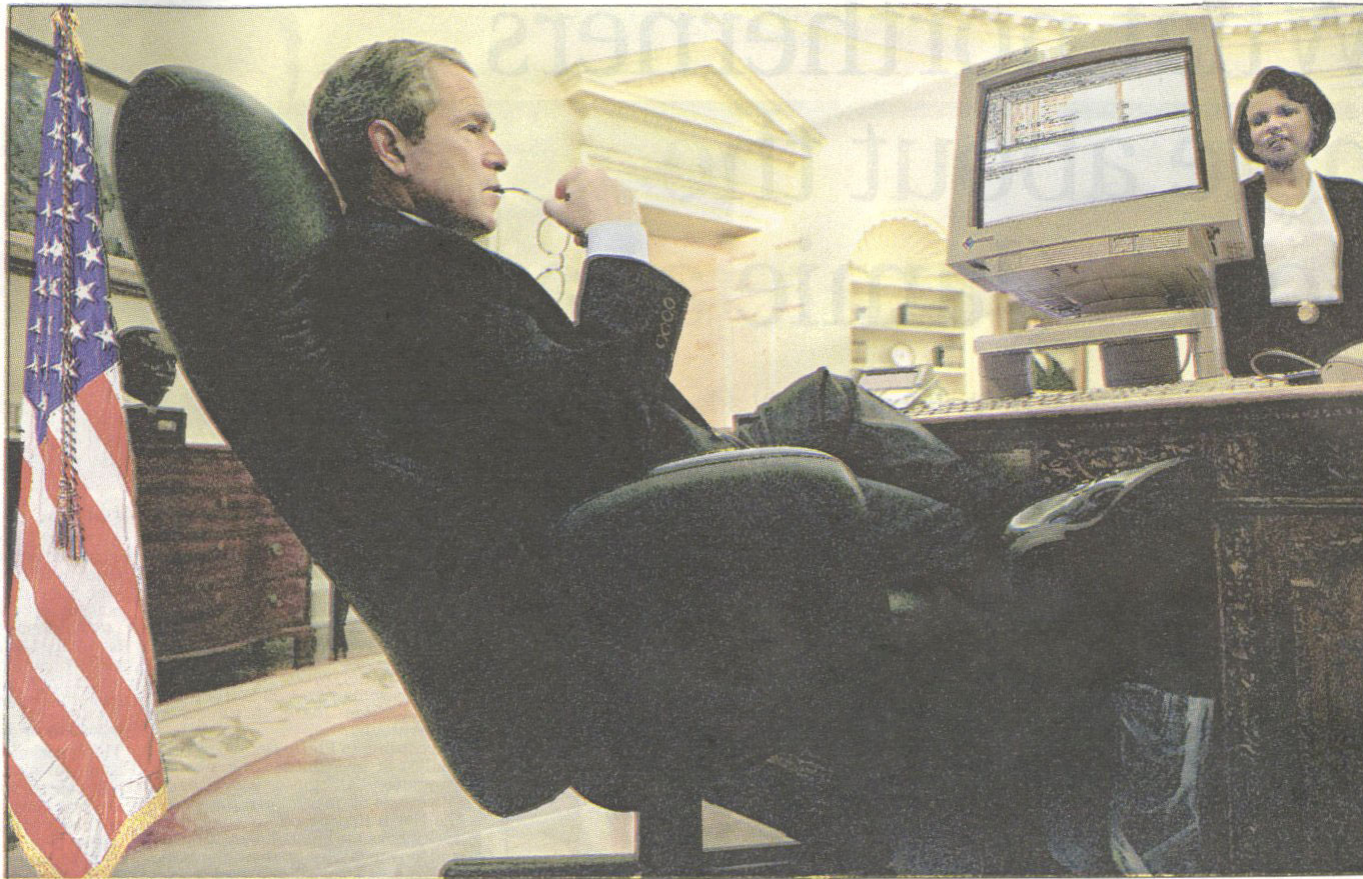
Network Control Center : Vodafone (The Netherlands)



Reading Room: Sapporo Shinseiki Hospital (Japan)

Evening Standard Tuesday, 20 November 2001 23

res



Photomontage

ht of bad man-
ore a friendly
ll done Saddam
ber-correspon-
rdinaire: he
et subscribe to

George

President's office. "The President has expressed his thoughts on that matter several times in public. The speech he held at the Brandenburg Gate on 14 September as well as the one he gave in Leipzig on 9 October

The President Room of "White House": Washington (U.S.A)



Photo Studio: The Photographer Mr. Douglas Dubler (U.S.A)



Installation Example



News Paper Publisher: Emirates Today (U.A.E)



Requirement for graphic arts display

Content Development Division
of National Digital Archives
Program, Taiwan

Date: 95/12/5

中島賢人: Masato Nakashima

Product Manager, Graphic Solutions

Overseas Sales & Marketing

Eizo Nanao Corporation



LCD Monitor Characteristics

- Merit

- Space and energy saving
- Very flexible setting
- Flat surface
- No geometrical distortion
- No defocusing and convergence error

- Demerit

- Narrow color space
- Viewing angle dependency of contrast and color
- Lack-smoothness of gamma characteristics
- Defective and difficult color adjusting functions

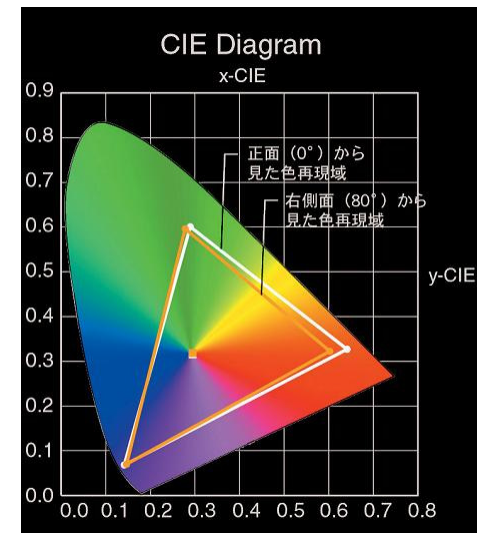
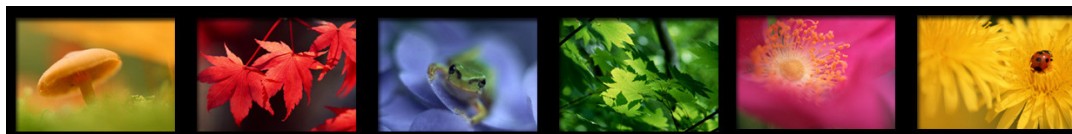




For Perfect Color Management

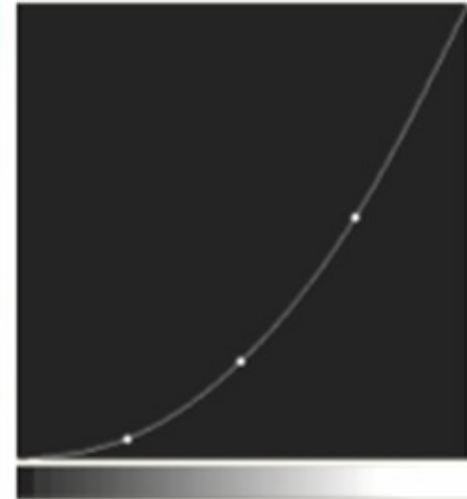
Monitor Required Features:

1. Smooth Tone Characteristics
2. Wide Color Gamut
3. Brightness & Color Uniformity
4. Brightness & Color Stability
5. Accurate Additive Color Mixture
6. Wide Viewing Angle
7. Hardware Calibration Capability



1. Smooth and Adjustable Gamma

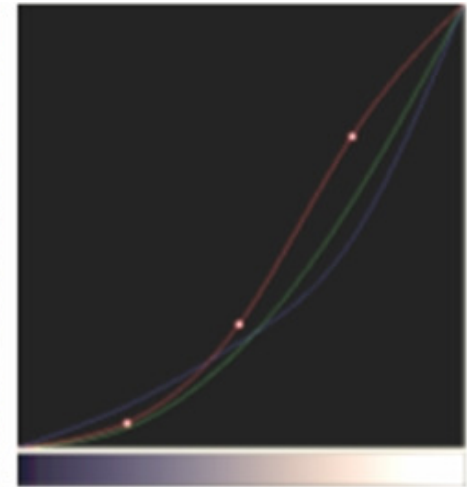
Original Image



Gamma = 2.2 for each color

Distorted Image

If the tone characteristics (gamma curve) of monitor per each color (R,G,B) vary, the picture looks different from the original.



Different gamma curve for each color



1. Smooth and Adjustable Gamma

Eizo ColorEdge Series

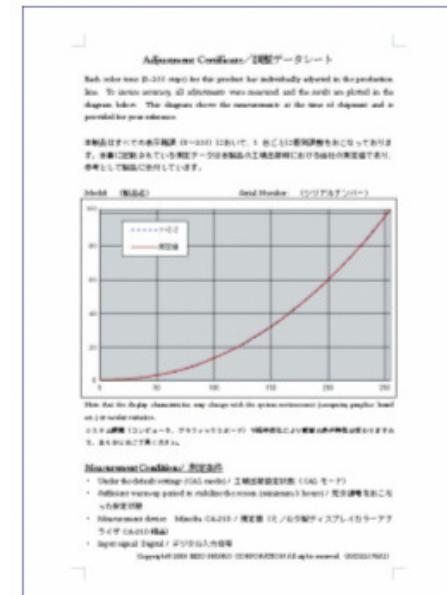


12-Bit LUT in EIZO original LCD controller built-in the monitor



Actual adjustments is performed in a darkroom

Factory adjustment for all 256 steps for each RGB



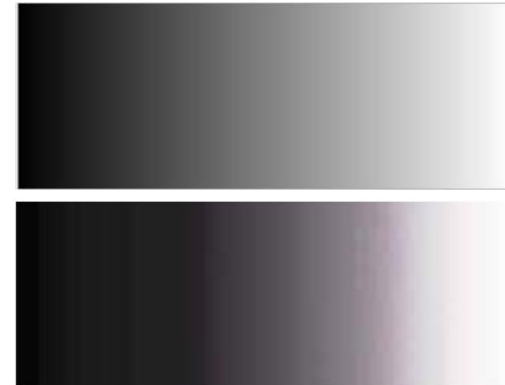
Adjustment Certificate

Each monitor has correct gamma characteristics



1. Smooth and Adjustable Gamma

- **Grayscale Display (Tone characteristics)**
 - Factory calibrated monitor (e.g. Eizo Monitors) enables smooth grayscale display.
 - General Monitors has obvious coloring and bandings in its grayscale display.



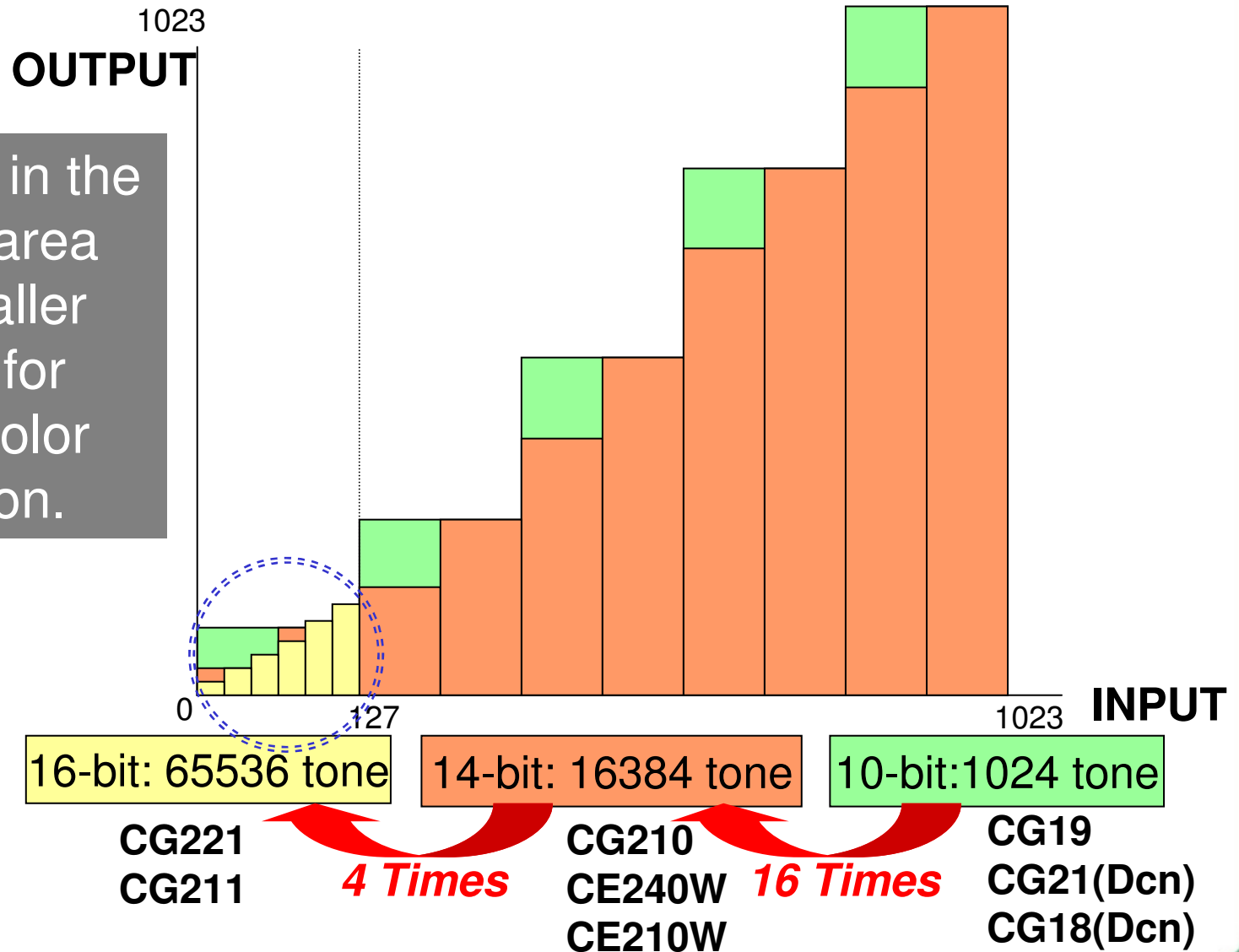
Single unit calibration as factory preset minimizes deviation between per each.



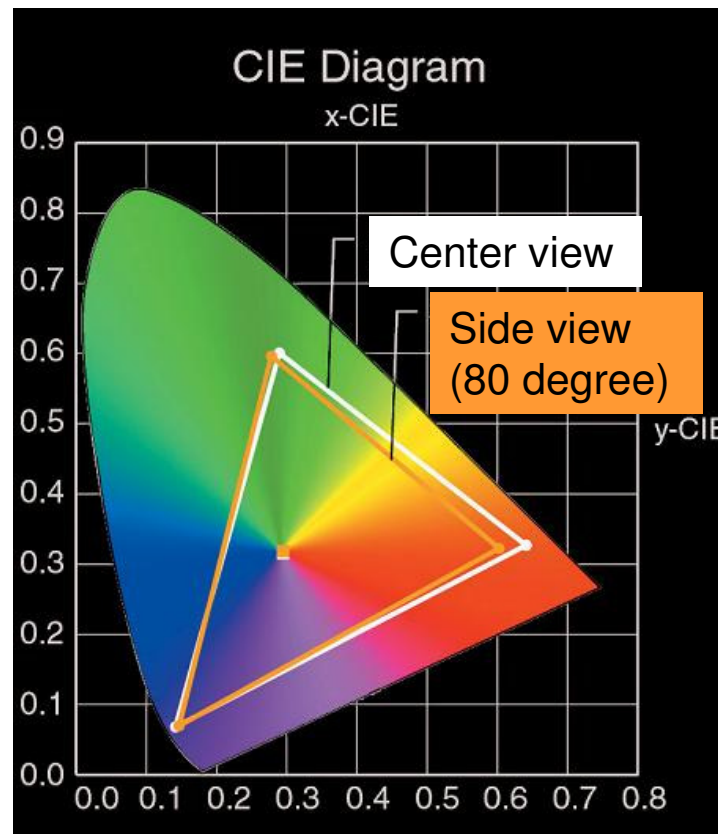
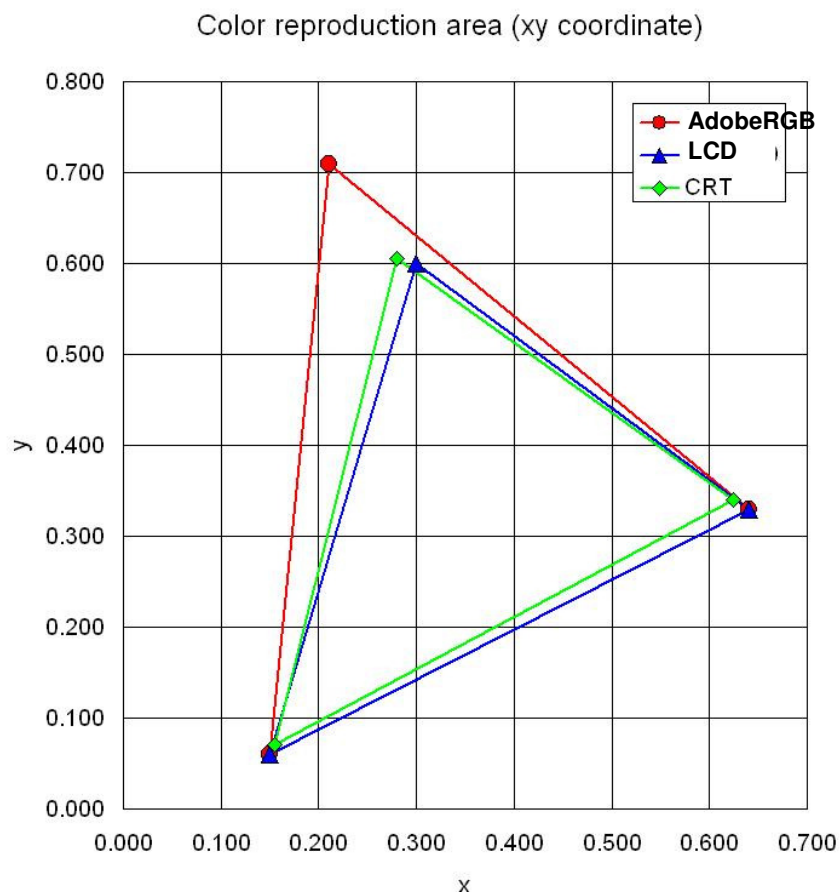


16-bit Color Processing

Especially in the dark tone area needs smaller increment for accurate color reproduction.



2. Wide Color Gamut



➤ Same Color Space as CRT

➤ Less Dependent of Angles

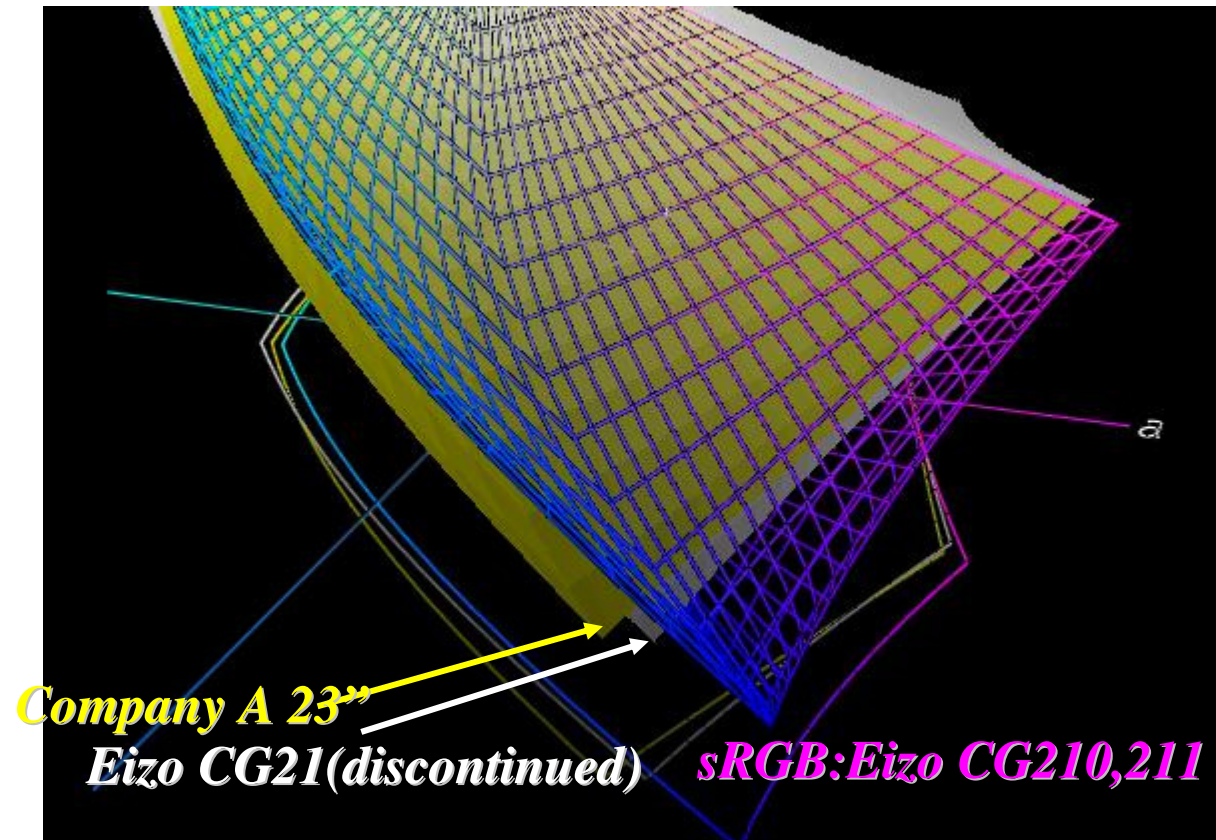
•Reference: Adobe RGB→ Eizo CG221, LCD→ Eizo CG211,
CRT→ Eizo High-end 21" CRT T966



2. Wide Color Gamut



sRGB Blue

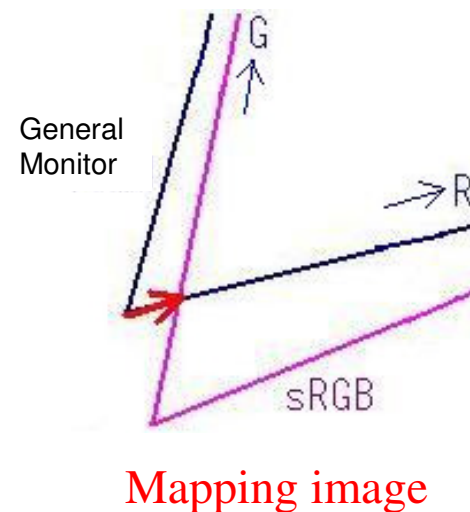
There is few monitors which can cover 100% sRGB gamut regardless LCD/CRT.



2. Wide Color Gamut

- Mapping means color space compression.
- The gap between sRGB and monitor's Blue coordinate makes blue color turn reddish by color mapping.

	Before	After
General Monitors		
CG211 CG210		

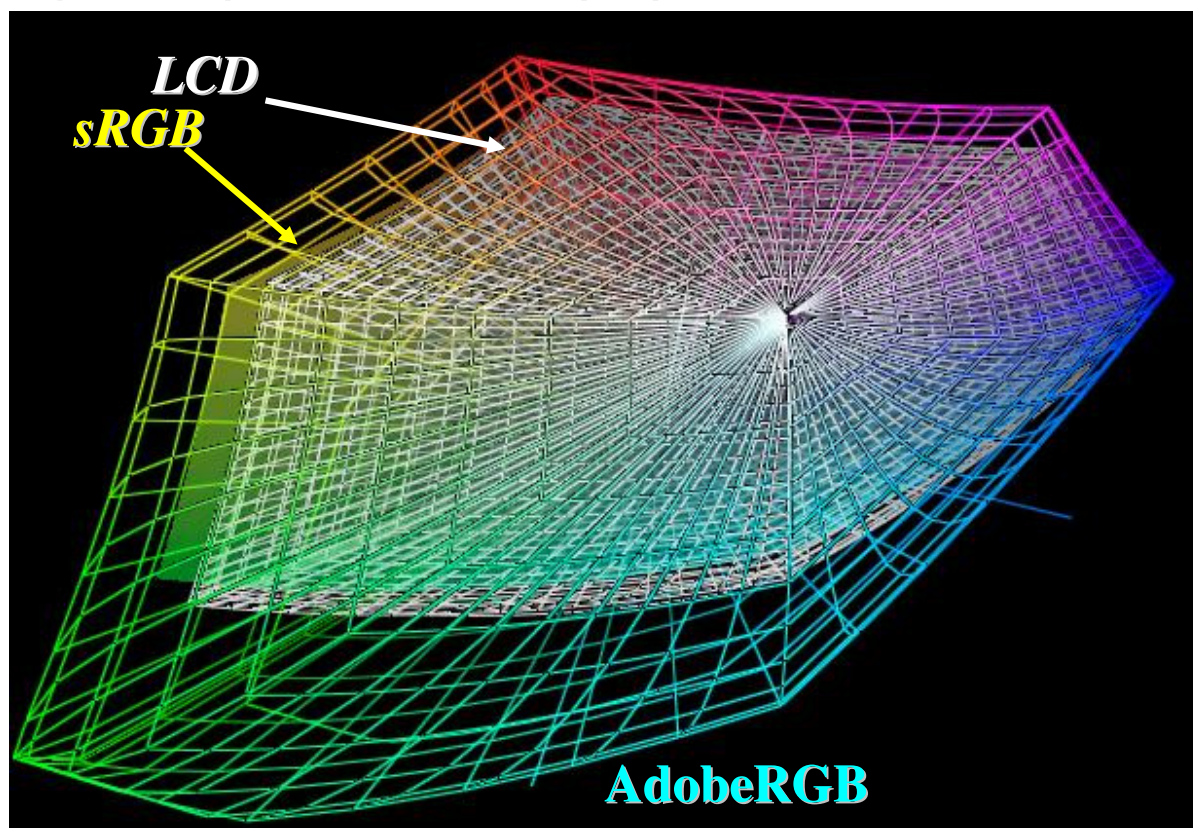


2. Wide Color Gamut

AdobeRGB

sRGB is not enough for perfect softproof to show saturated Cyan, Yellow and Magenta printed on a paper.

→next page

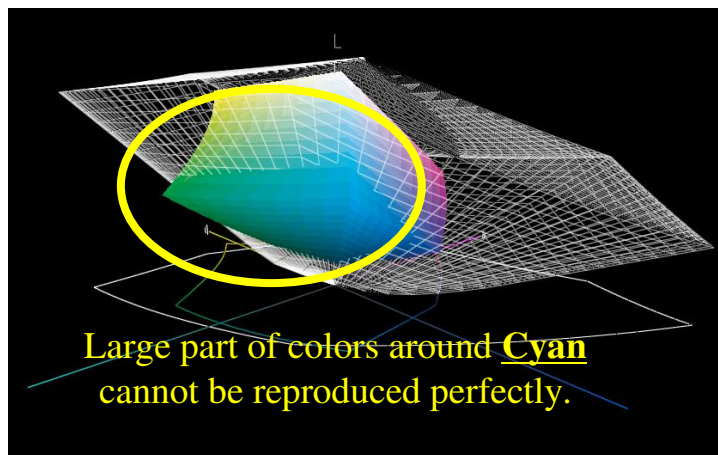


•Reference: Adobe RGB→ Eizo CG221, LCD→ Eizo CG19

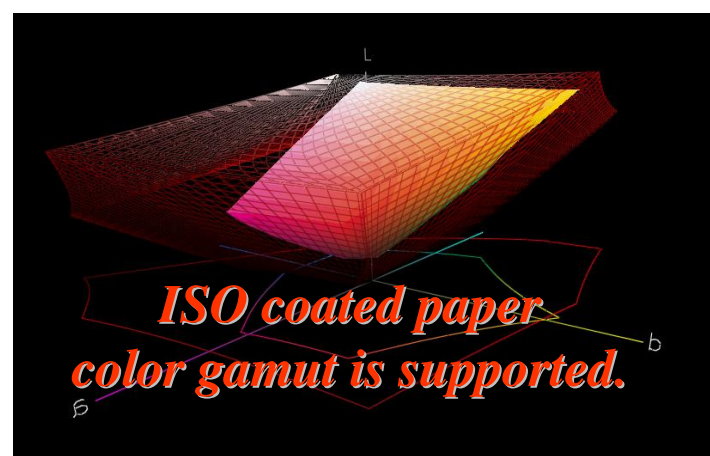
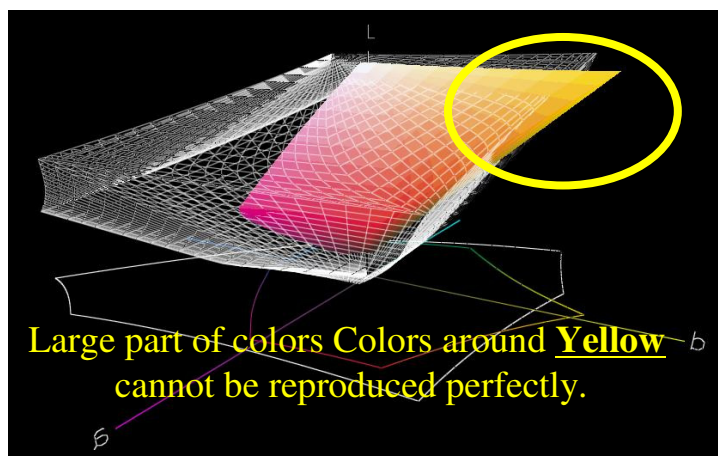
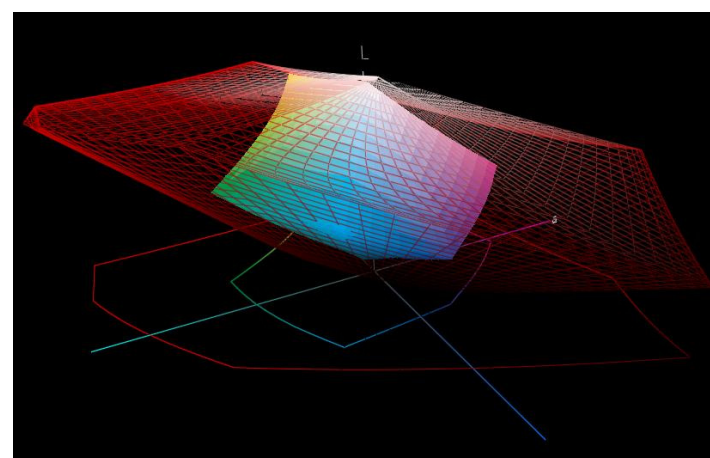
2. Wide Color Gamut

Gamut Comparison with ISO Coated Paper

sRGB: Traditional LCD/CRT Monitor

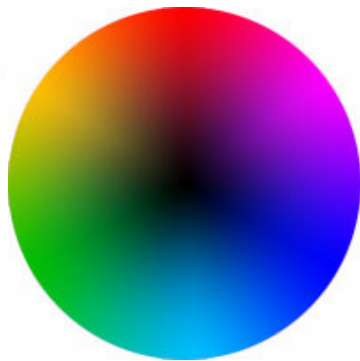


AdobeRGB



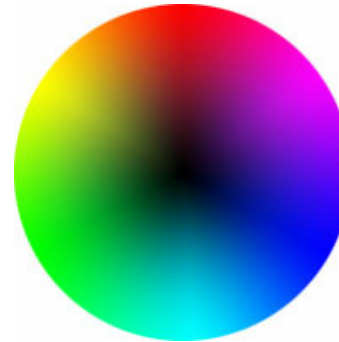
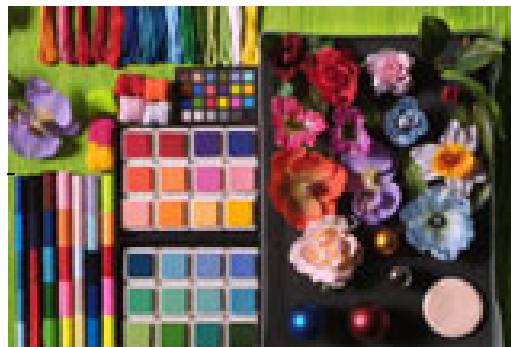
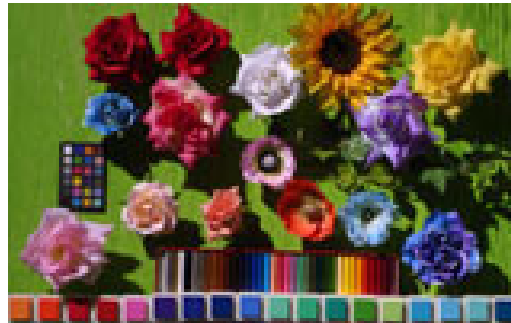
•Reference: Adobe RGB→ Eizo CG221

2. Wide Color Gamut

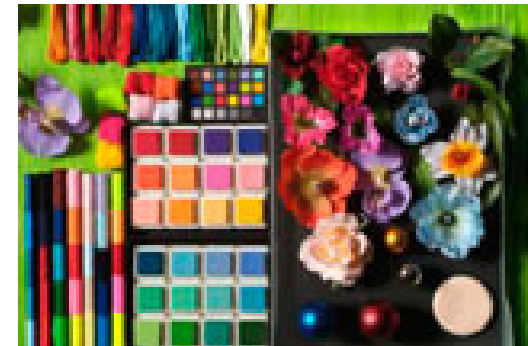
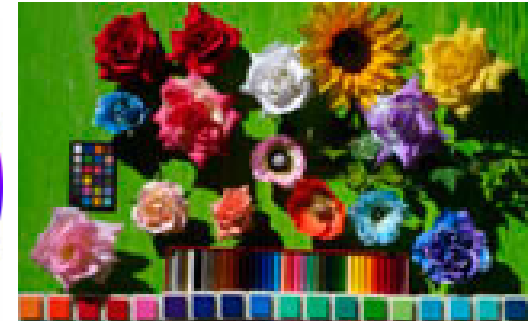


sRGB

- General LCD Monitors



AdobeRGB



Saturated color especially Cyan and Yellow is compressed.

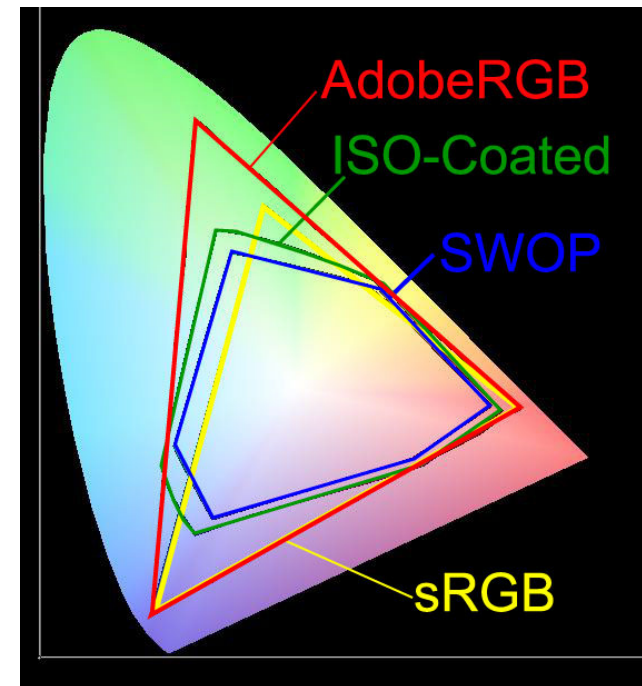


Deep tone color around Cyan and Yellow is displayed.

1. Wide Color Gamut

- Reference monitor for AdobeRGB formatted picture data.
 - AdobeRGB is a market standard for high-end digital camera and scanner though there is no capable monitor to show the image with original colors.
- Feasible monitor for softproof.
 - Consistent Color Reproduction.
 - “ISO coated”, “SWOP”, “Japan color”, “Euroscale” color gamut is covered.

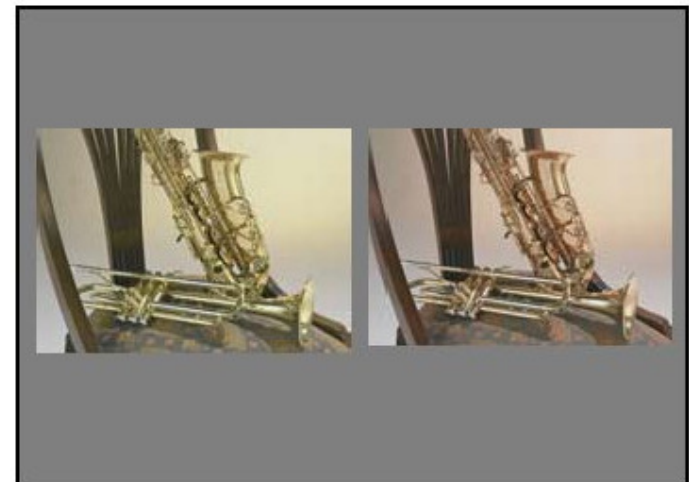
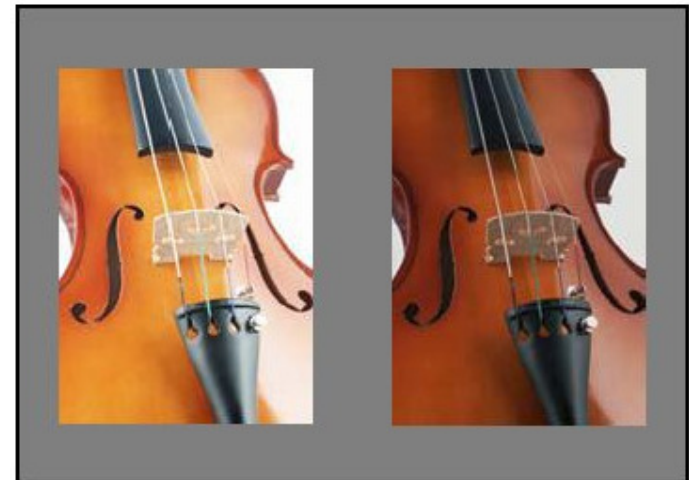
AdobeRGB color gamut can increase efficiency of color management enormously.





3. Brightness & Color Uniformity

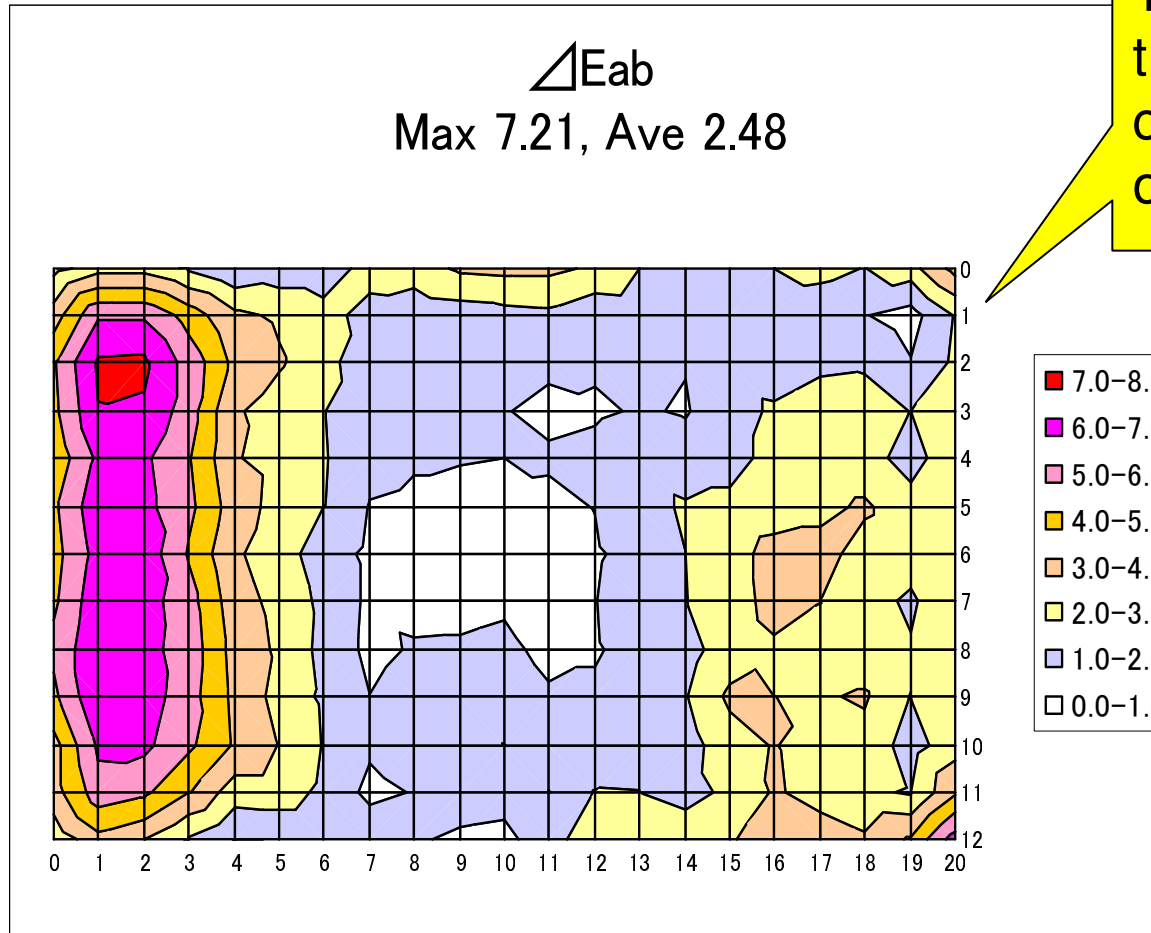
- Screen uniformity can easily effect critical color work.





3. Brightness & Color Uniformity

- Actual Screen Uniformity

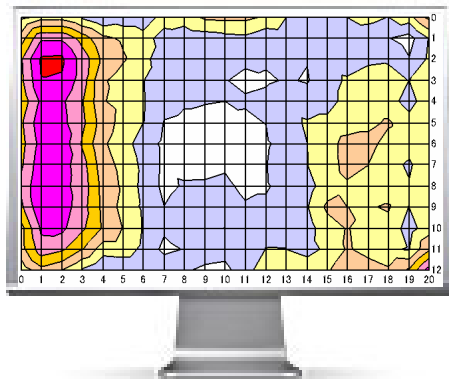


This is a usual case there are validation of color and brightness on an entire screen.

3. Brightness & Color Uniformity

- Screen Uniformity

	Average	Maximum
Eizo w/t DUE	$\Delta E=1.0$	$\Delta E=3.5$
Eizo w/o DUE	$\Delta E=2.5$	$\Delta E=6.0$
Company A 23"	$\Delta E=3.5$	$\Delta E=7.4$



At 5000K, Video Level 255

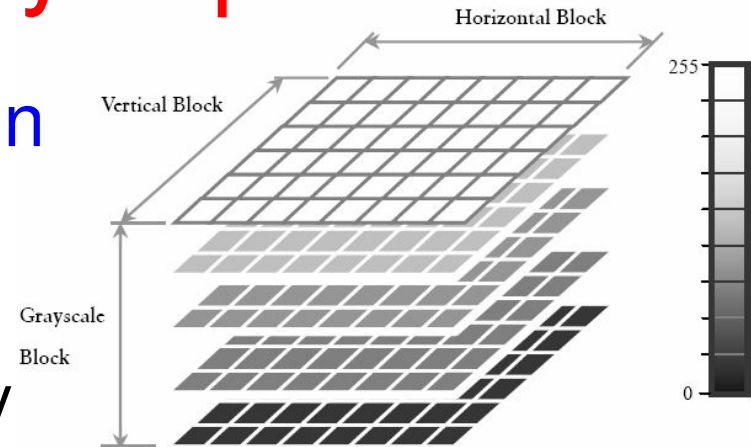
* DUE: "Digital Uniformity Equalizer" function

*The above value is based on Eizo own test

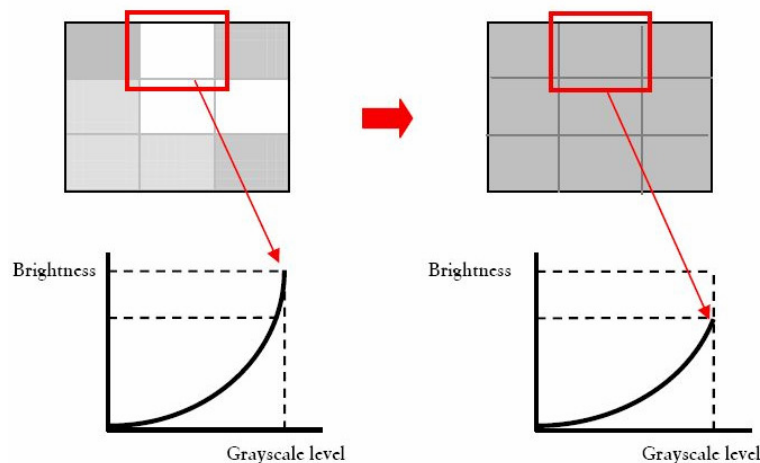


Digital Uniformity Equalizer

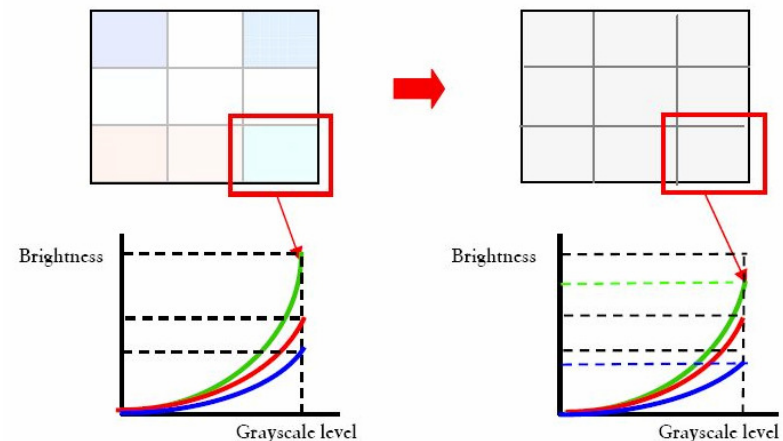
- New uniformity compensation process at EIZO factory production line
 - Both brightness & chromaticity are adjusted at 425 points in an entire screen.



Compensations are made on various grayscale levels



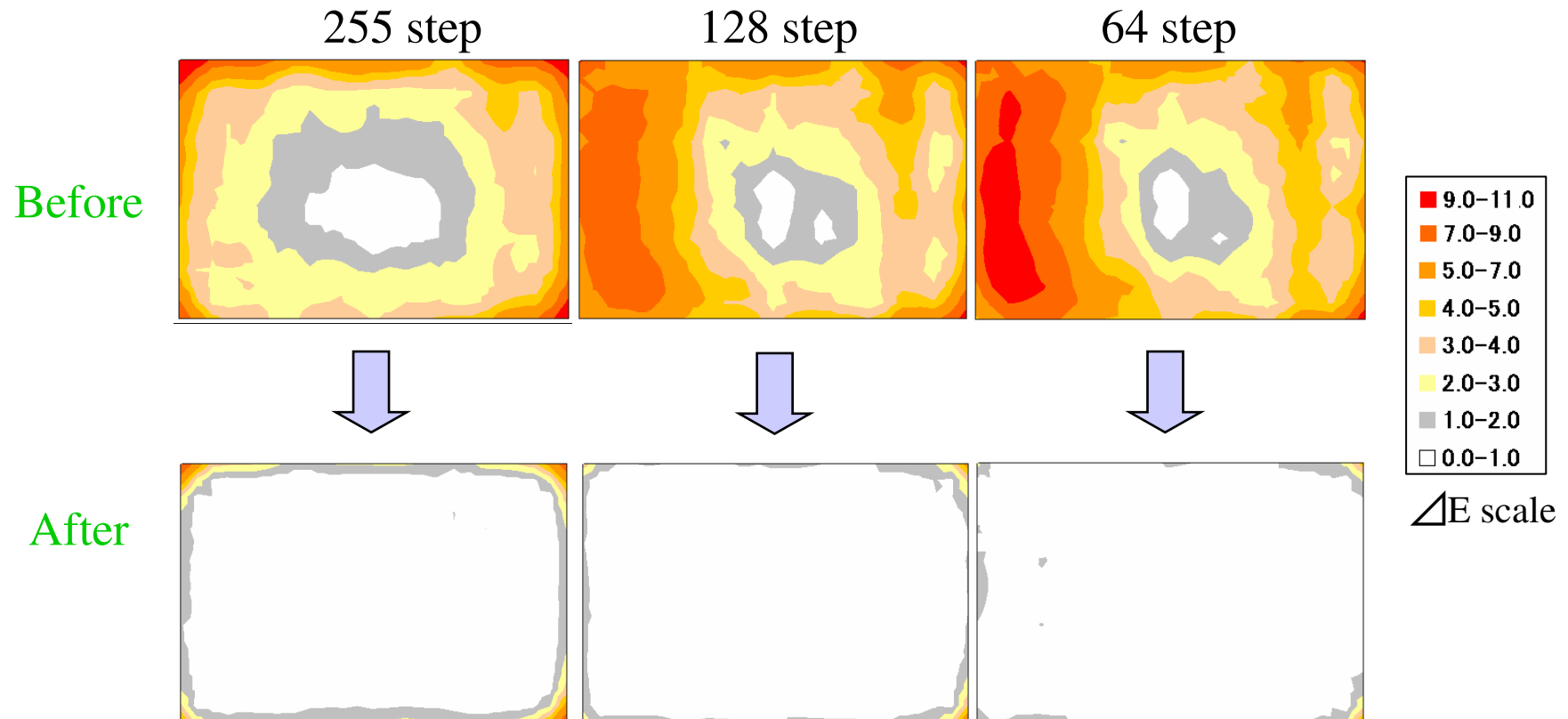
Brightness uniformity compensation



Chromaticity uniformity compensation

Measurement example

- Color uniformity is now delta E 1 to 2 or below at each grayscale level





4. Brightness Stability

• Brightness Stability

• General LCD and CRT Monitor

Power ON

Time



Brightness starts dark, then goes up



Brightness starts high, then goes down

Normally it takes 1, 2 h

• Eizo Monitors

Power ON

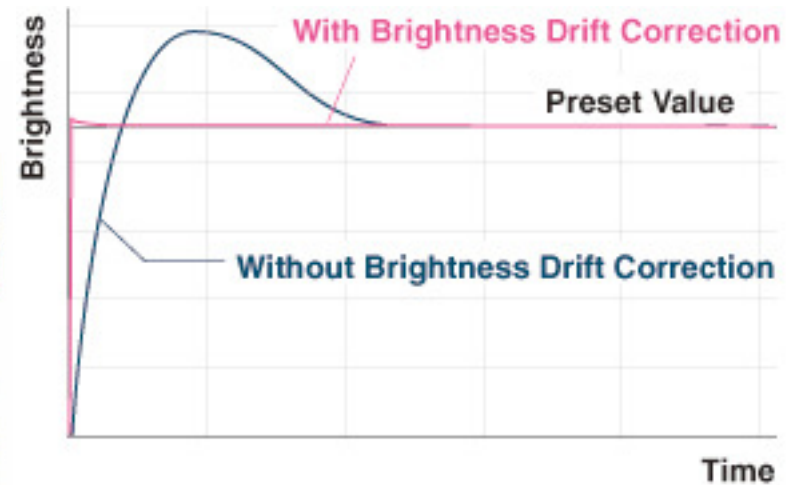
Time



Stable brightness immediately after power on

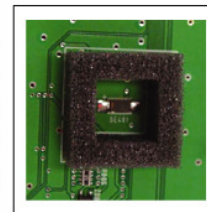
It takes less than a half hour

Brightness Transition

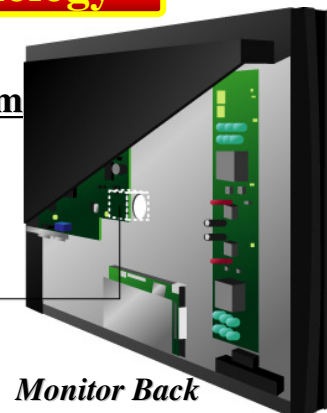


Eizo Patented Technology

Eizo Backlight Control System



Backlight sensor



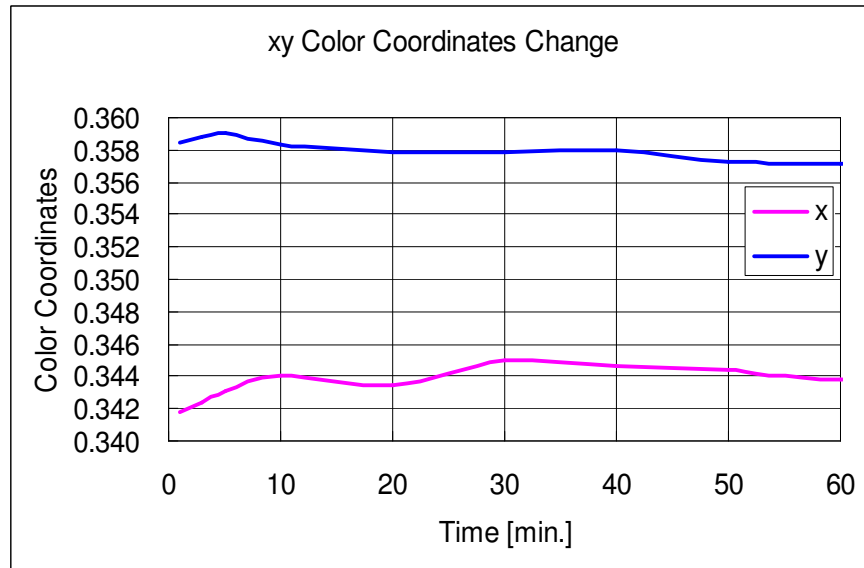
Monitor Back



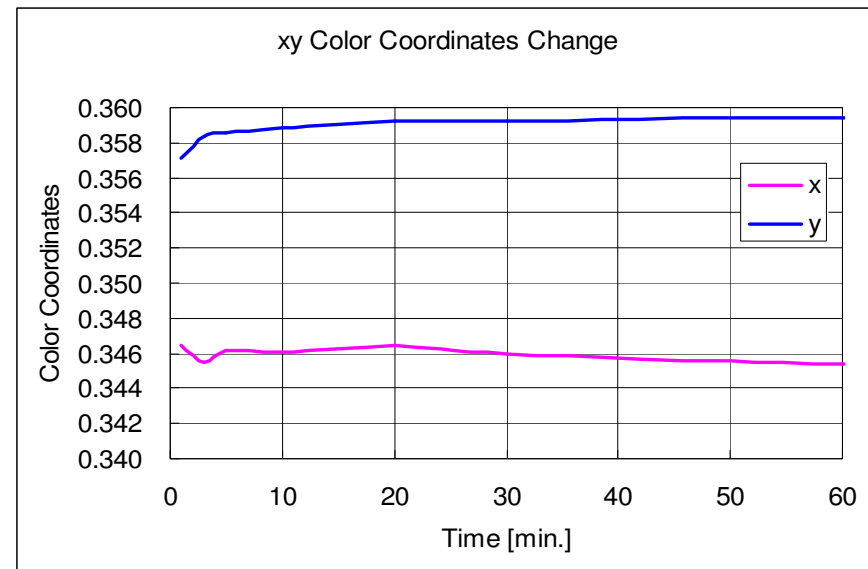
4. Brightness Stability

- Chromaticity Stability

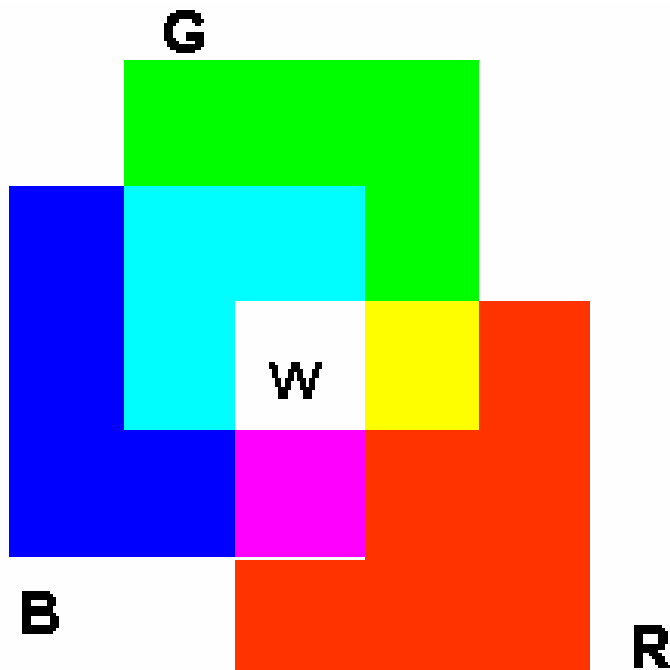
Normal



w/t Eizo brightness stabilizer



5. Accurate Additive Color Mixture

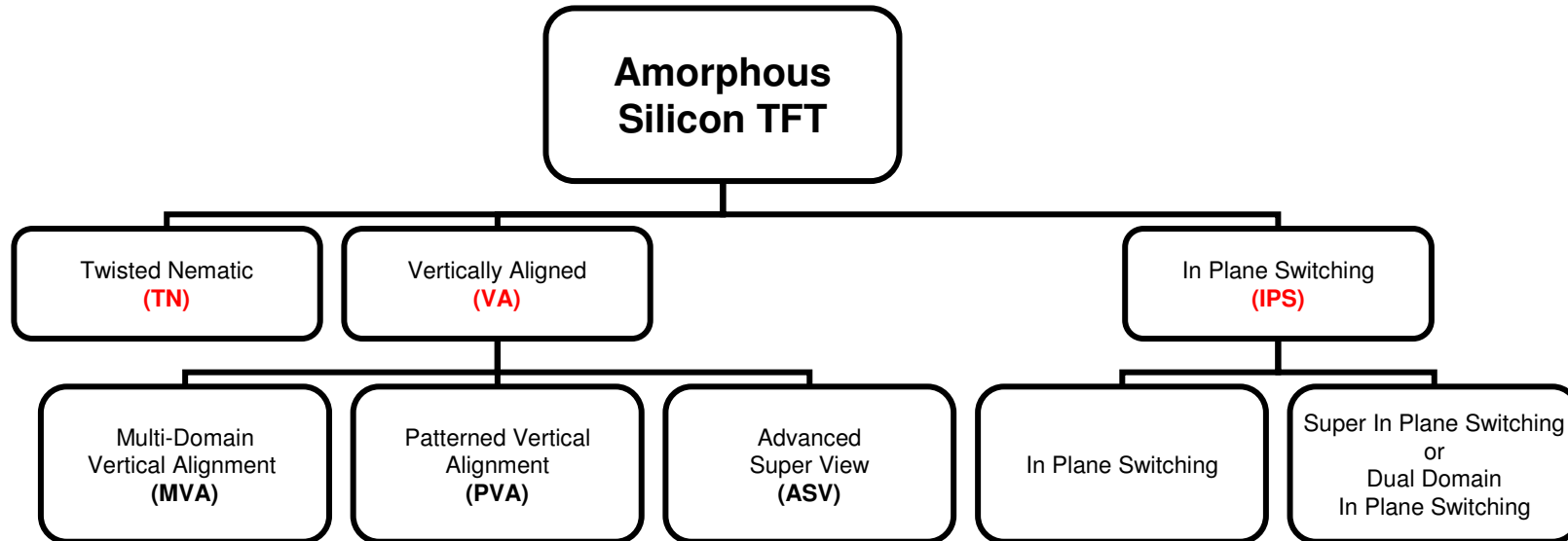


$$R+G+B = W$$

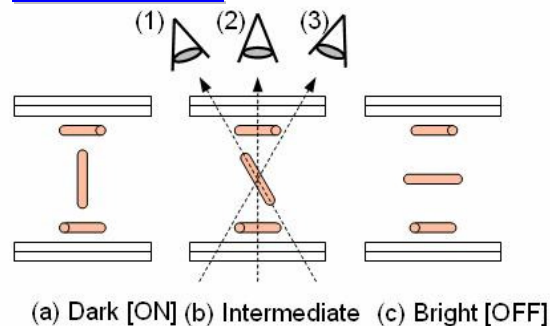
Not happen on most LCDs

ColorEdge has very good characteristics like CRTs

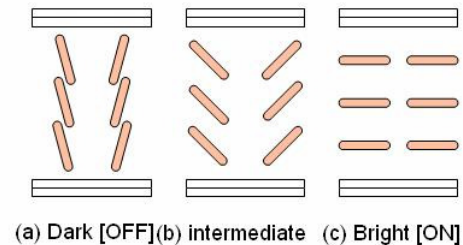
TFT Liquid Crystal Mode



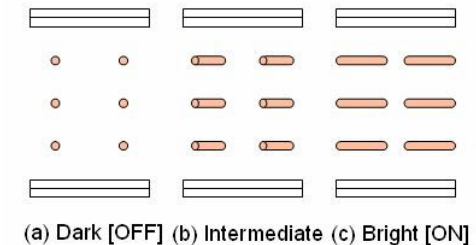
TN+Film



VA



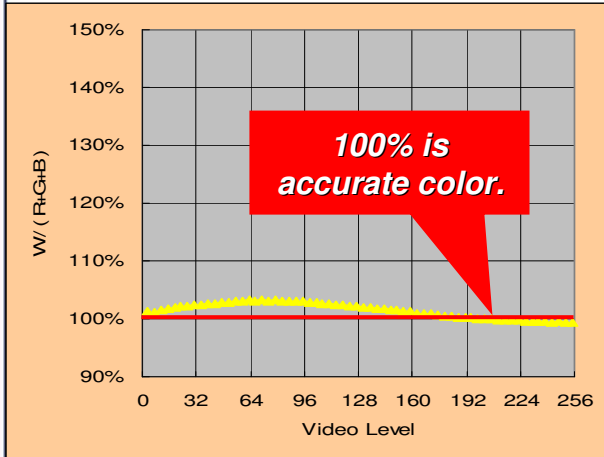
IPS



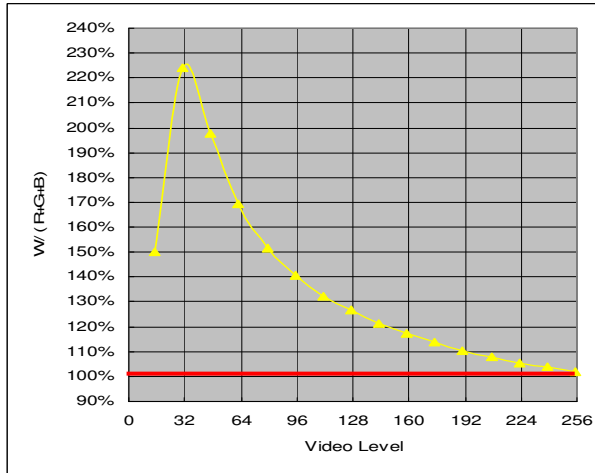


Failure of Additive Mixture

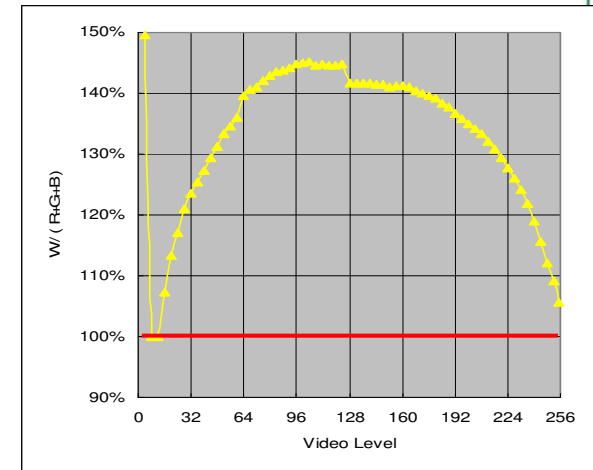
Eizo CG211 S-IPS



Company SH: 18", ASV



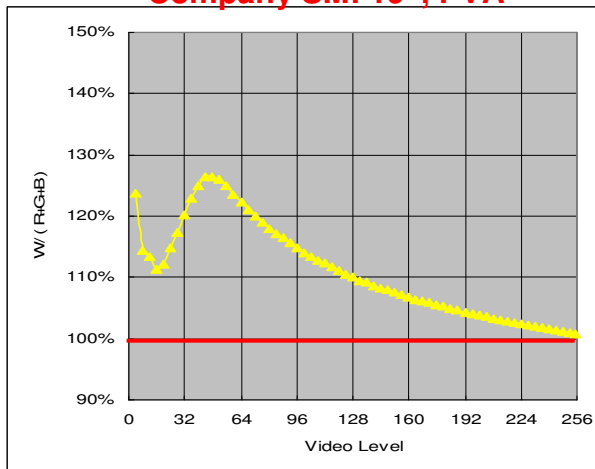
Company SH: 19.6", TN



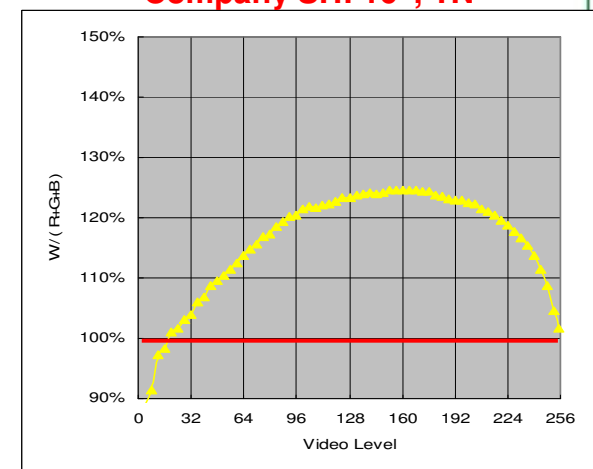
Vertical value is how close to accurate color.
100% is accurate color.

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

Company SM: 19", PVA



Company SH: 16", TN



6. Wide Viewing Angle



Original Image



ColorEdge



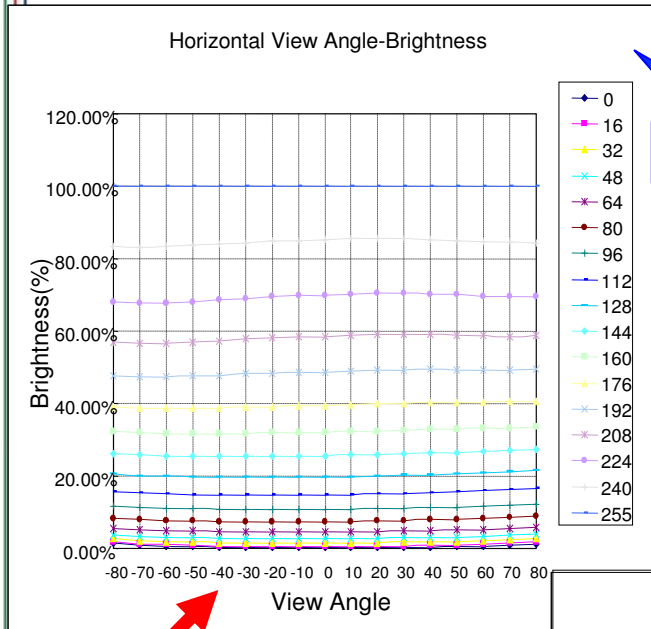
Typical LCD Monitor

Even the specification state 170 degree viewing angle, color looks washed out from the side on general LCD monitors.

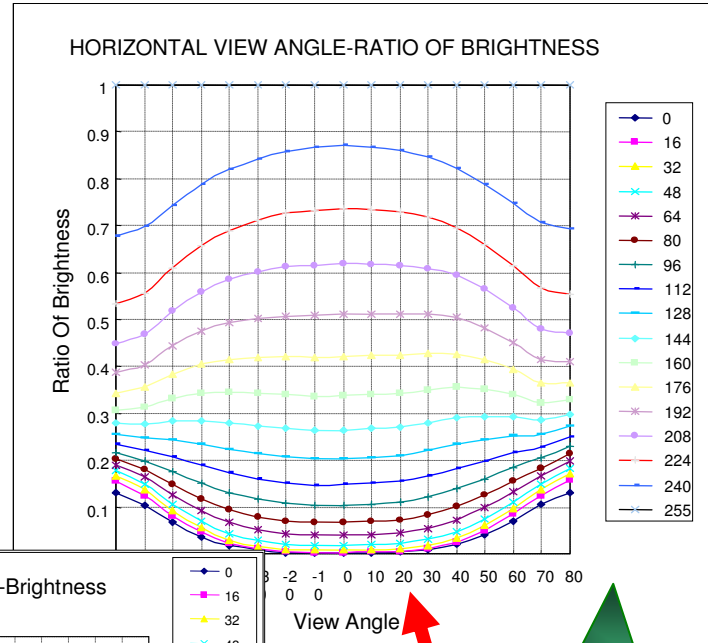
ColorEdge has very good viewing angle with very little color shift with S-IPS technology LCD panel



H-Viewing Angle Characteristics



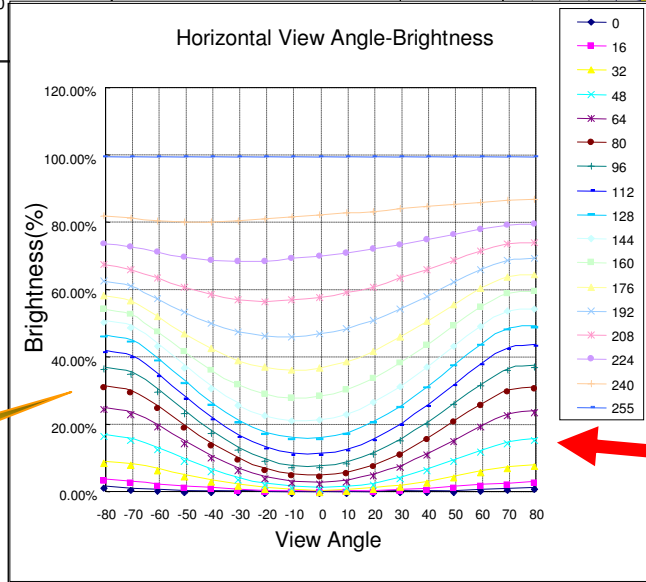
S-IPS



TN+Film

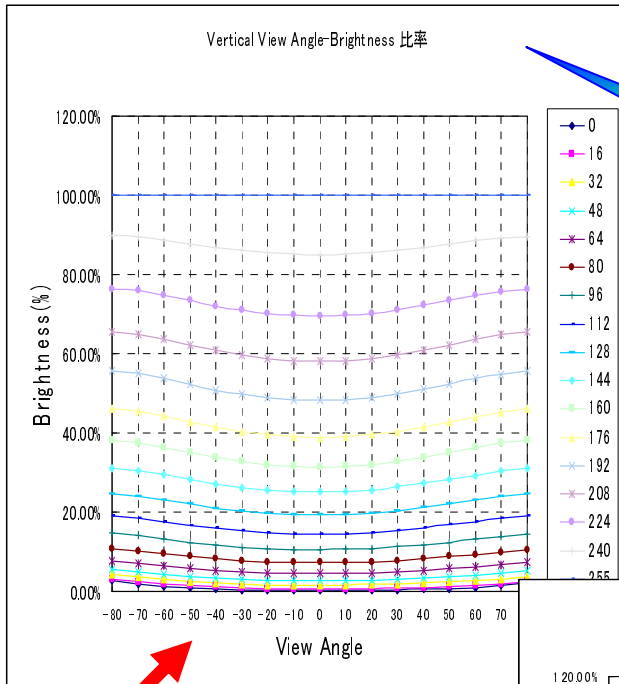
Tone characteristics from side view is almost same than that from center view.

VA

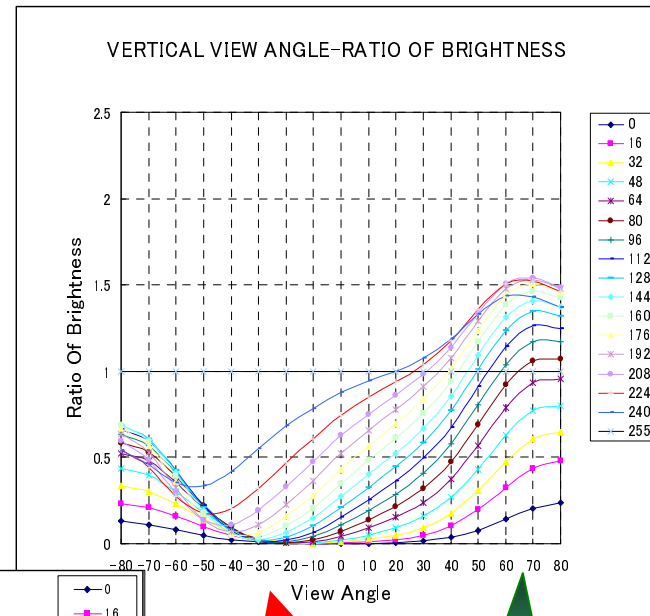


Tone characteristics from side view is different than that from center view.

V-Viewing Angle Characteristics



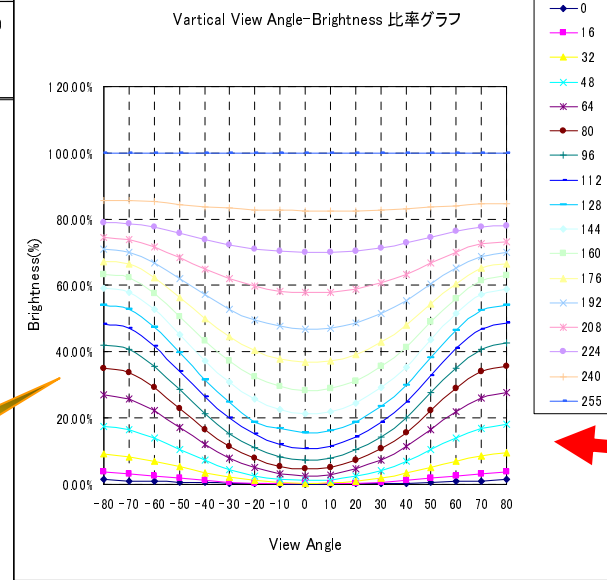
S-IPS



TN+Film

Tone characteristics from side view is almost same than that from center view.

VA



Tone characteristics from side view is different than that from center view.



7. Hardware Calibration Capability

Achievable Points by Monitor Calibration

1. Accurate Viewing Adjustment

- ✓ Brightness
- ✓ Color Temperature
- ✓ Gamma Value

2. Color Matching with Other Devices

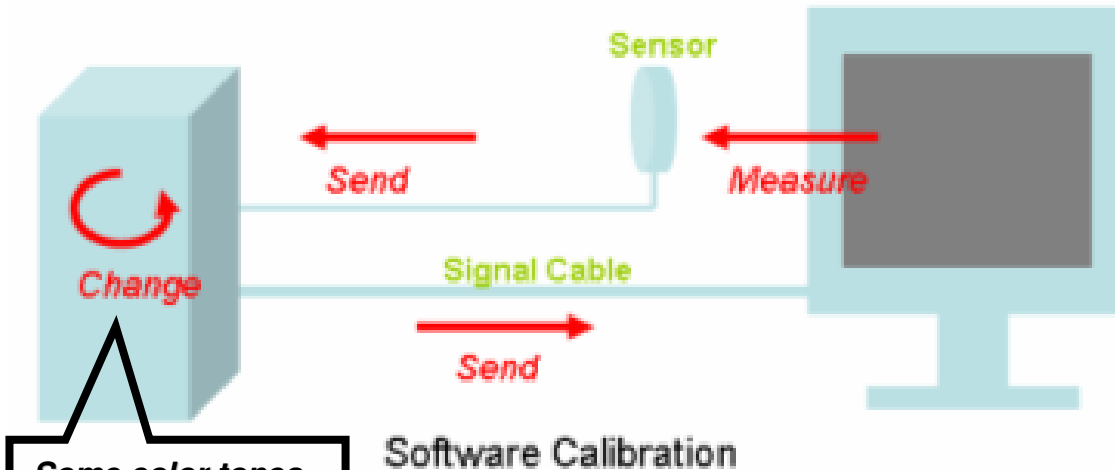
Point:

- Monitor gets accurate color.
- Every user gets same result.





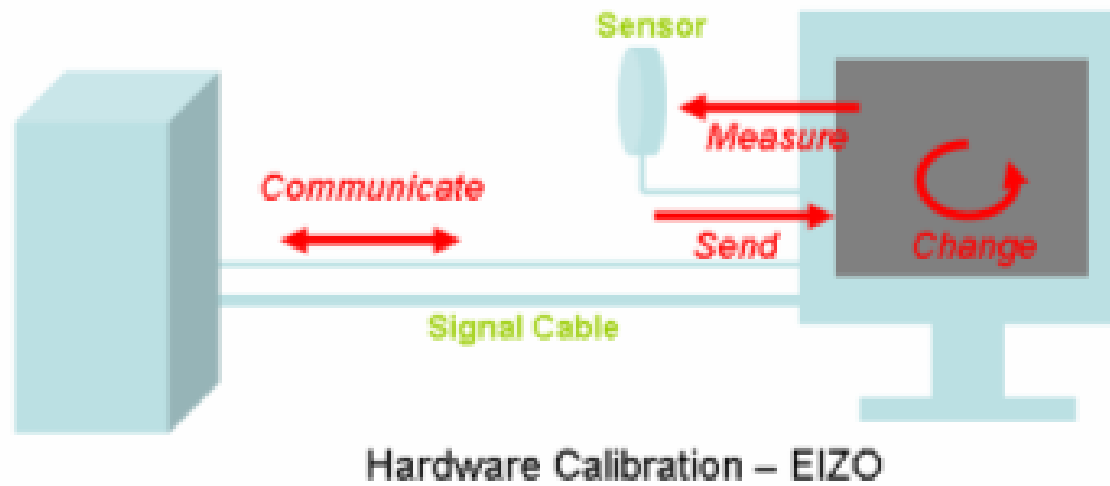
General Monitor + Calibration software



Some color tones get missing during the process.

Changes graphics card's property
Most video cards have 8-bit capability

Hardware Calibration Monitor



Changes monitor's property
ColorEdge has 12-bit LUT inside

12-bit steps

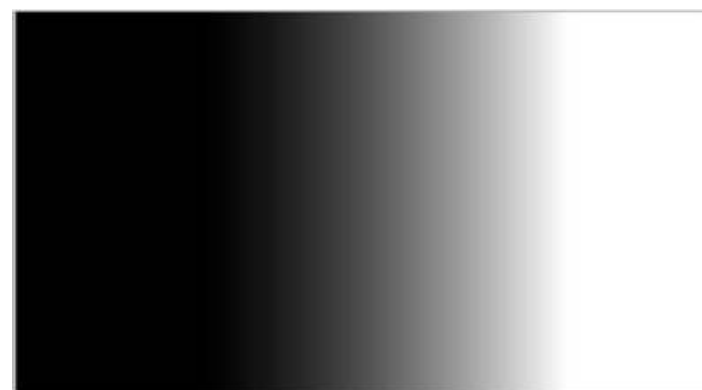
- 16 times more than 8-bit

General Monitors 8-bit:

16.7 million colors

R: 256, G: 256, B: 256

$256^3 = 16,777,216$



8-bit with software calibration
Some tonality breakups

Eizo ColorEdge: 8-bit from 12-bit LUT

16.7 million colors from

4.4 billion color pallets

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

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



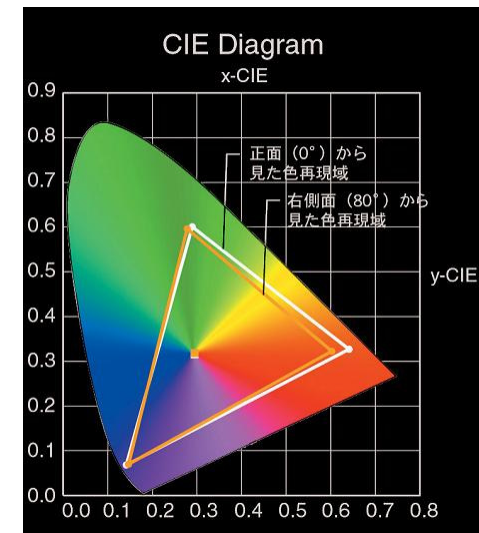
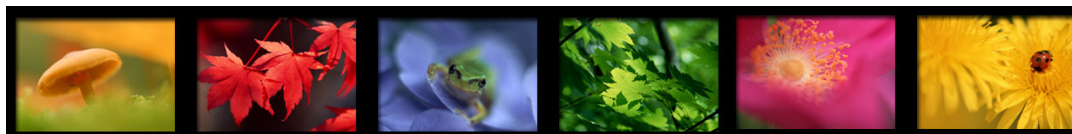
12-bit with hardware calibration
Very smooth gradation



Perfect Color Management

Monitor Required Features:

1. Smooth Tone characteristics
2. Wide Color Gamut
3. Brightness & Color Uniformity
4. Brightness & Color Stability
5. Accurate Additive Color Mixture
6. Wide Viewing Angle
7. Hardware Calibration Capability

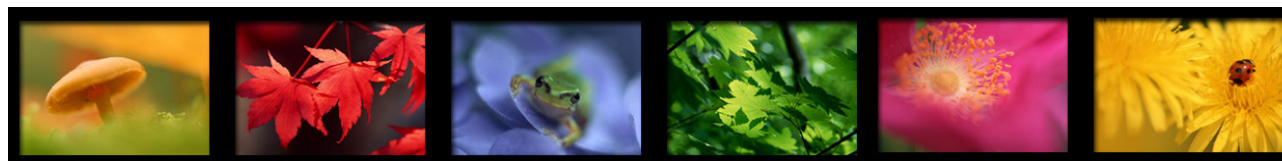


International softproof standard

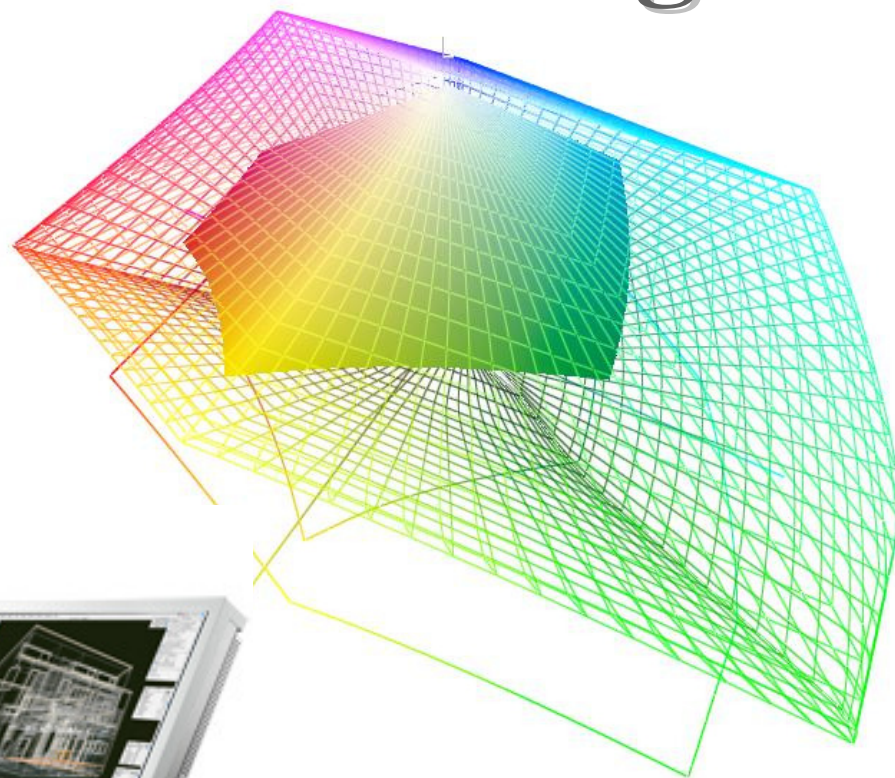
- ISO12646-2006 is now officially DIS (Draft of International Standard).
- TÜV Rheinland will start “Fogra certification ready” as a monitor certification system based on the new standard.
- Eizo joined establishment of the standard and may obtain 1st certification in the beginning of year 2007.



* “Fogra certification ready” Logo mark has not been decided.



Eizo ColorEdge Series



Requirement for graphic arts display

© EIZO NANA CORPORATION



Reference Information: Monitor Technology Today & Tomorrow





Is LCD best for graphics use?

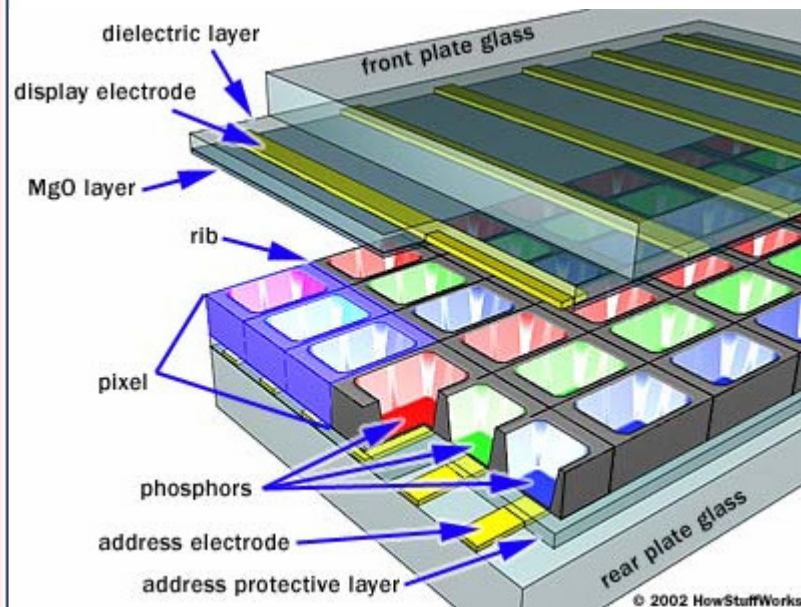


Requirement for graphic arts display

© EIZO NANO CORPORATION

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:

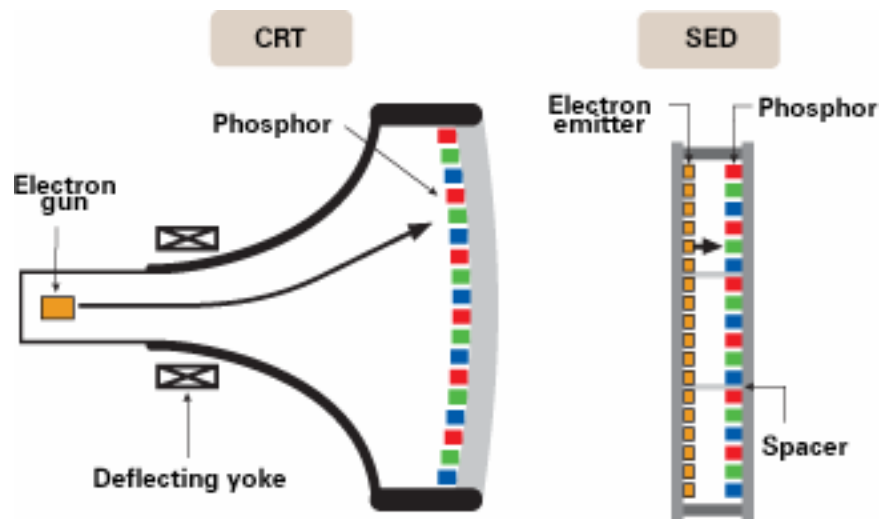
DPI, large screen only, ambient light reflection, after image

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:

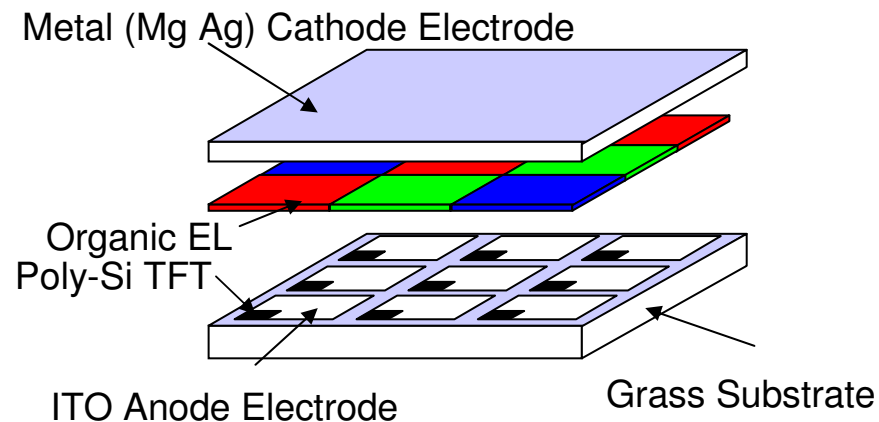
DPI, large screen only, production cost

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.**