DISPLAY TECHNOLOGY

PAST, PRESENT, & FUTURE
BACK TO WHERE WE STARTED

COLOR LIKE YOU HAVEN’T SEEN SINCE 1954

▸ RCA CT-100
IT GETS WORSE BEFORE IT GETS BETTER

GIVING UP GAMUT VOLUME FOR BRIGHTER IMAGES

- SMPTE C Phosphors - 60s tech, 80s standard
FINALLY SOME AGREEMENT ON COLOR AND RESOLUTION

- Most CRTs inherently low resolution
- Adoption of LCD & PDP

SPEAKING THE SAME LANGUAGE

REC 709
WHERE WE ARE NOW

MOREPIXELS, MORE COLOR

- P3 Gamut & UHD / 4K resolution are here now
- LCD & OLED solutions
THE FUTURE IS NOW

THE QUEST FOR BETTER PIXELS

- Diminishing returns for more pixels, still a lot to gain from higher luminance and larger color gamuts
COLOR GAMUT AND COLOR VOLUME

REC2020 – UNINTENDED CONSEQUENCES

- Primaries lie on spectral locus
- B: 467nm, G: 532nm, R: 630nm
- Increased Observer Variability / OMF
IMPACT OF HDR ON THE DEMAND SIDE OF DISPLAY DEVELOPMENT

HDR — ARGUABLY MOST IMPACTFUL WITH MOST ROOM FOR IMPROVEMENT

- Color Volume
  - higher luminance plus wider color gamut
- Demand for HDR is shaping what are considered viable / desirable display development efforts
- Future success of OLED, LCD, MicroLED, and other technologies closely tied to their ability to address HDR requirements
REIGNING CONTRAST CHAMPION OF THE WORLD

- OLED is an emissive technology that offers relatively wide color gamut and best in class contrast ratio
W-OLED VOLUMETRIC CHALLENGES

THE HDR CHALLENGE FOR W-OLED

- Volumetric collapse towards grey at higher luminance
- You can preserve saturation or luminance, but not both!

Image courtesy of Lightillusion
LCD LIKE YOU HAVE NEVER SEEN IT BEFORE

- LCD with Light Modulating Cell Layer Technology offers artifact free HDR performance with none of the loading behavior or burn in concerns of OLED
NEW TAKE ON AN OLD IDEA: WIDE GAMUT ZONED BACKLIGHT LCD

WHEN 1000NITS ISN’T ENOUGH

- The latest generation of zoned backlight LCD monitors offer a ‘here today’ solution with the contrast, resolution, and color gamuts needed to meet most current HDR specifications.
INCREMENTAL IMPROVEMENTS IN ZONED BACKLIGHTS FOR LCD

TWO IMPORTANT TRENDS IN LED BACKLIGHTING

- Transition from RGB LED to Wide Gamut White LED Backlights
- PFS Phosphor

- Mini LED Backlights for Televisions
  - Thousands of Backlight Elements - High density, but not direct view
DIRECT VIEW MICRO LED - PROMISE VS REALITY

- MiniLED and LMCL are seen by many as short term, transitional solutions
- MicroLED is widely considered one of the most promising future technologies (size < 100μm)
- Challenges with Colorimetry and Scalability, but main problem over short term is cost
- Expensive & Difficult to Manufacturer
  - Over 25 Million LED chips needed for 4K TV
QUESTIONS ABOUT DISPLAY TECHNOLOGY?

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