

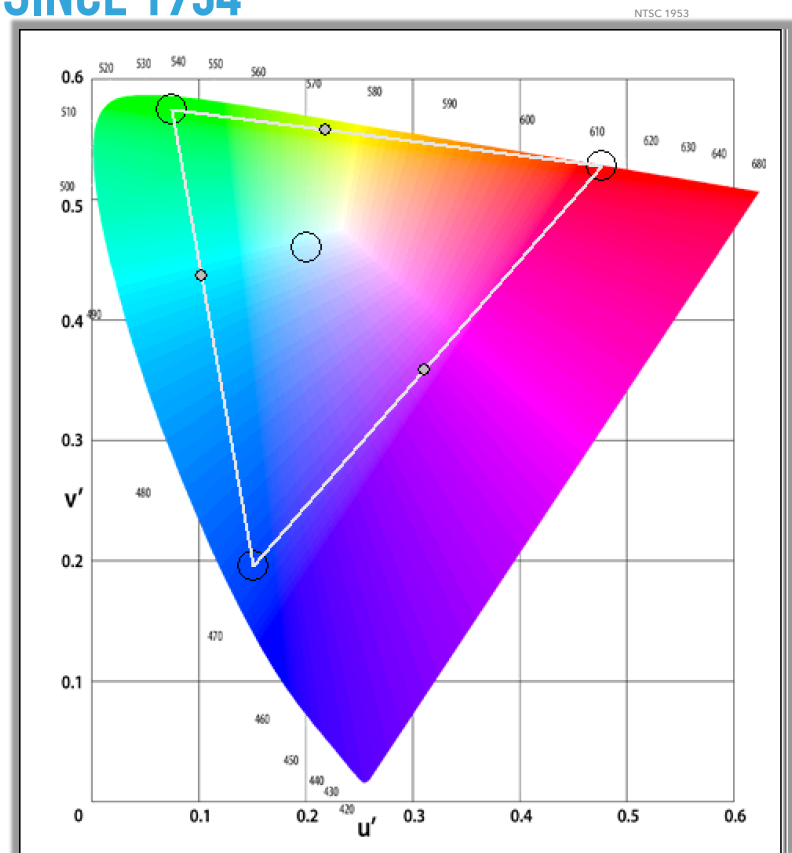
DISPLAY TECHNOLOGY

PAST, PRESENT, & FUTURE

BACK TO WHERE WE STARTED

COLOR LIKE YOU HAVEN'T SEEN SINCE 1954

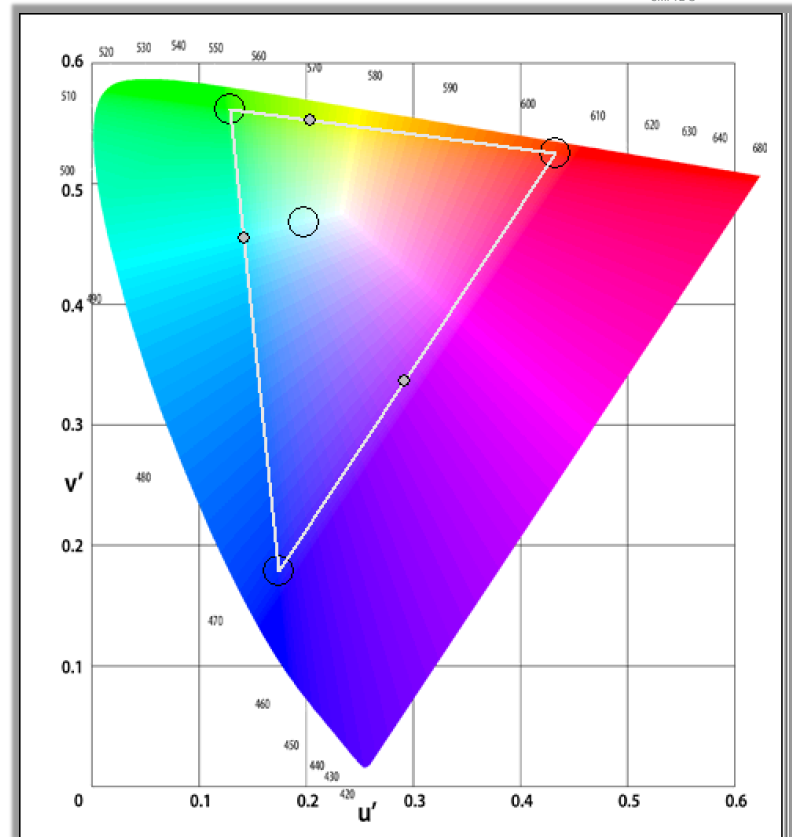
▶ RCA CT-100



IT GETS WORSE BEFORE IT GETS BETTER

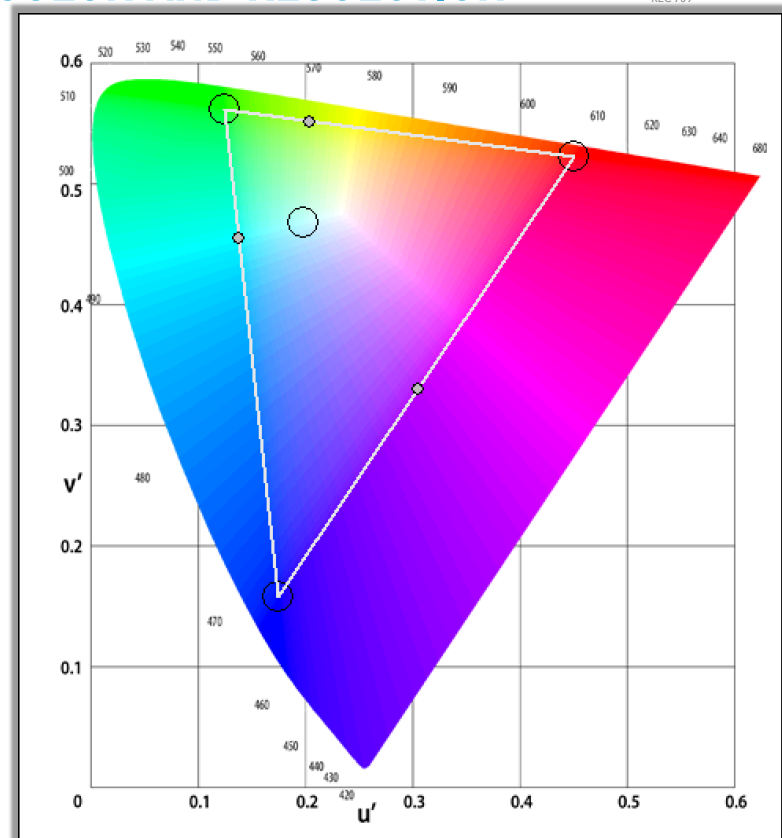
GIVING UP GAMUT VOLUME FOR BRIGHTER IMAGES

- ▶ SMPTE C Phosphors - 60s tech, 80s standard



FINALLY SOME AGREEMENT ON COLOR AND RESOLUTION

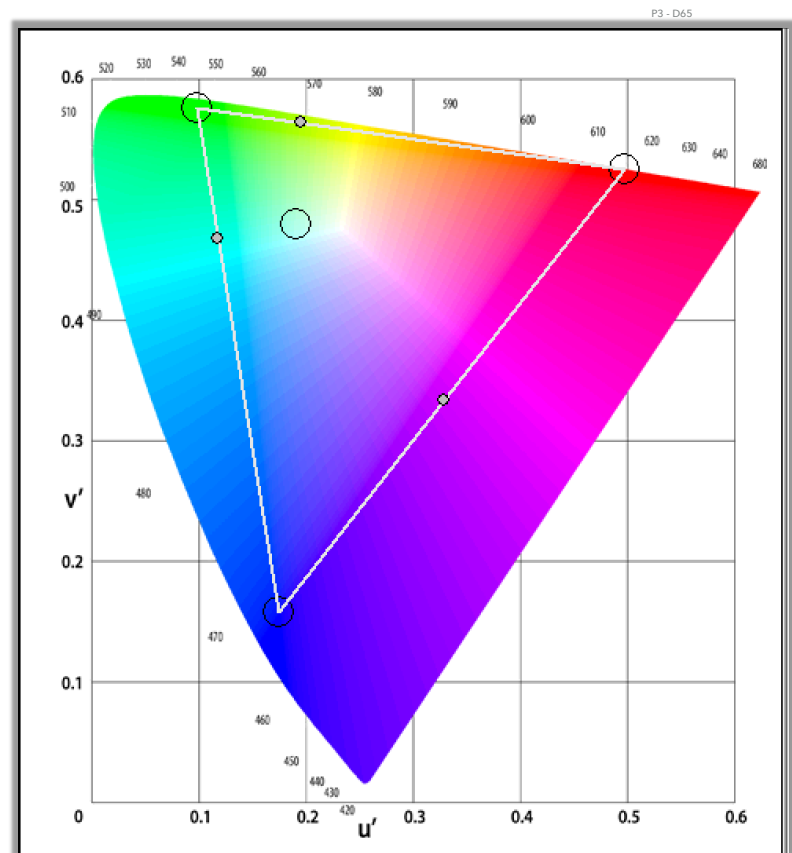
- ▶ Most CRTs inherently low resolution
- ▶ Adoption of LCD & PDP



WHERE WE ARE NOW

MORE PIXELS, MORE COLOR

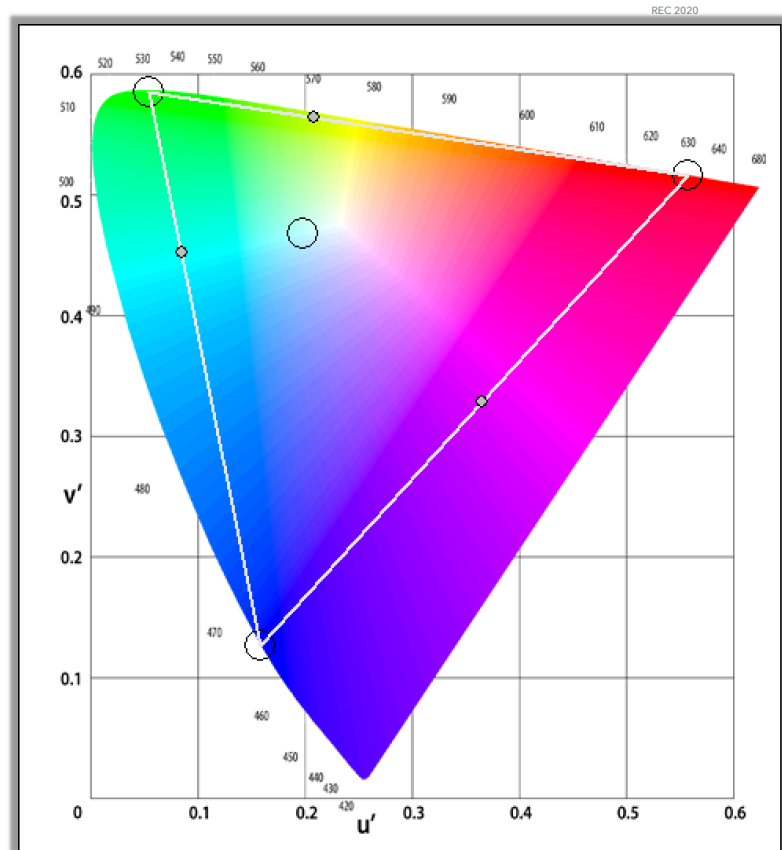
- ▶ P3 Gamut & UHD / 4K resolution are here now
- ▶ LCD & OLED solutions



THE FUTURE IS NOW

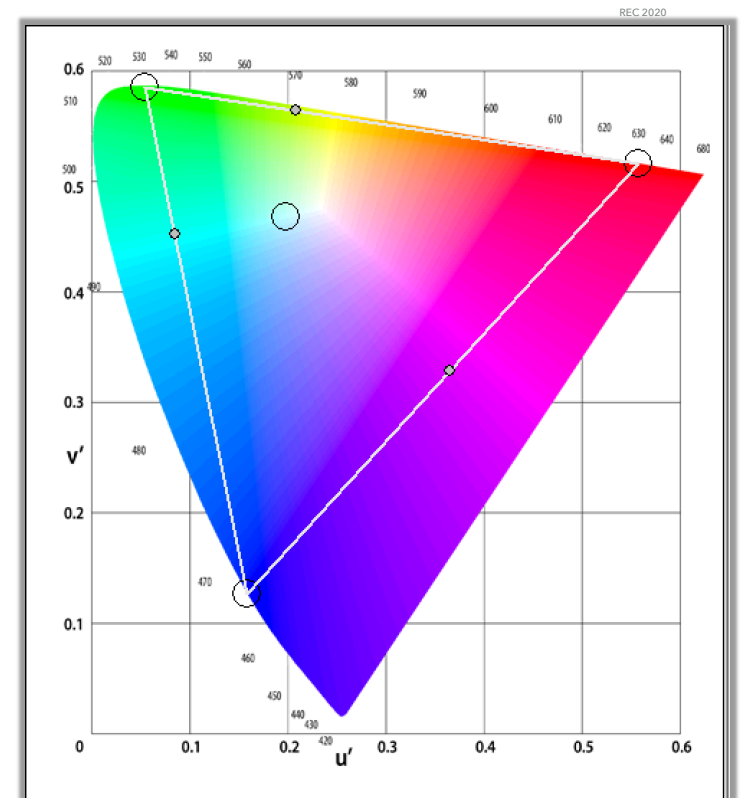
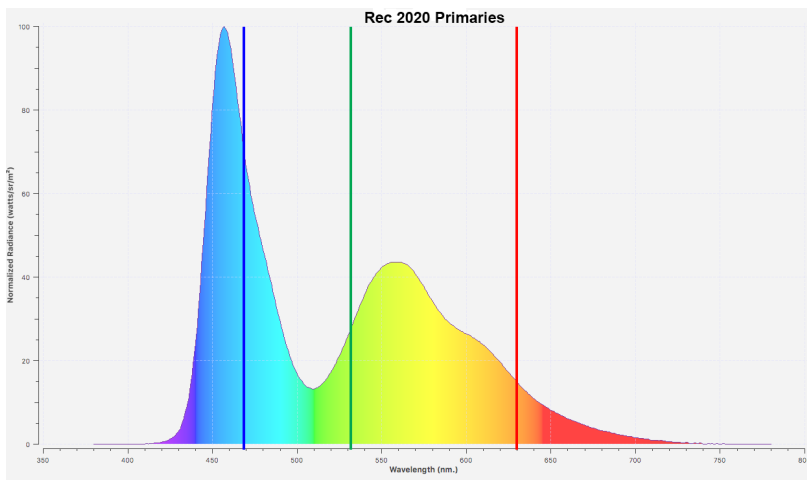
THE QUEST FOR BETTER PIXELS

- ▶ Diminishing returns for more pixels, still a lot to gain from higher luminance and larger color gamuts



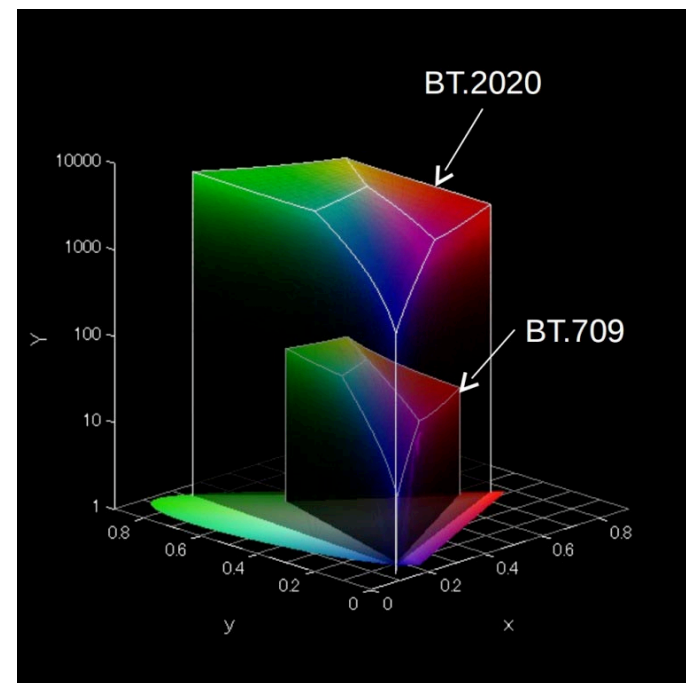
REC2020 – UNINTENDED CONSEQUENCES

- ▶ Primaries lie on spectral locus
- ▶ B: 467nm, G: 532nm, R: 630nm
- ▶ Increased Observer Variability / OMF



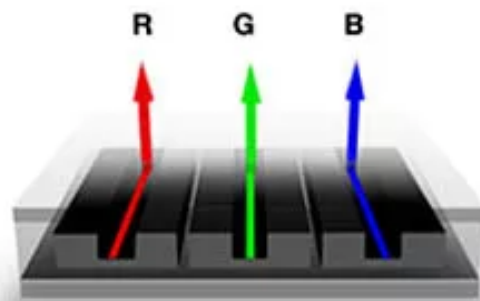
HDR – ARGUABLY MOST IMPACTFUL WITH MOST ROOM FOR IMPROVEMENT

- ▶ 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

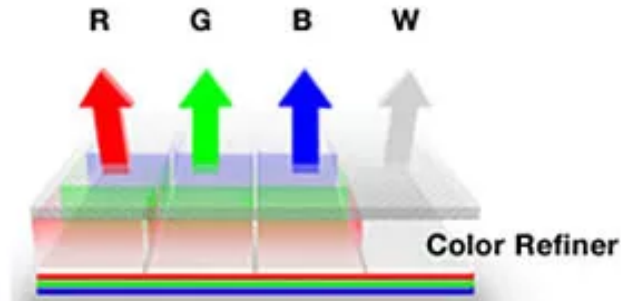


REIGNING CONTRAST CHAMPION OF THE WORLD

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



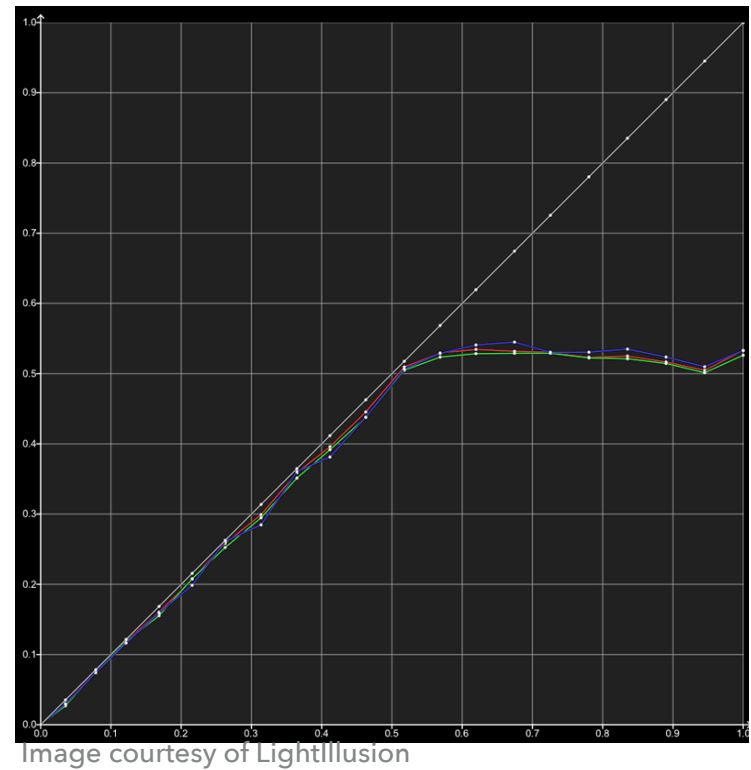
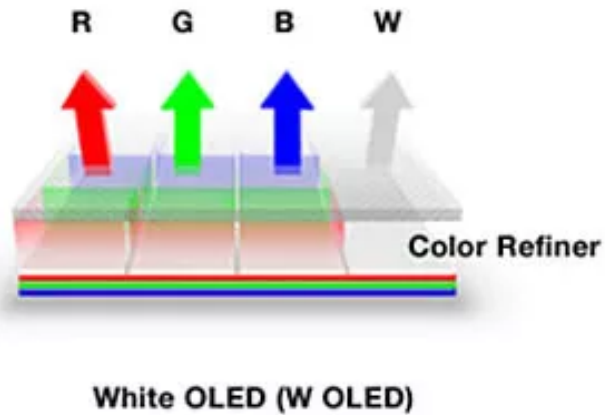
RGB OLED



White OLED (W OLED)

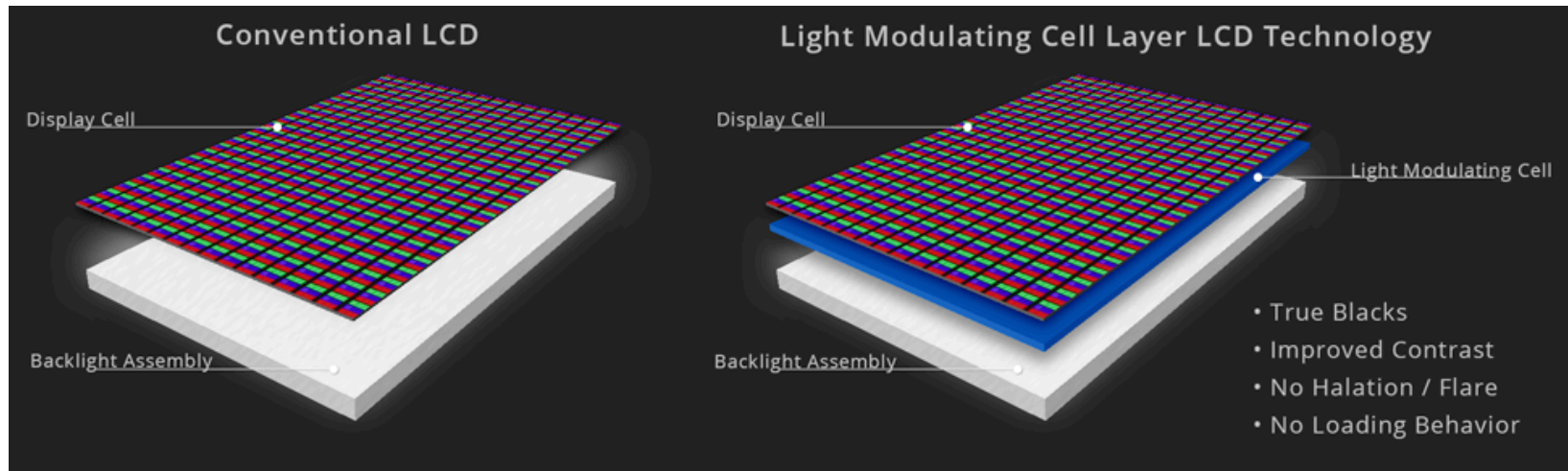
THE HDR CHALLENGE FOR W-OLED

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



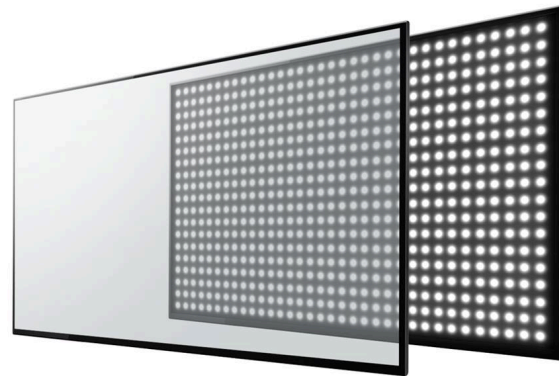
LCD LIKE YOU HAVE NEVER SEEN IT BEFORE

- ▶ LCD with Light Modulating Cell Layer Technology offers artifact free HDR performance with none of the loading behavior or burn in concerns of OLED



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.

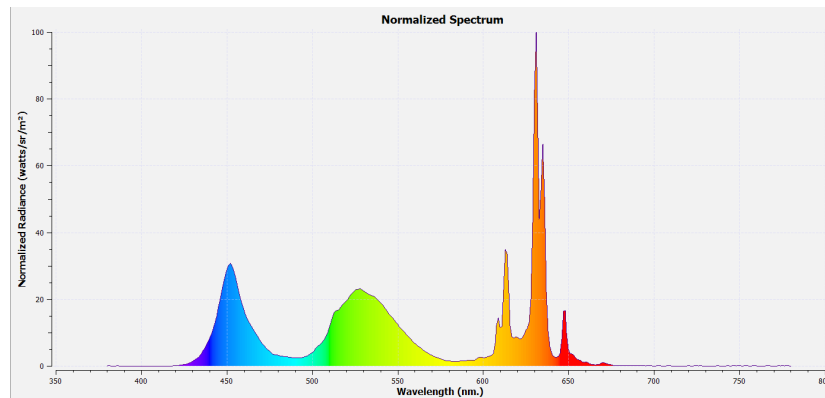


Full-array



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<100 μ m)
- ▶ 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



CONTACT US

QUESTIONS ABOUT DISPLAY TECHNOLOGY?

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