High Performance Displays for Future VR

Fenglin Peng, Yun Wang, Xingzhou Tu, Melissa Geng, Jacques Gollier and Barry Silverstein
Reality Labs Research, Meta, Redmond, WA 98052, U.S.A.
Tel.: 650-304-6384, E-mail: fenglin.peng@meta.com

Meta has published multiple generations of VR headsets since 2015, from Gear VR to the most recent Quest Pro, and we have experienced great progress on VR display development. Starting from adopting smartphones as the display panel in Gear VR, to the most recent display in Quest Pro, we have implemented the advanced display technology including >1000-PPI display panels, high performance mini-LED backlights and quantum dot films to achieve high resolution, contrast ratio and better color performance [1].

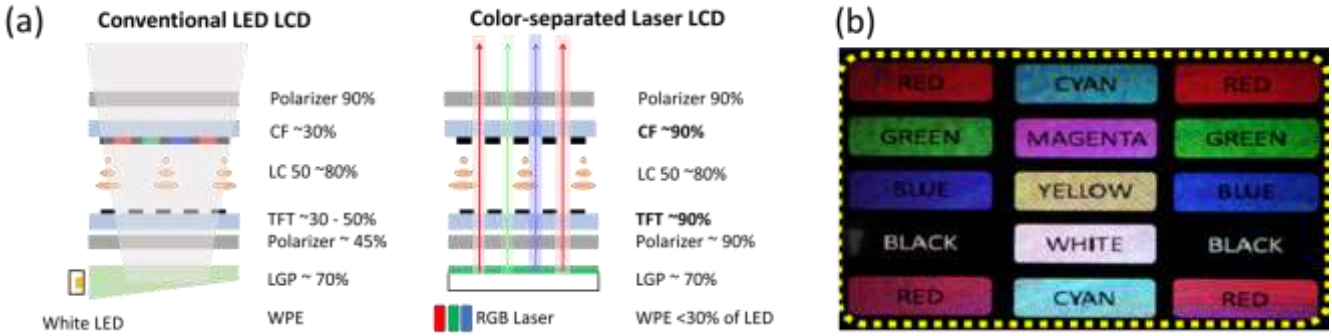

Fig. 1. (a) Illustration and efficiency comparison between conventional LCD and color-separated LCD and (c) Real display image taken through color-separated LCD prototype

For the future VR displays, there are six key metrics, including 1) high resolution to meet retinal limit, 2) glasses form factor for comfort wearing, 3) high panel efficiency to save battery life, 4) large color gamut, 5) less ghost images and 6) less motion-image blur for a better image quality. In this keynote, we will present the goal and our progress for each metric. In addition, for future VR headset, Reality Labs Research has demonstrated a super compact VR headset known as "Holocake" [2], which uses diffractive optics to shrink the optics volume and requires a laser-based LCD to keep high resolution. However, the existing laser-based LCDs are of low efficiency, as 1) the transmittance of existing LCDs is < 5% and 2) the wall-plug-efficiency of RGB laser sources is 3~6X lower than that of the white LED. Therefore, we proposed the adoption of the display architecture called "color-separated LCD" (Fig 1(a)), to overcome the efficiency loss inside the LCD stack (e.g., Small TFT aperture and color-filter layer) and boost the optical transmittance by ~12X. In addition, it supports the widest Rec2020 color gamut and suppresses ghosts in pancake optics. We will review the working principles of color-separated LCDs and share our recent demo (Fig 1(b)) in this presentation.

Acknowledgement

We want to thank Doug Lanman and Andrew Maimone for Holocake, Andy Gunderson for mechanical support and all help from RL research and product teams.

References

1. https://www.oculus.com/blog/vr-display-optics-pancake-lenses-ppd/
2. A. Maimone and J. Wang, A*CM Transactions on Graphics (TOG)*, 39(4), 67-1 (2020)