

Laser Light sources in Cinema Projection

Consequences for cinematographers

Kommer Kleijn SBC

www.kommer.com

kommer@kommer.com

kommer@imago.org

IMAGO FNF Oslo Digital Cinematography Conference
Oslo, Norway, June 16th, 2023

Kommer Kleijn SBC www.kommer.com

- VFX cinematographer, stereographer, film school teacher, retired
- Early retirement due to unfortunate health accident
- Initiated Additional Frame Rates standardization for DCP in 2004
- SMPTE 27C P-member, chairing frame rate subgroups 2006-2020
- Former chairman of the IMAGO technical committee
- Audiovisual perception researcher (both Image and Sound)
- Participates in development of a new type of loudspeakers
- IMAGO honorary member 2019
- SMPTE Fellow member 2020

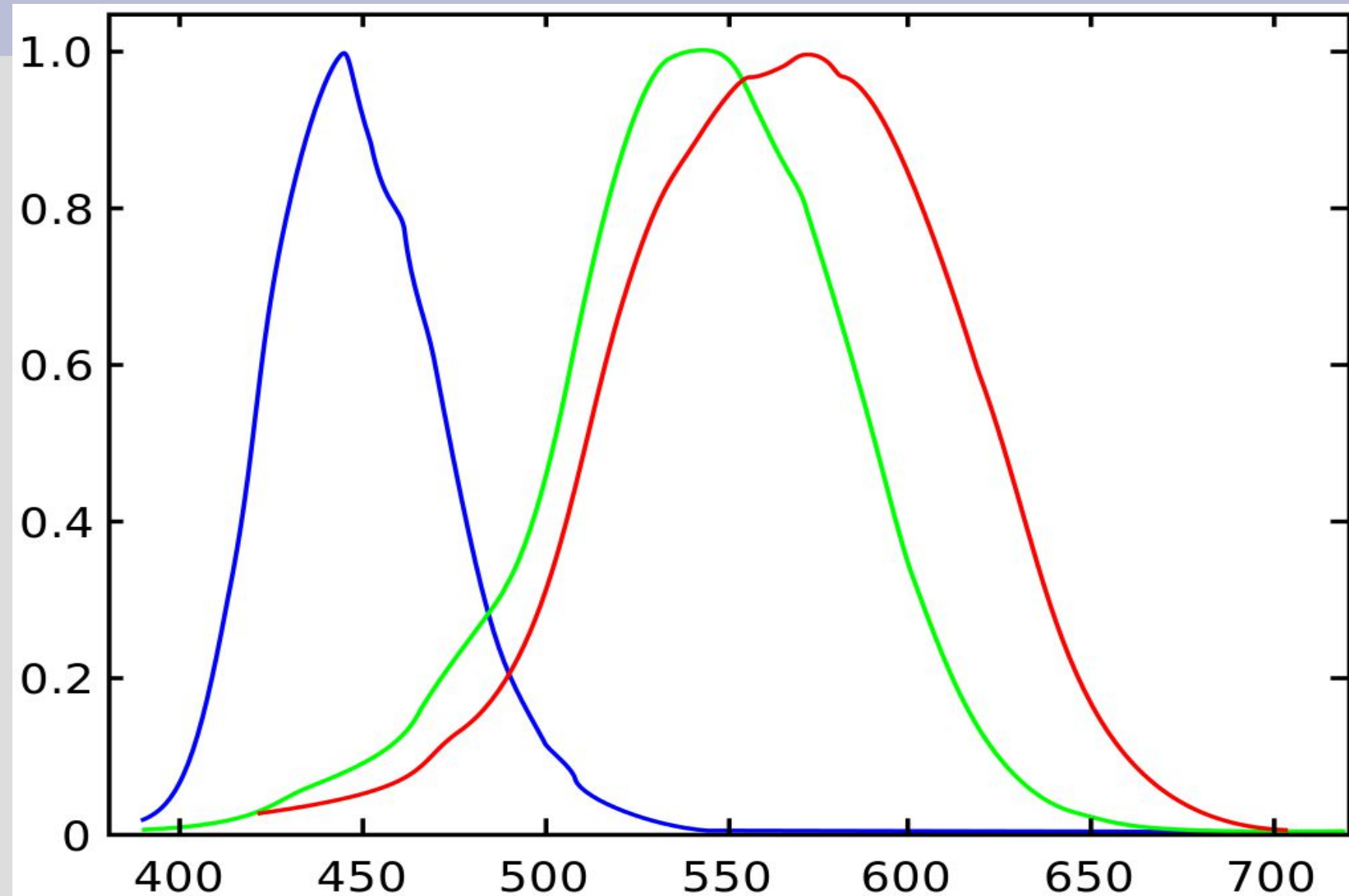
Advent of Laser projection light sources

- Prototypes were shown around 2010/12 – Commercially available 2014
- Only the light source changes, same modulation techniques as Xenon
- No more lamp changes, the laser source is good for 20 - 40.000 hours
- More output power possible, wider color gamut, less power consumption
- Commercial introduction was after the Digital conversion was complete →
Not that many projectors in the field today, mainly big rooms or new rooms
- Xenon projectors are hardly made any more
- RGB / Phosphor types:
 - RGB laser has three narrow bandwidth primaries
 - Phosphor-laser source has one (sometimes 2) narrow bandwidth primary (blue) and two that are similar to Xenon light (G and R)(sometimes only G)
- Phosphor Laser used for small, medium screens, RGB for BIG screens
- Grading rooms still equipped with Xenon, as are the majority of theatres

RGB Laser source projection challenges

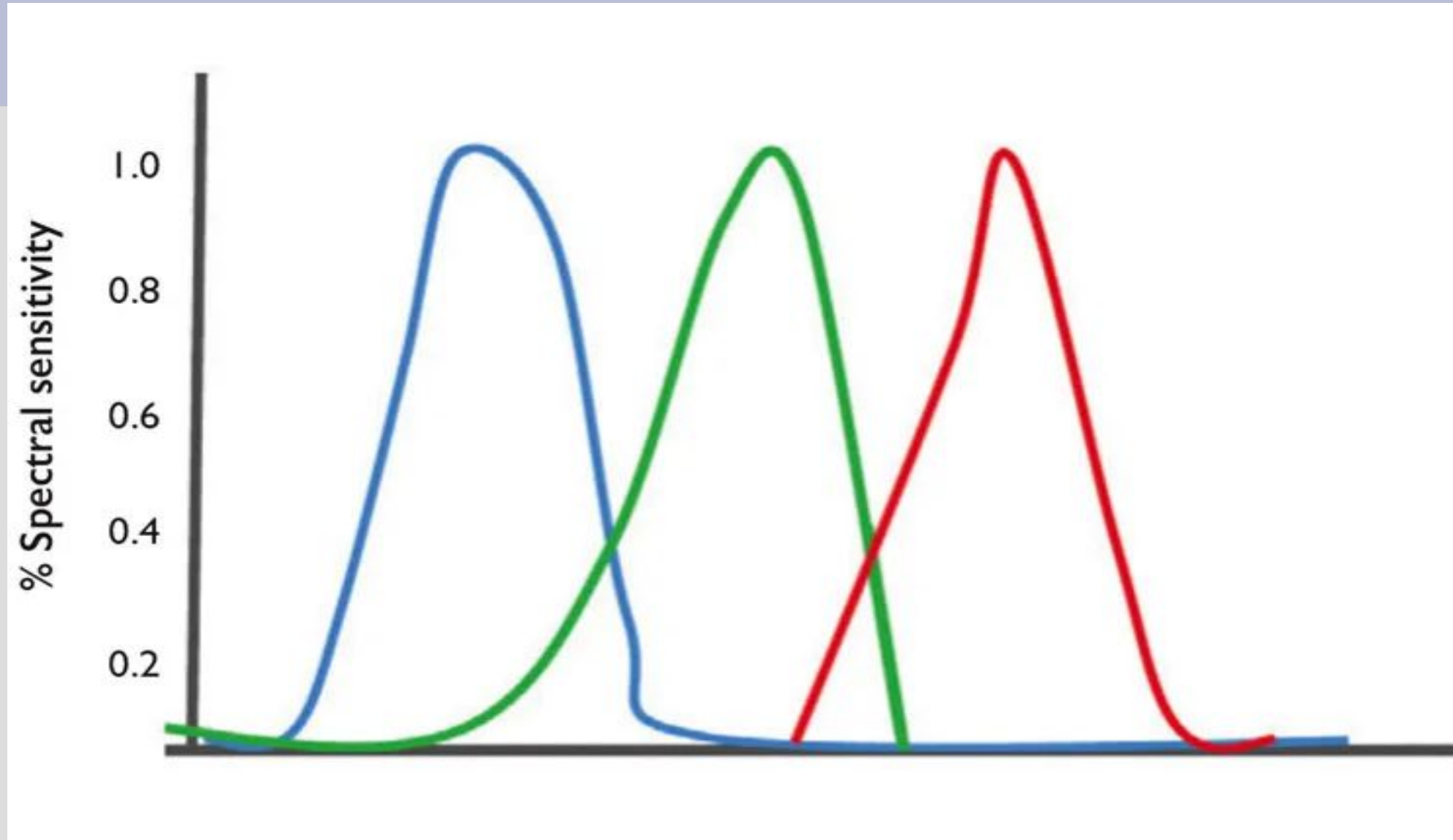
- Metamerism (perceived color differences)
 - Pictures graded on a Xenon projector may look different when shown on an RGB laser projector. Cinematographers need to verify in a laser theatre
 - These differences may also vary from person to person (!)
 - With Phosphor-laser projectors this problem is not seen (or much less)
- Color Fringing (perceived colored borders at sharp, high contrast image borders & subtitles)
 - This is also due to an interaction between the small bandwidth primaries and the human visual system. The colored lines are not actually there!
 - Stronger effect when far from the screen (no effect when very close)
 - Stronger effect for viewers wearing prescription glasses / contact lenses

Human Retina Average Spectral Sensivity is quite different from ...



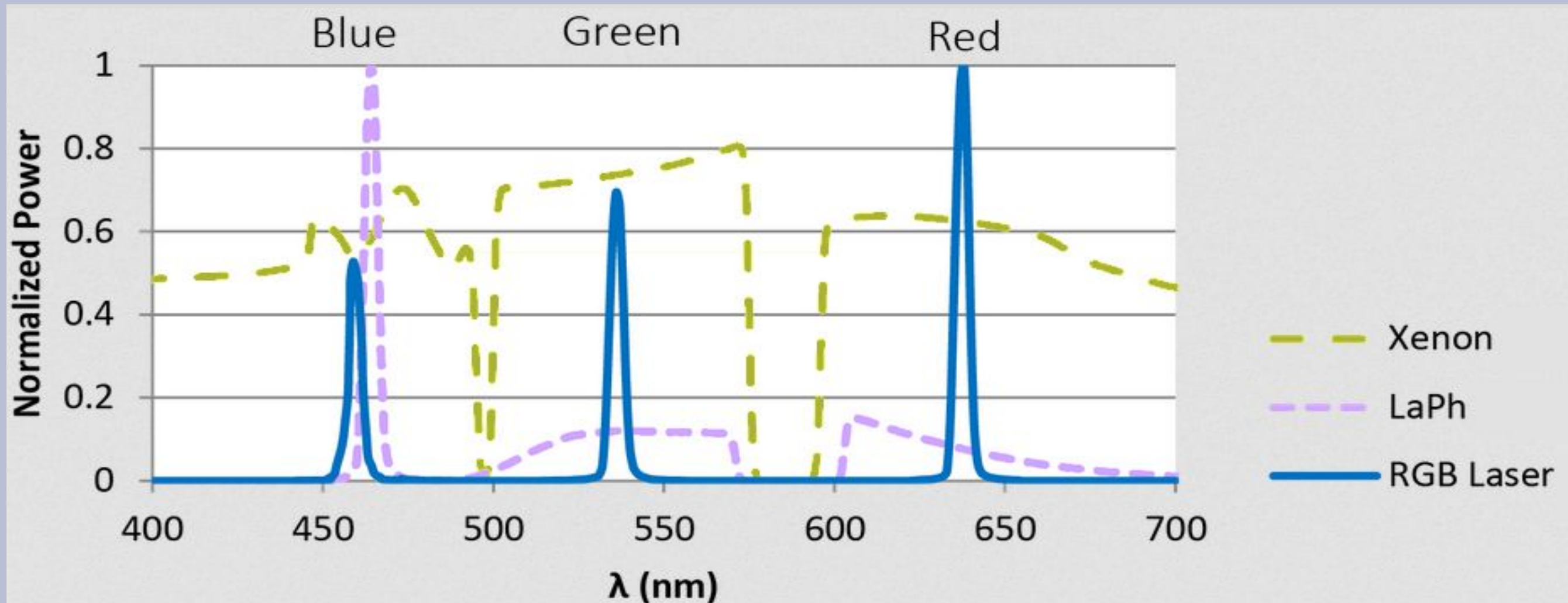
Picture source: https://en.wikipedia.org/wiki/Spectral_sensitivity

f.e. a Digital Camera Average Spectral Sensivity



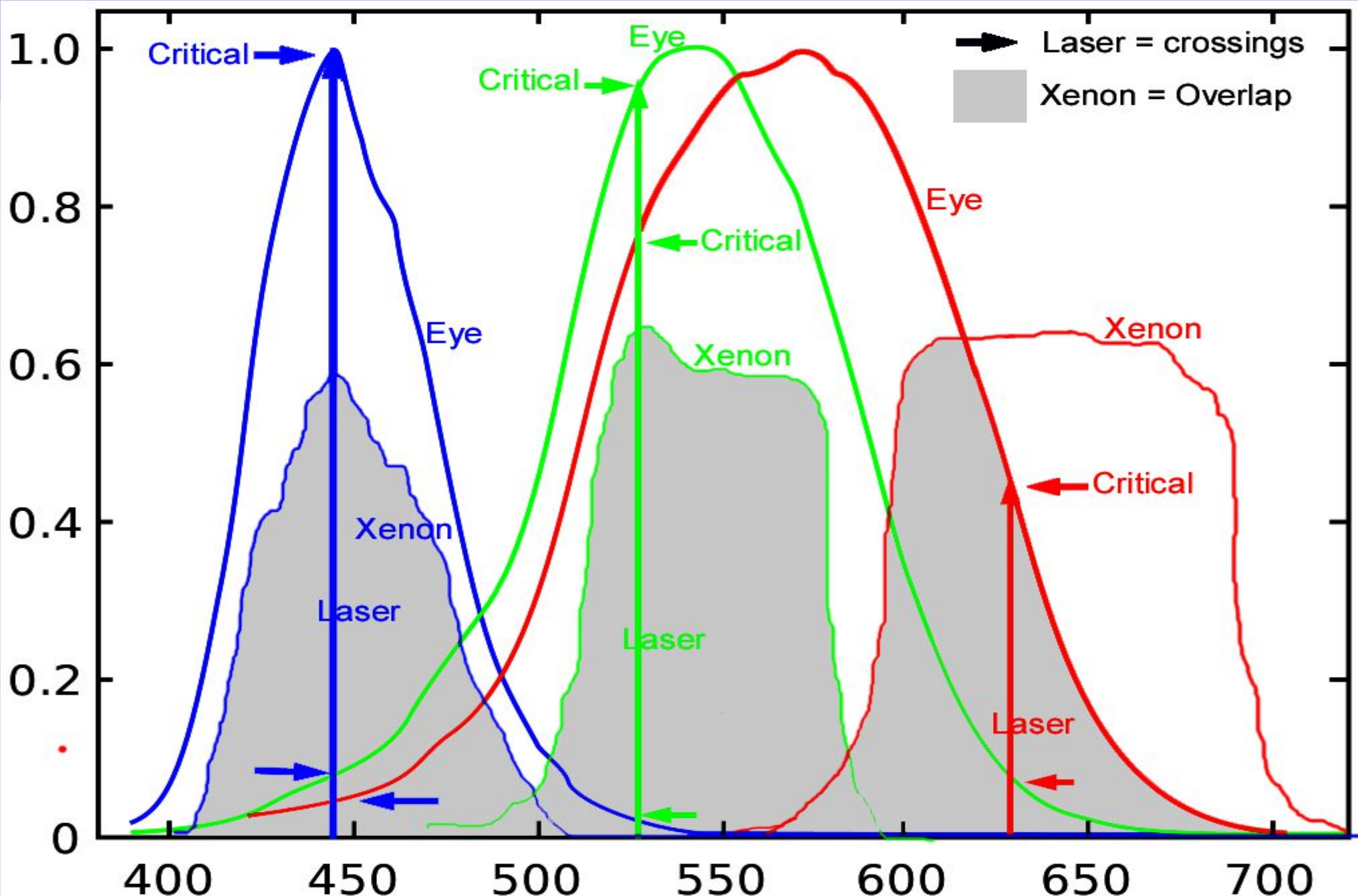
Picture source: <https://www.techbriefs.com/component/content/article/tb/supplements/pit/features/technology-leaders/36142>

Appr. Color Primaries of Digital Projector Types



Picture source: <https://spie.org/news/spie-professional-magazine-archive/2018-july/the-days-of-the-xenon-lamp-are-numbered>

RGB Laser Projector Stimuli on a Human Retina



RGB Laser source projection challenges

- After grading the work on a Xenon projector, cinematographers (and directors) may want to check the result in an RGB-laser equipped theatre
 - Please report to ITC if important differences are perceived and which
- More research is needed to quantify the problem
 - Please let us know if you can participate :-)
- A solution is needed to assure again that movies always look the same on all presentation systems
 - This was a primary goal and promise for D-cinema and the DCP standard

**An upcoming special application of laser light
sources:**

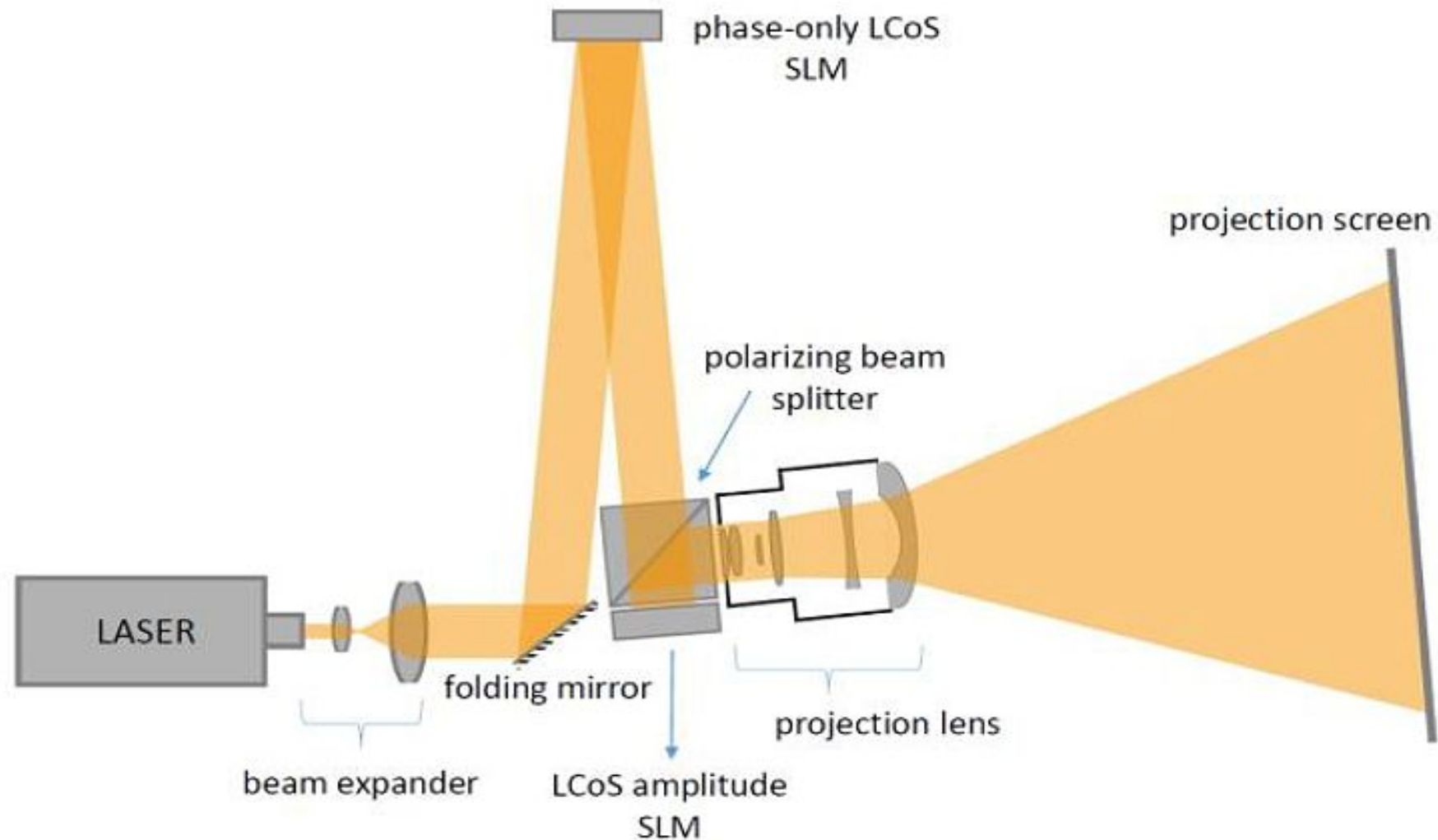
The Light Steering Projector

An upcoming special application of laser light: The Light Steering Projector

- Light not needed in dark areas of the image can be used for highlights
- HDR highlights possible, several stops above general max white, with a limited screen area but without the need for a stronger light source
- Deeper blacks possible by steering light away from darker areas, when steered towards brighter areas or towards a waist provision

- Created by MTT Innovation Inc., Vancouver, Canada
- MTT Innovation Inc. was acquired by BARCO in June 2016
- Prototype of a practical projector has been developed
- Early public prototype demonstration: CinemaCon May 2018
- Recent demonstrations at the Cannes festival May 2023 and other demonstrations between these events.

Light Steering Projector Diagram



- Picture source: <https://vccimaging.org/Publications/Damberg2017LightSteering/Damberg2017LightSteering.pdf>

Light Steering Projection Challenges

- Requires RGB laser light source (not possible with Xenon or Ph-laser)
- HDR Highlights only possible for limited screen areas, not for a big surface like a sky that fills half of the image. This may not be a problem but will need to be managed, also by the content creators (we!)
- New standards will be required to manage this
- May need more time to become accepted and if so, mass produced
- Theatre owners may be tempted to wait for direct view (LED) screens rather than investing in an intermediate technology

Laser Light sources in Cinema Projection

Consequences for cinematographers

Thank you for your attention

Please feel free to contact me on

www.kommer.com

imago@kommer.com

kommer@imago.org

IMAGO FNF Oslo Digital Cinematography Conference
Oslo, Norway, June 16, 2023