Colour Correction

Foreground and Background

in Virtual Production

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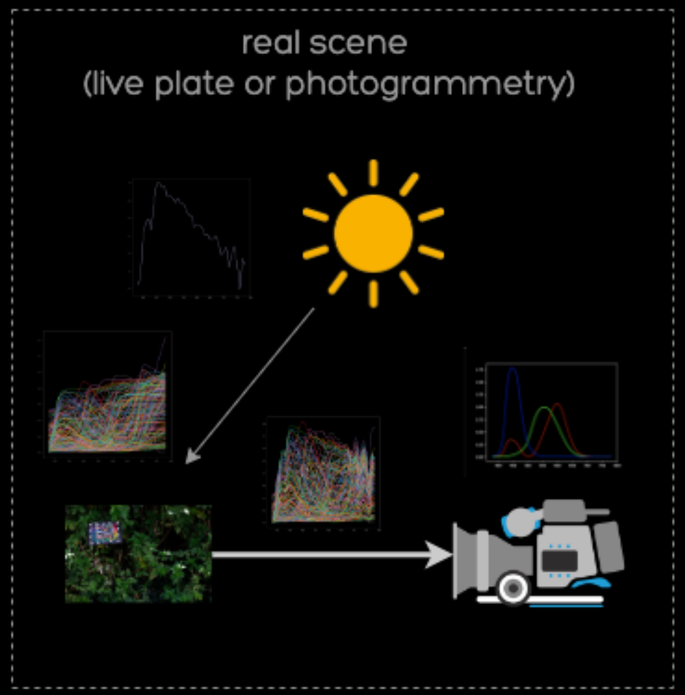
@FilmLight

Please

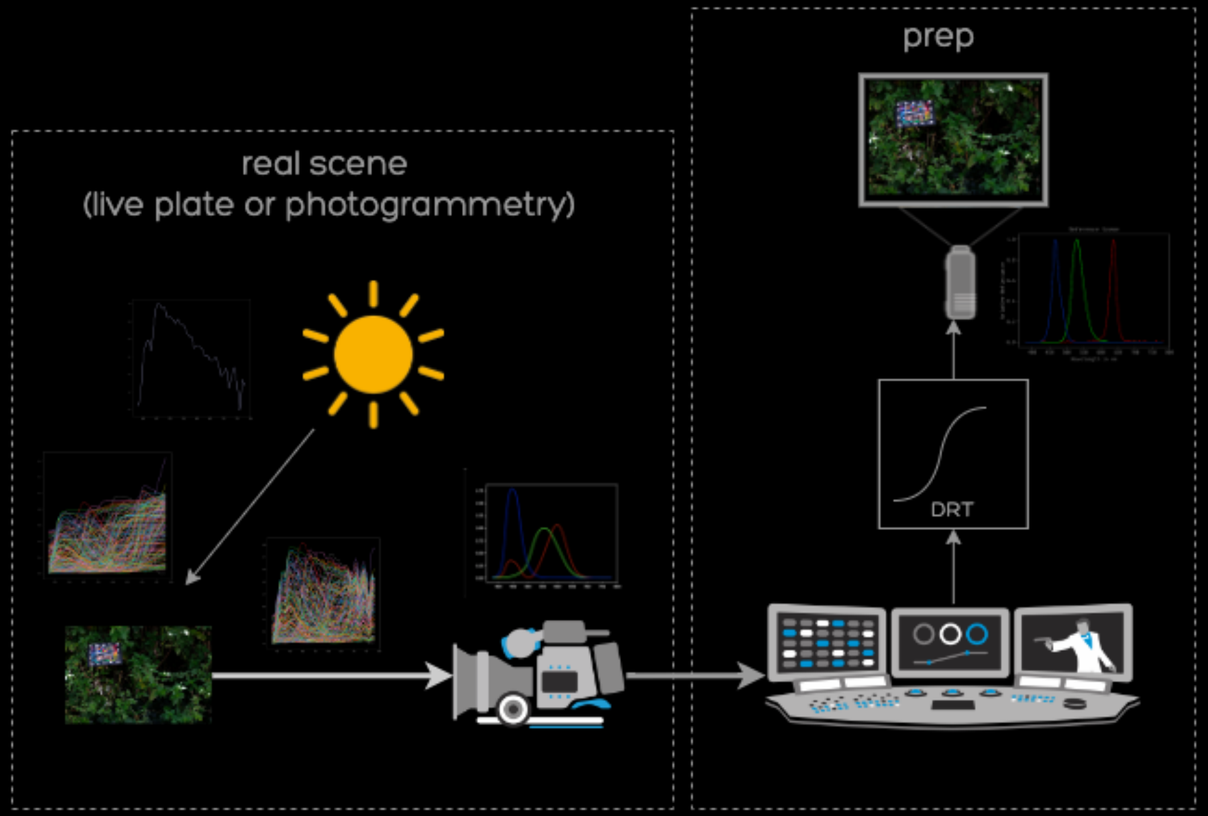
Before we match Foreground and Background

Calibration the LED Volume

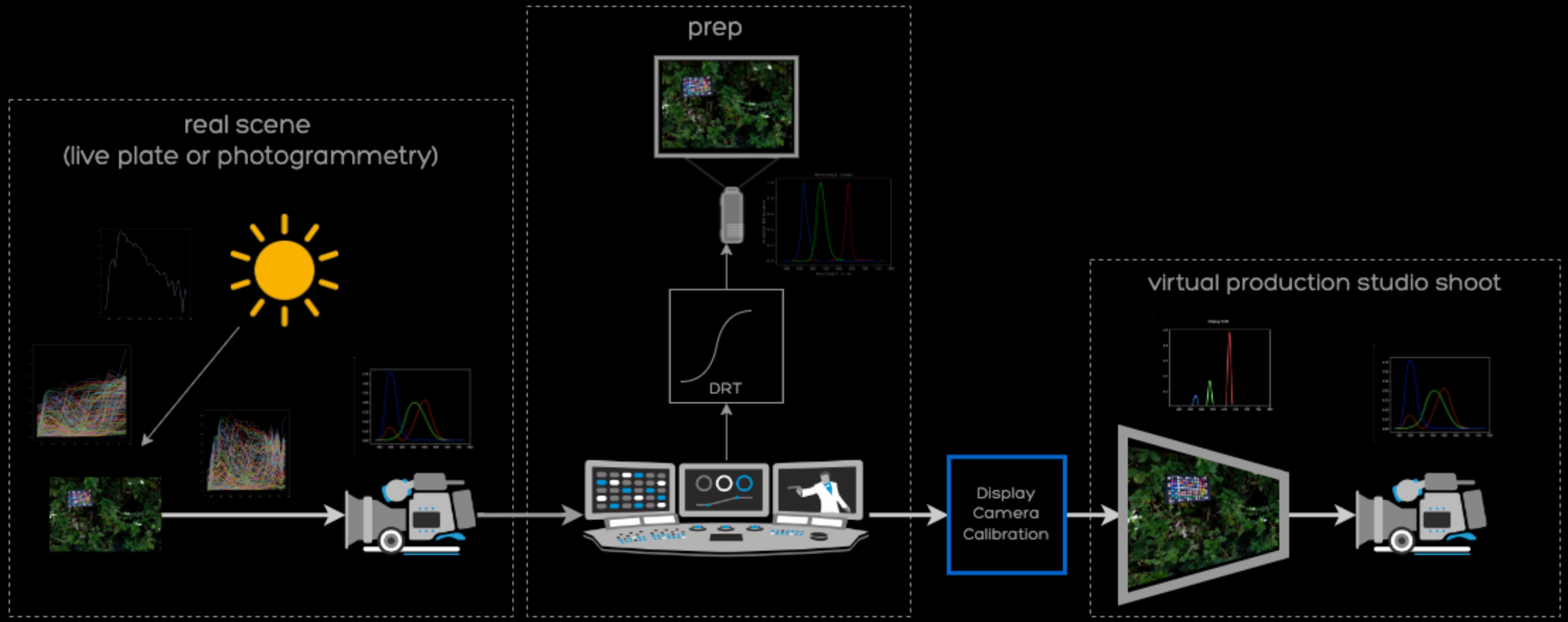
Calibration



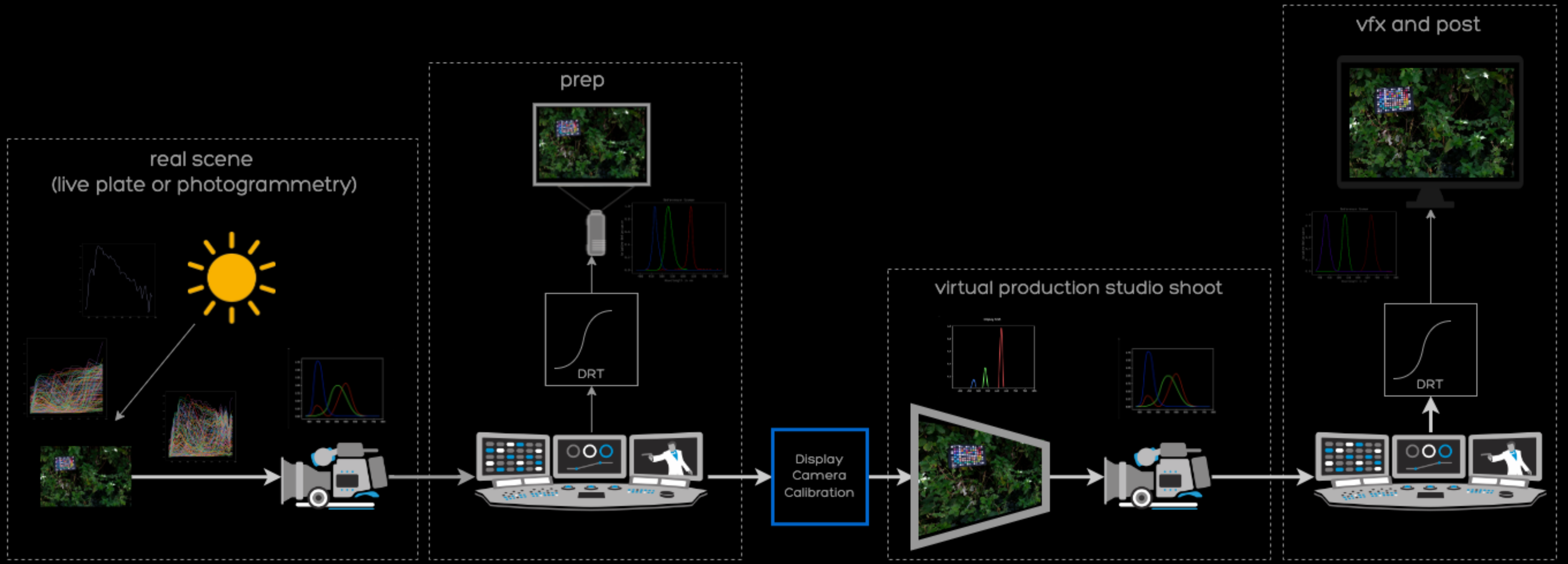
Calibration



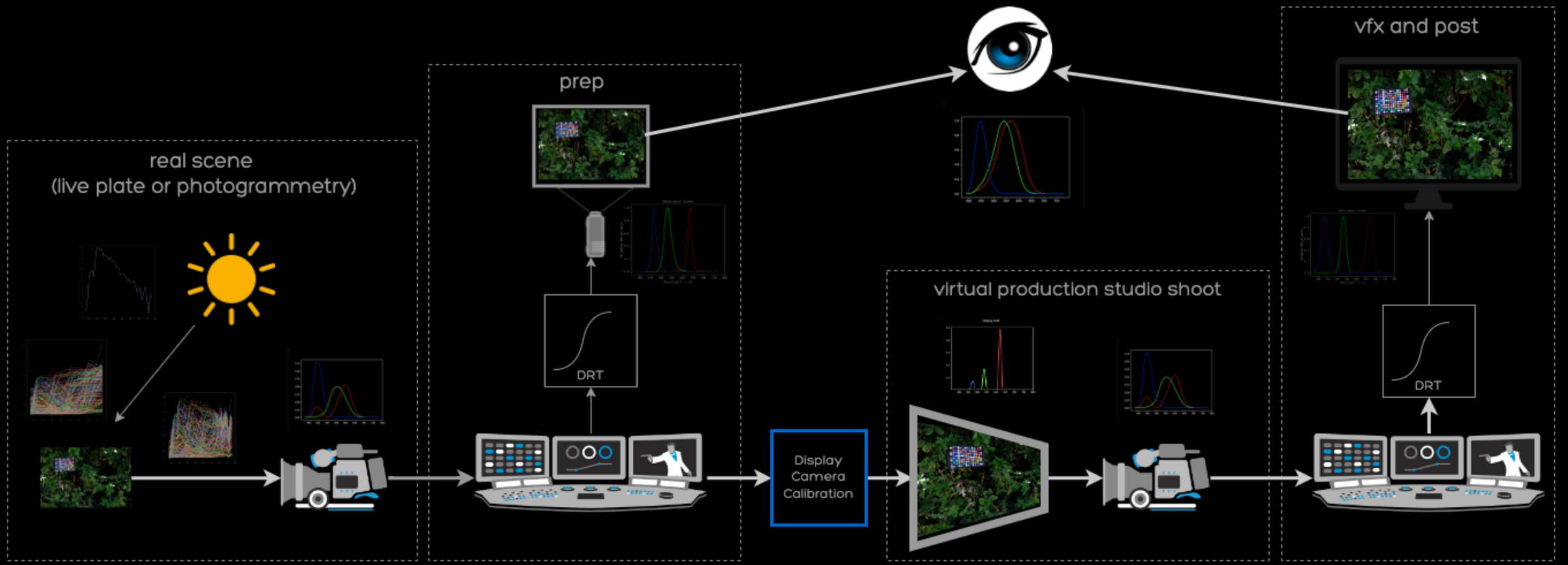
Calibration



Calibration



Calibration



Avoid those Pitfalls:

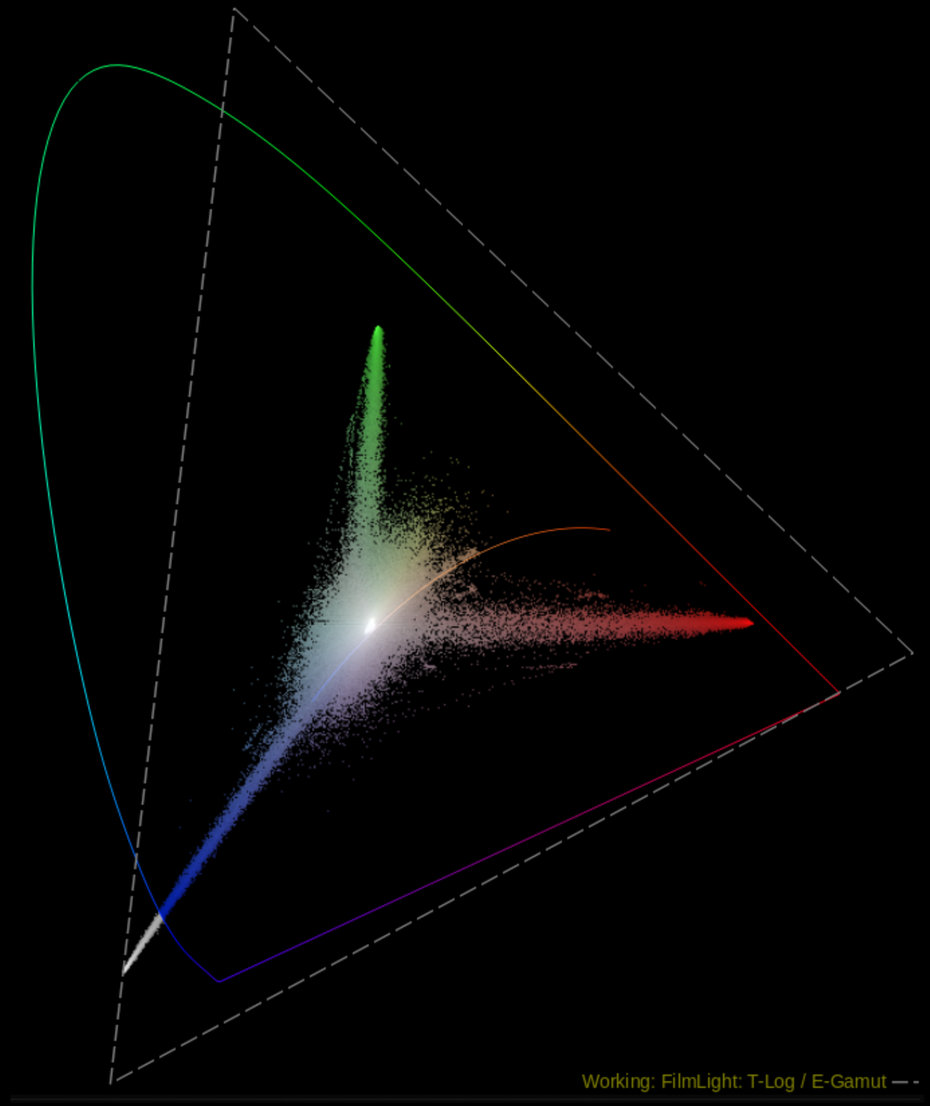
1. driving the virtual production display in a preset like P3 or Rec.2020
2. calibrate the colours with a spectrometer or colourimeter
3. sending display referred media to the virtual production wall

Instead:

- driving the virtual production display in the native gamut
- calibrating the virtual production display with the production camera
- stream scene-referred image state to the virtual production display

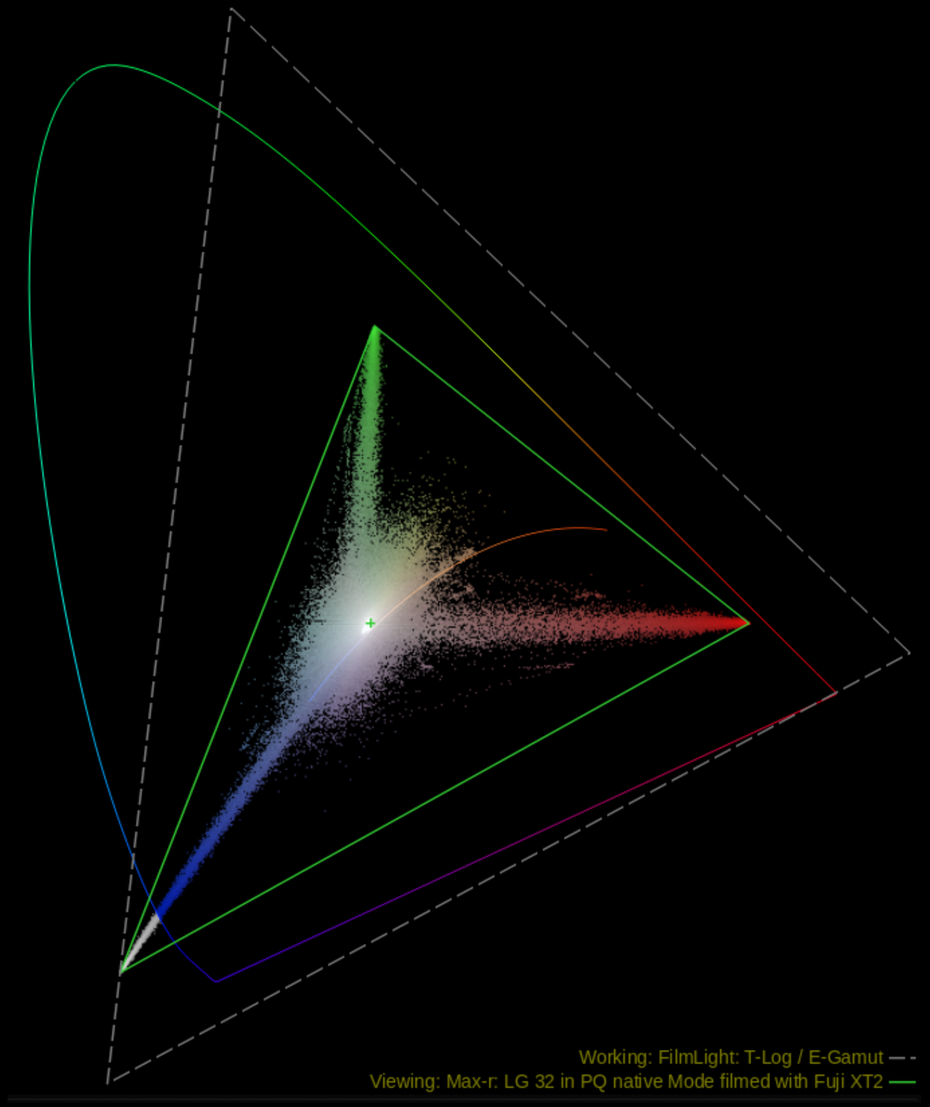
Native gamut

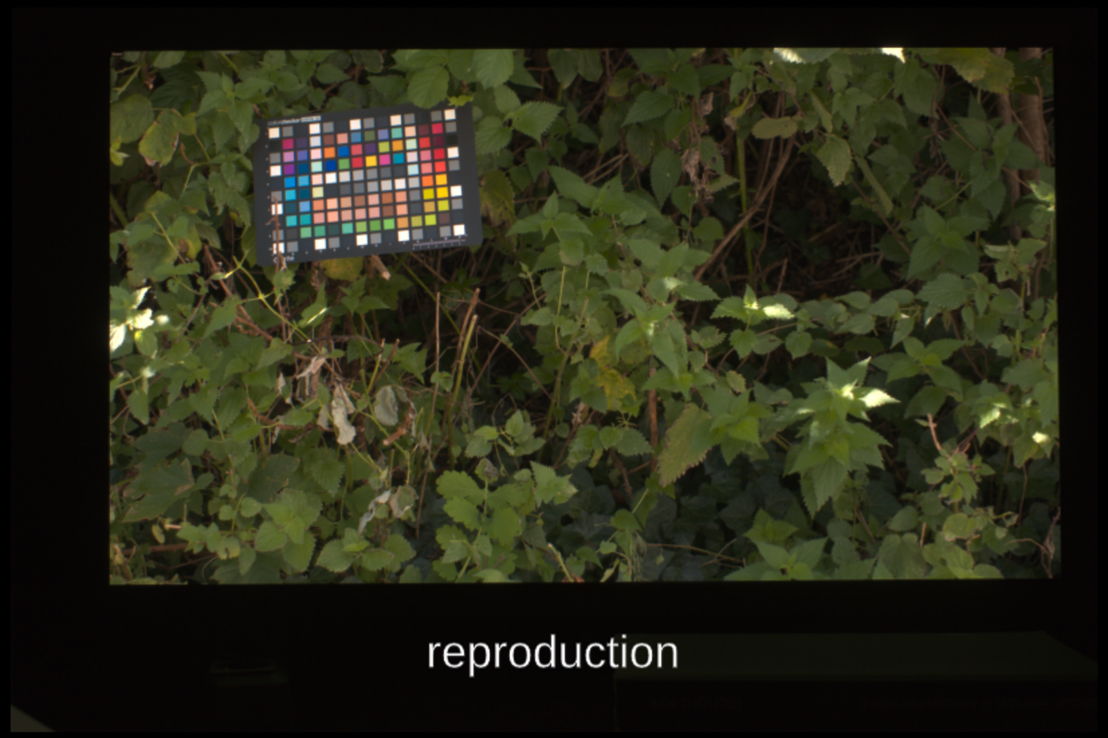
as seen by the virtual production camera



Native gamut

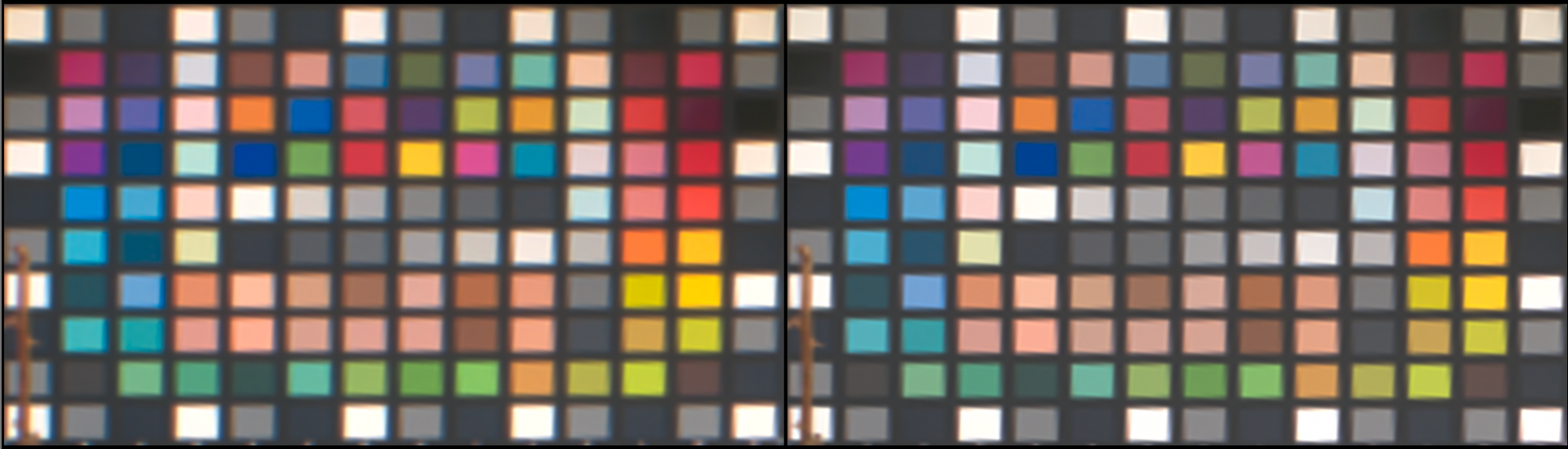
as seen by the virtual production camera

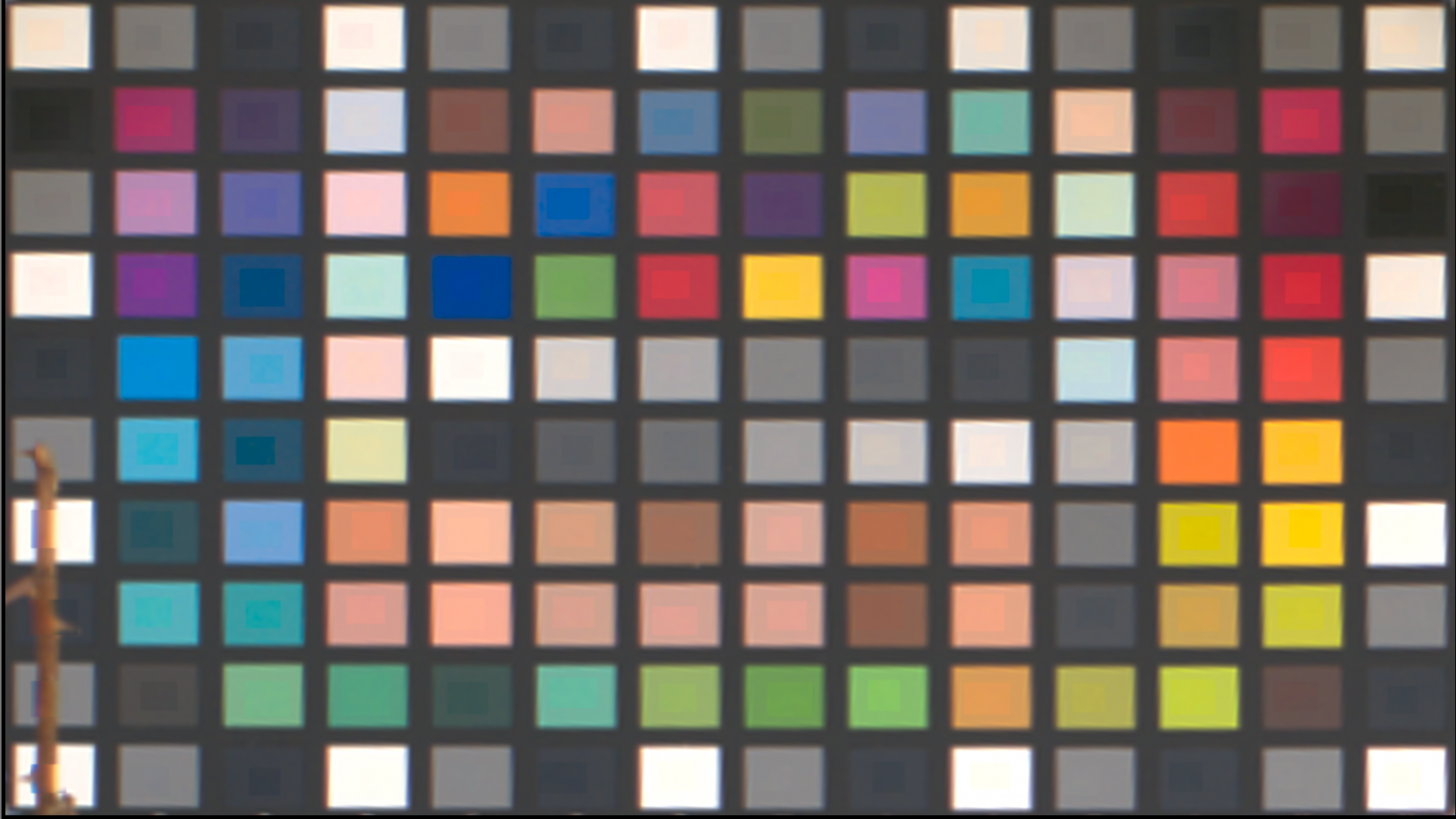




reproduction

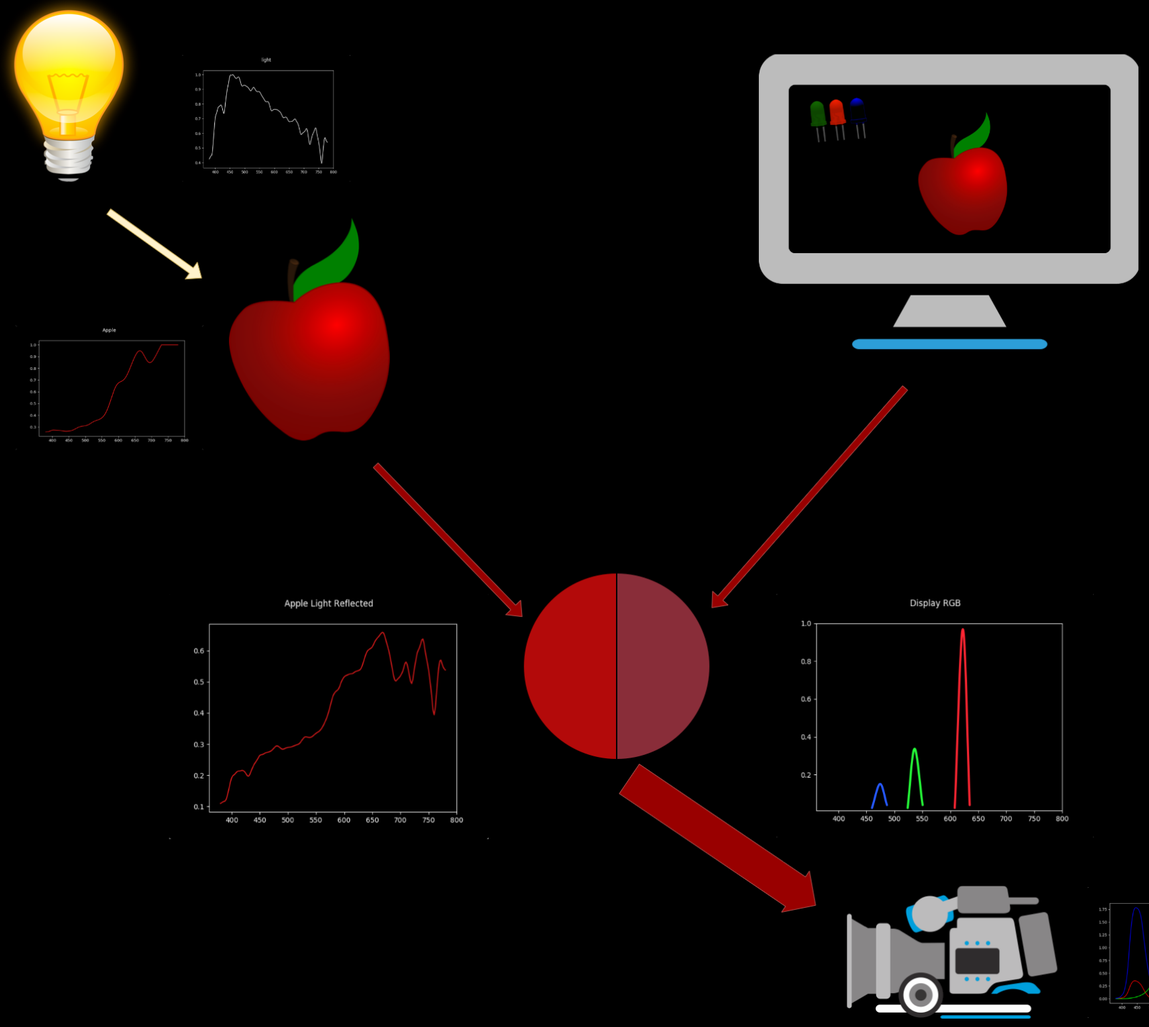
original



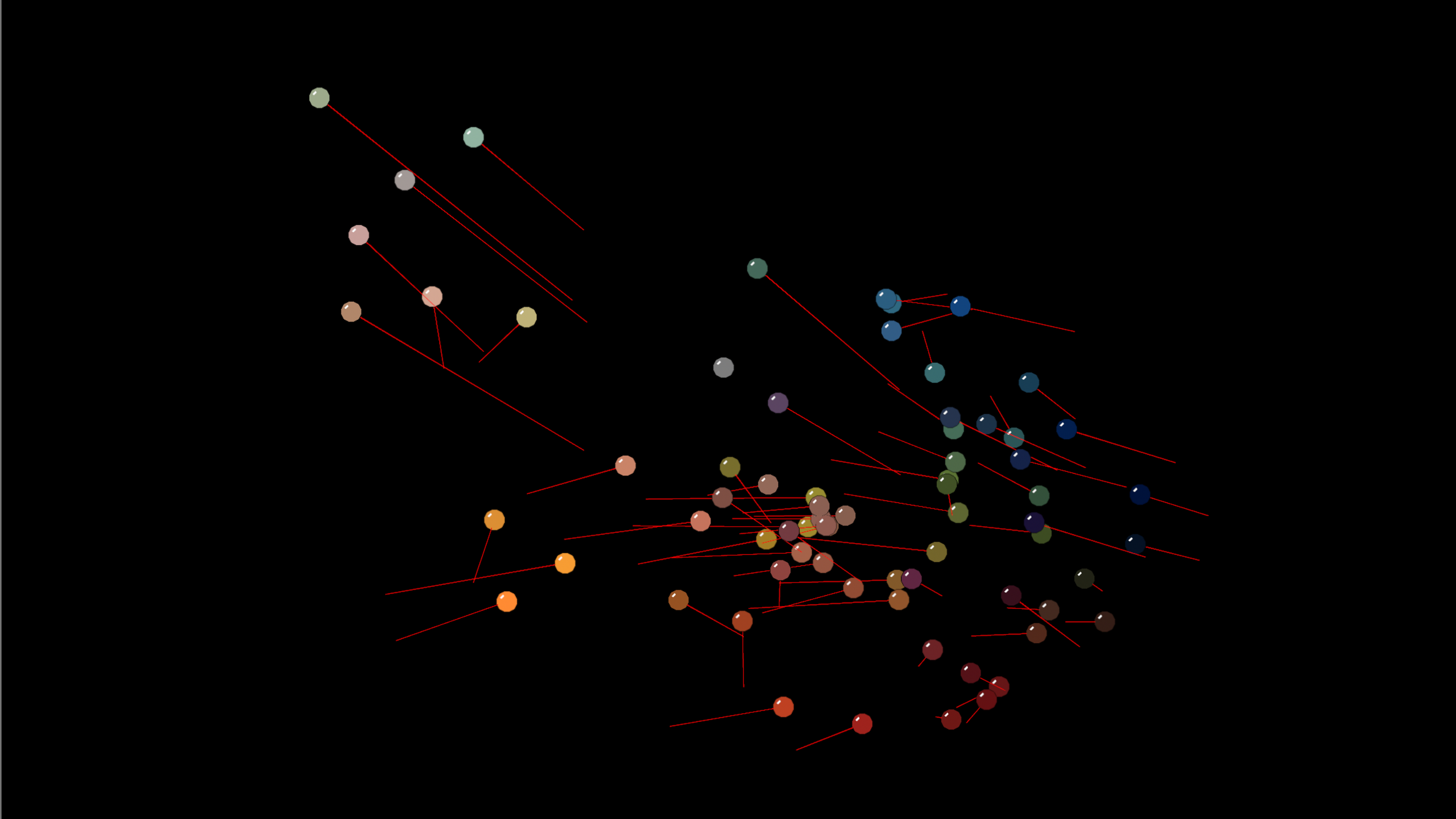


colorchecker DIGITAL SG
x-rite
Colour: Sense 8 Measurement
Richard Kirk
Colour: Sense 8 Measurement
Richard Kirk
Colour: Sense 8 Measurement
Richard Kirk

No Metamers



$$C_{bg} \neq C_{fg}$$



Fix the lighting

$$C_{fg} = Object * Light$$

change lights until

$$C_{bg} = C_{fg}$$

overall minimisation
full-colour match is impractical

Grading to solve the equation

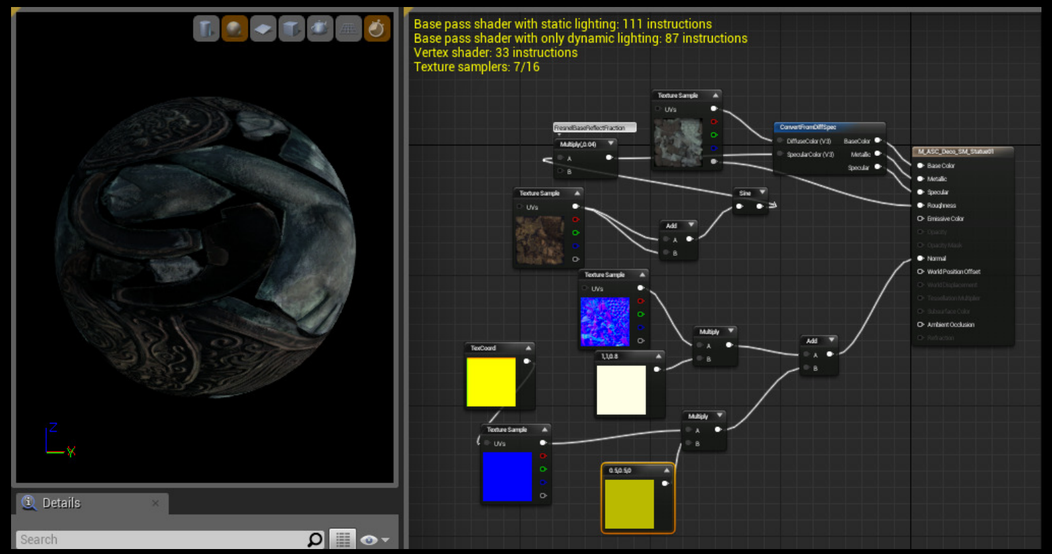
$$f_{grading}(C_{bg}) = C_{fg}$$

Not so fast!

Modify the RT Engine Scene directly until

$$C_{bg} = C_{fg}$$

In theory, the best solution



- works only for objects rendered in RT
- Shader controls can be complex
- RT Engine native controls can lack intuition
- Object colours might be modified by post-process
- slow if you need to modify many objects

https://docs.unrealengine.com/4.27/en-US/BuildingWorlds/LevelEditor/Modes/MeshPaintMode/VertexColor/MaterialSetup/Color/

Grading to solve the equation

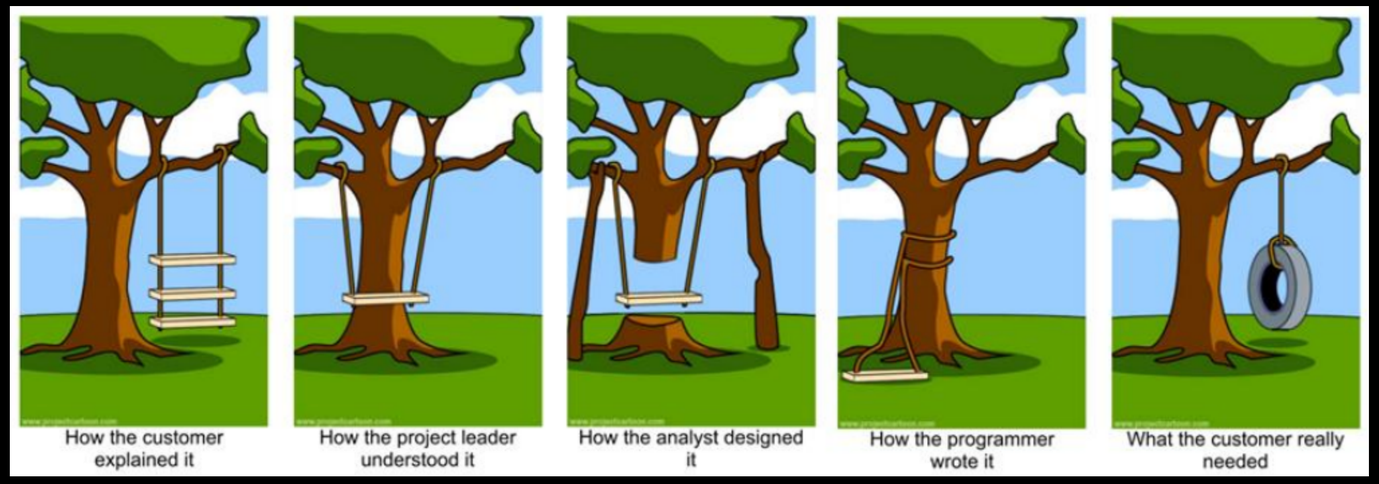
$$f_{grading}(C_{bg}) = C_{fg}$$

includes

$$f_{grading}(\sum_{i}^{n} f_{grading}(C_{bg_i})) = \sum_{i}^{n} C_{fg_i}$$

Requriements:

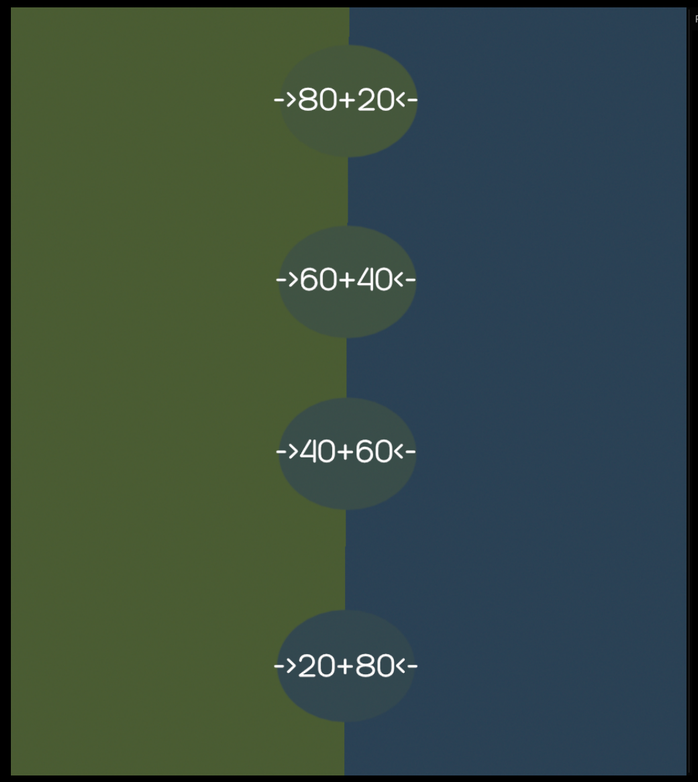
- scene-referred pipeline
- physically plausible (additive colour mixture)
- fast and constant to execute
- applicable both on objects and output
- linear light processing
- easy to use
    - predictable
    - fast learning curve
    - operated by none colour experts

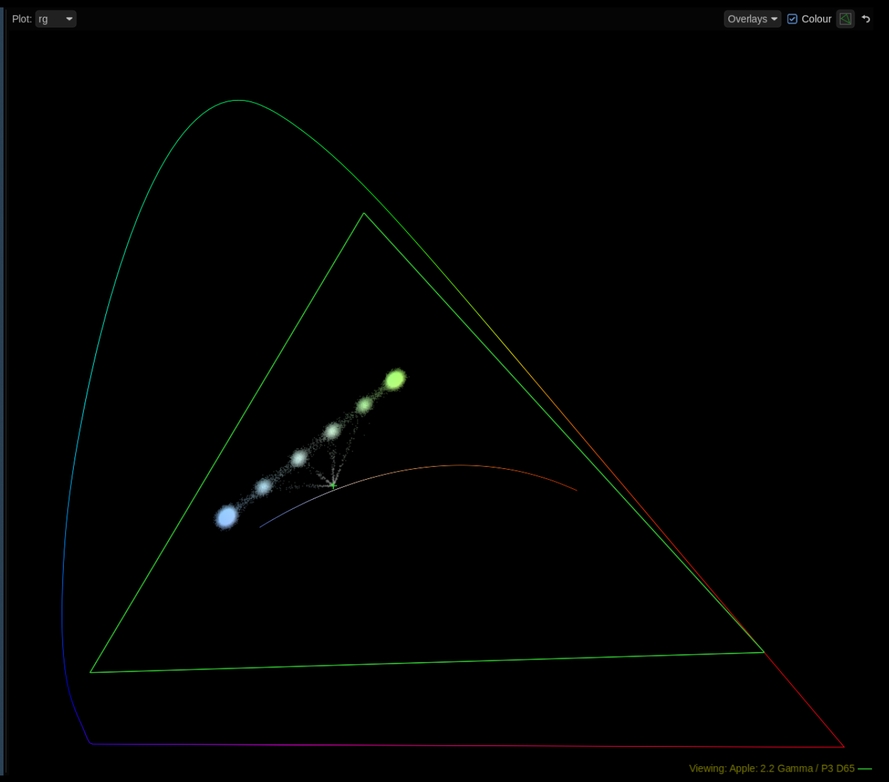


http://projectcartoon.com/cartoon/867912

Additive Colour Mixture

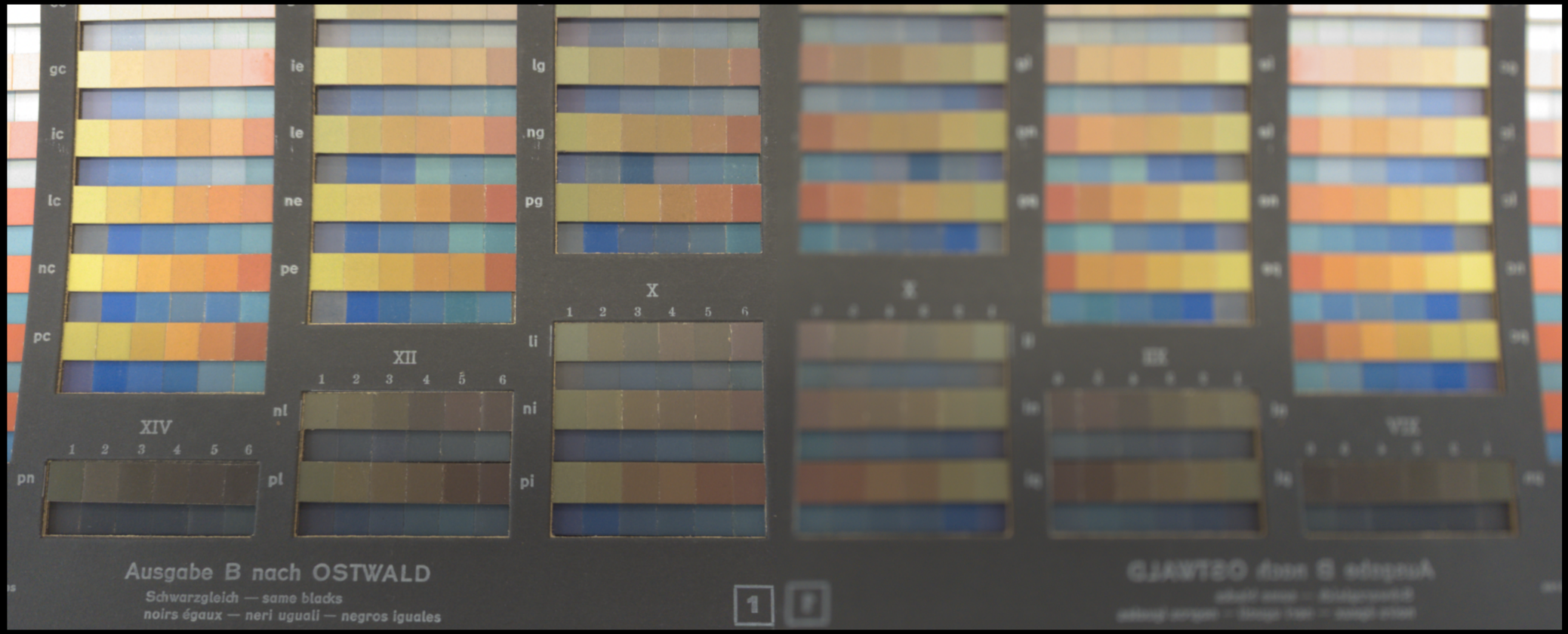
the additive mixture of two lights produces a light which falls on a straight line connecting the two lights (in the observer space)





Additive Colour Mixture

Lens Blur



Additive Colour Mixture

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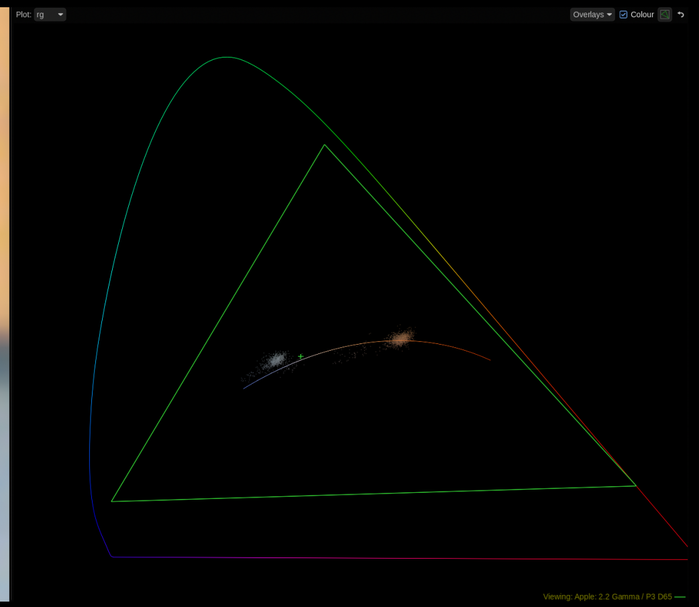
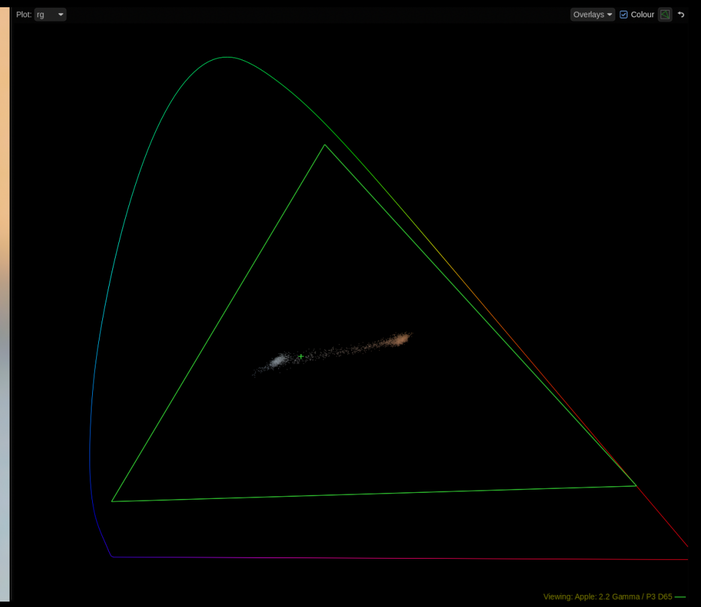
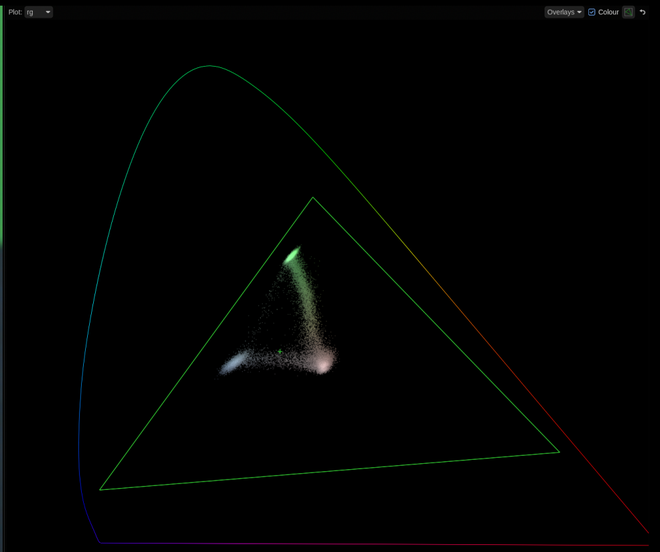




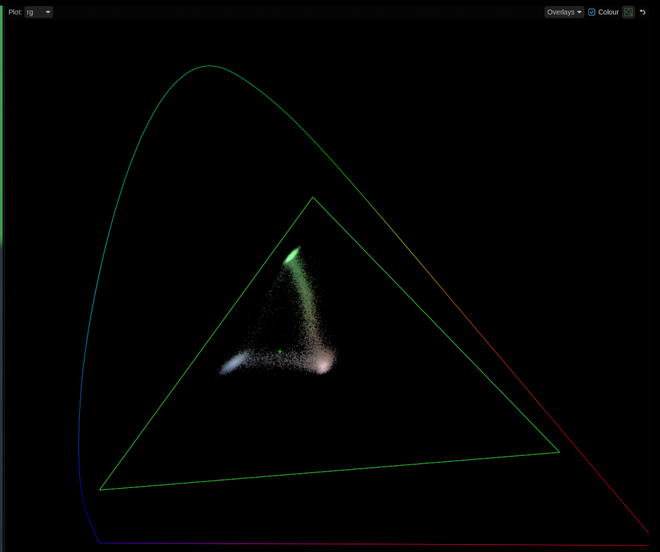
Additive Colour Mixture

Motion Blur



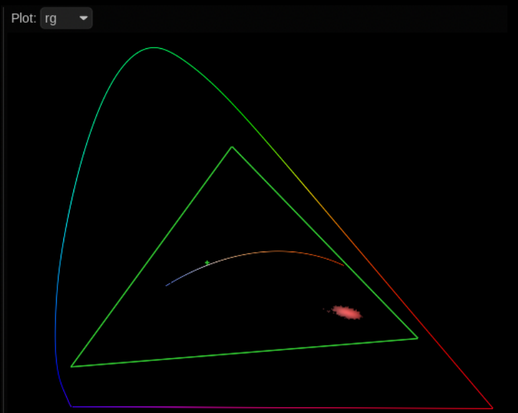
Additive Colour Mixture

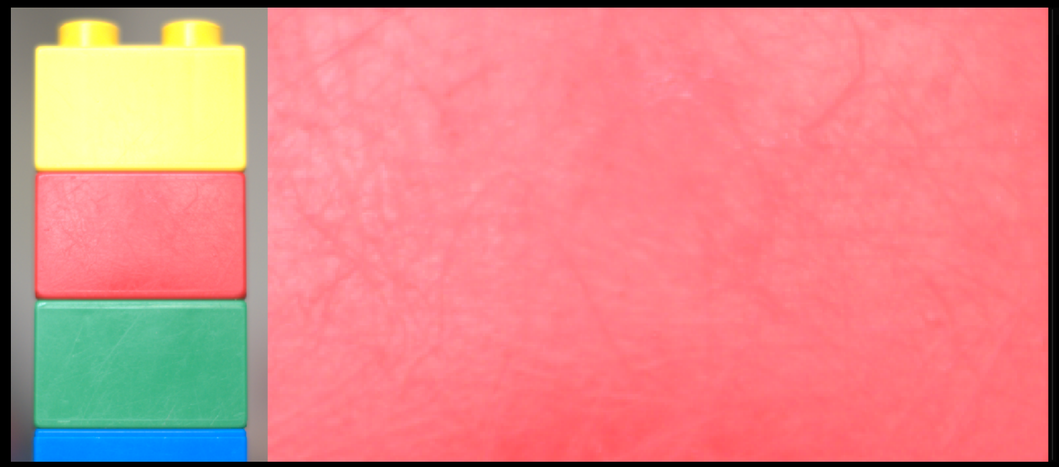
Motion Blur

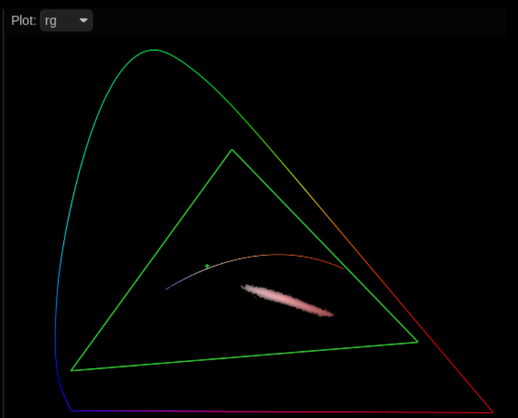


Additive Colour Mixture

Gloss

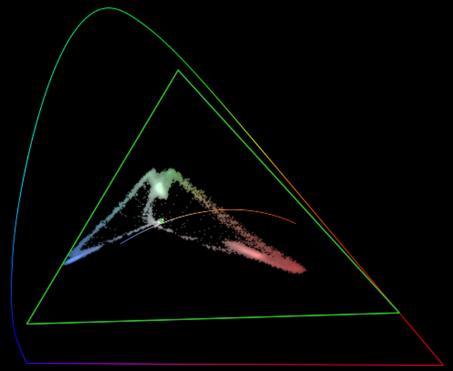




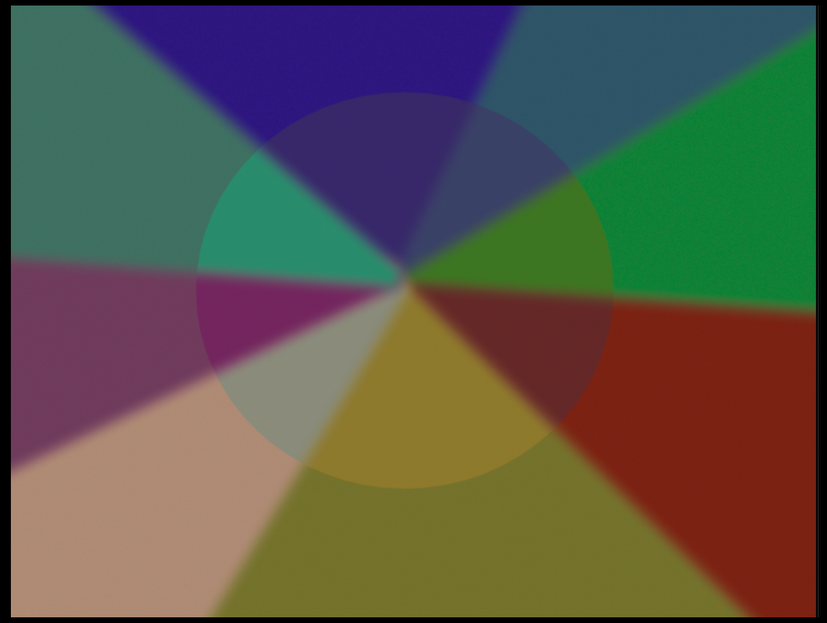


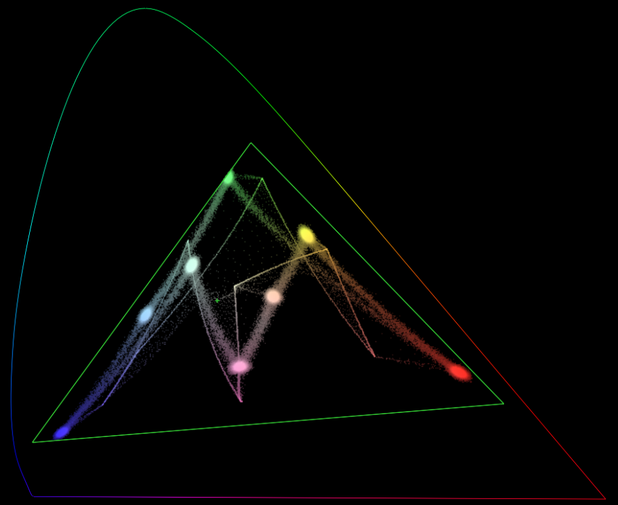
Additive Colour Mixture

Spill



Some matching experiments

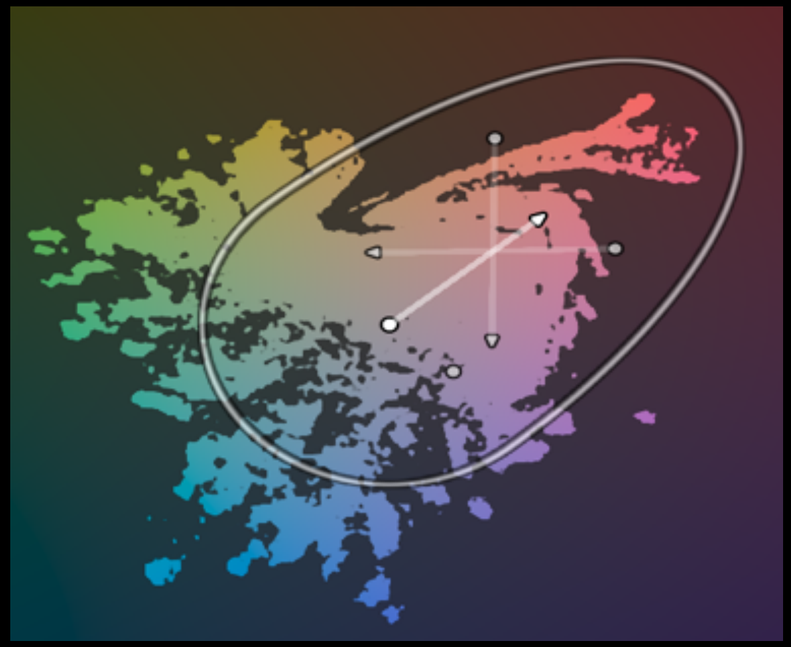




Conclusion

- Linear Light Gains (aka white balance) for a single colour/object/colour location
- Keys, HSV, or scale-based tools distorted the nature of the additive mixture
- perceptual tools are not helpful (additive mixture)
- 3x3 matrix only works for three colours
- XGrade type grade looks like a promising solution

sometimes, the correct solution is not achievable
prelighting and colour-matching foreground and background can be speeded up dramatically



Thank You

??? Questions ???