Parametric Appearance Compensation

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HPA

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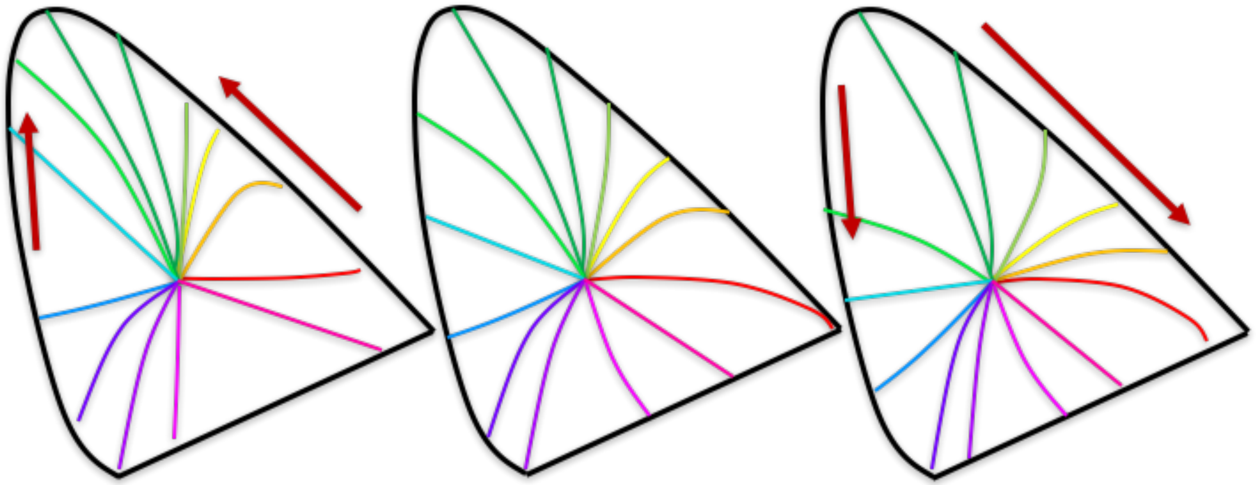


Scene Light → **Display/Projector Light**

Linear Scene-Referred Light

Linear Display/Projector-Referred Light

(both can be read directly with a Spectral Radiometer)

This is the Fundamental Transform

(aka “OOTF”, Optical to Optical Transfer Function)

- **BT.2100 and ACES pursue the definition of an “OOTF”**
- **The OOTF is the key to all forms of “color science”**
- **The centerpiece of the OOTF is also known as “color rendering”**
- **A consistent “family” of OOTF’s is needed for heterogeneous displays**

Appearance Compensation

Ref: Color Appearance Models, 2ndEd, Mark D. Fairchild, Color Appearance Phenomena, Chapter 6

Pixel-independent (not regional) appearance effects:

*** Abney: Constant hue vs. saturation goes along curved lines**

*** Stevens: Contrast increases with luminance**

*** Hunt: Colorfulness increases with luminance**

x Bezold-Brucke: Hue of monochromatic color changes with luminance

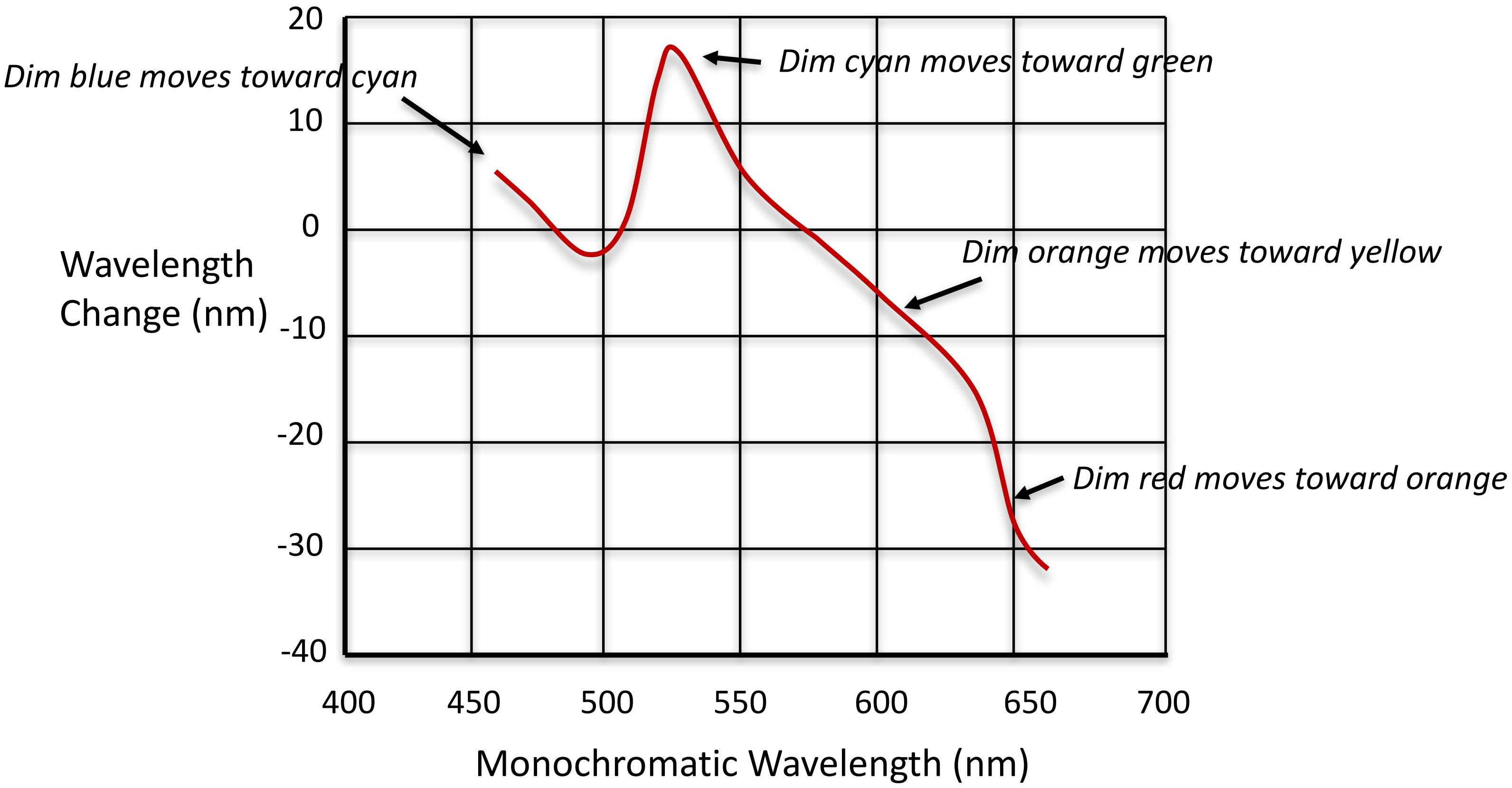
x Helmholtz-Kohlrausch: Brightness increases with color saturation

*** *modeled and compensated***

x *to be explored*

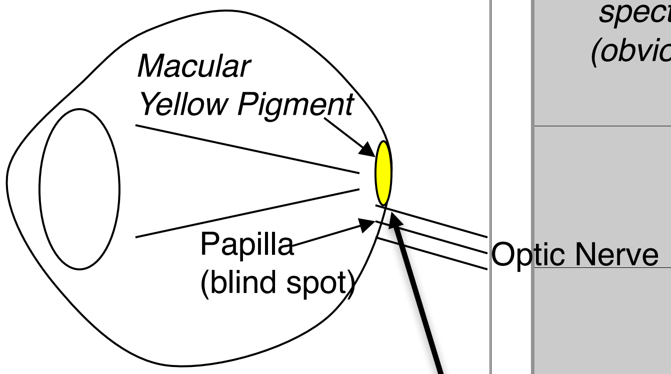
Bezold-Brucke Monochromatic Hue Shift

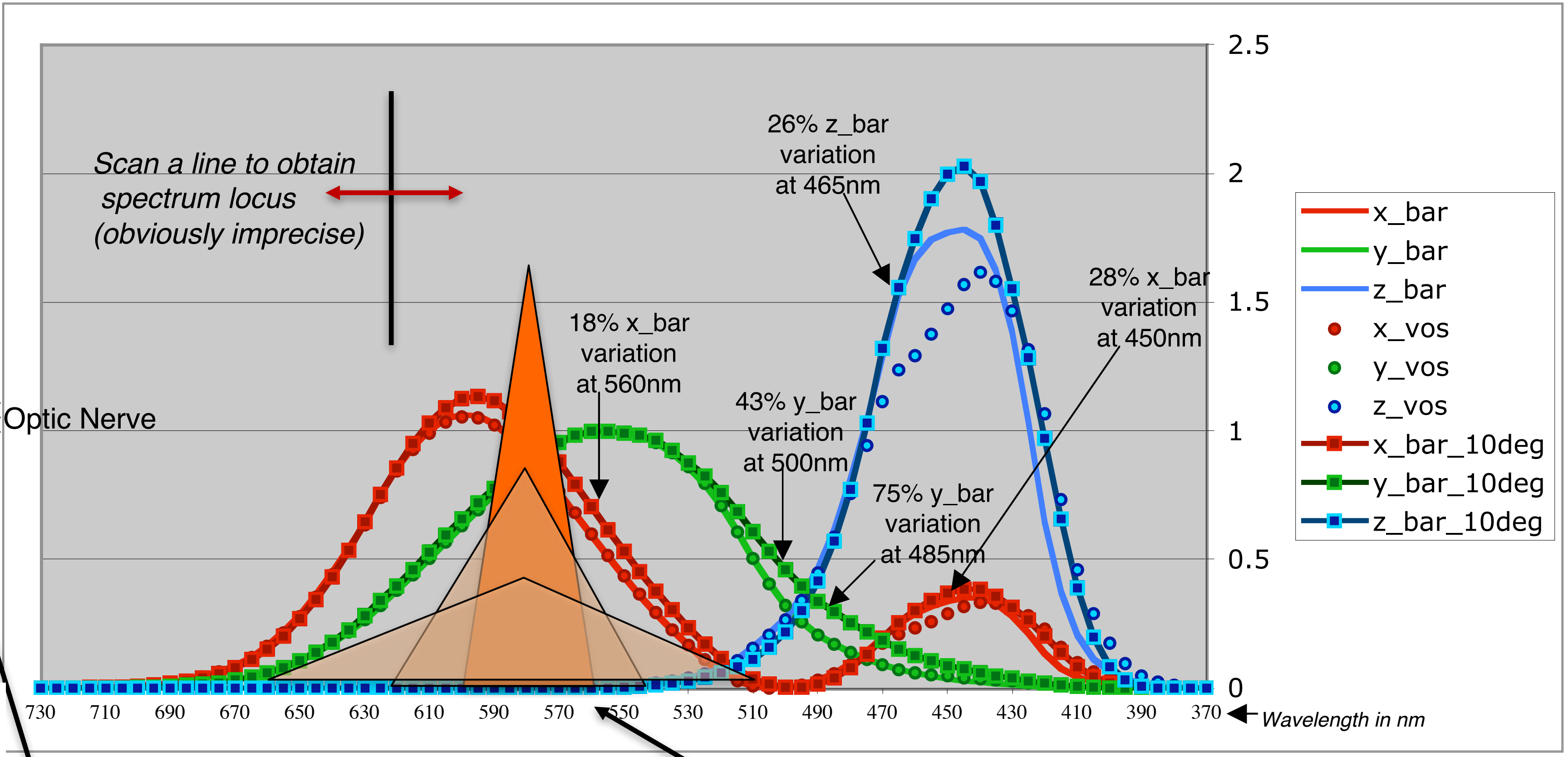
(for a 10x reduction in luminance, nit levels unknown)



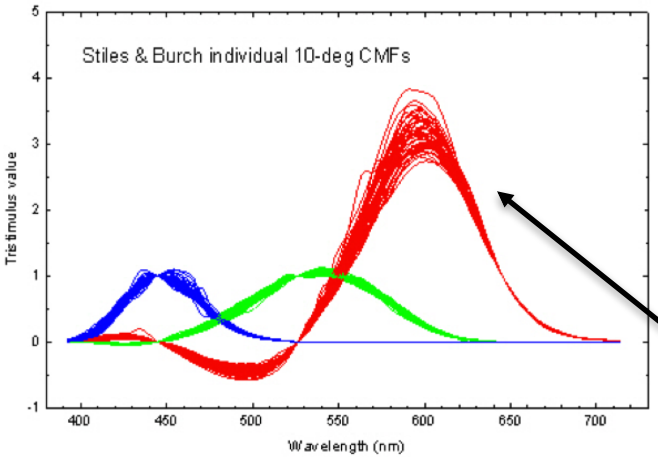
- What about wider spectra?
- What about different HDR brightness ranges?

Ref: Color Science: Concepts and Methods, Quantitative Data and Formulae, 2nd ed., by Gunter Wyszecki and W. S. Stiles, Wiley, 1982



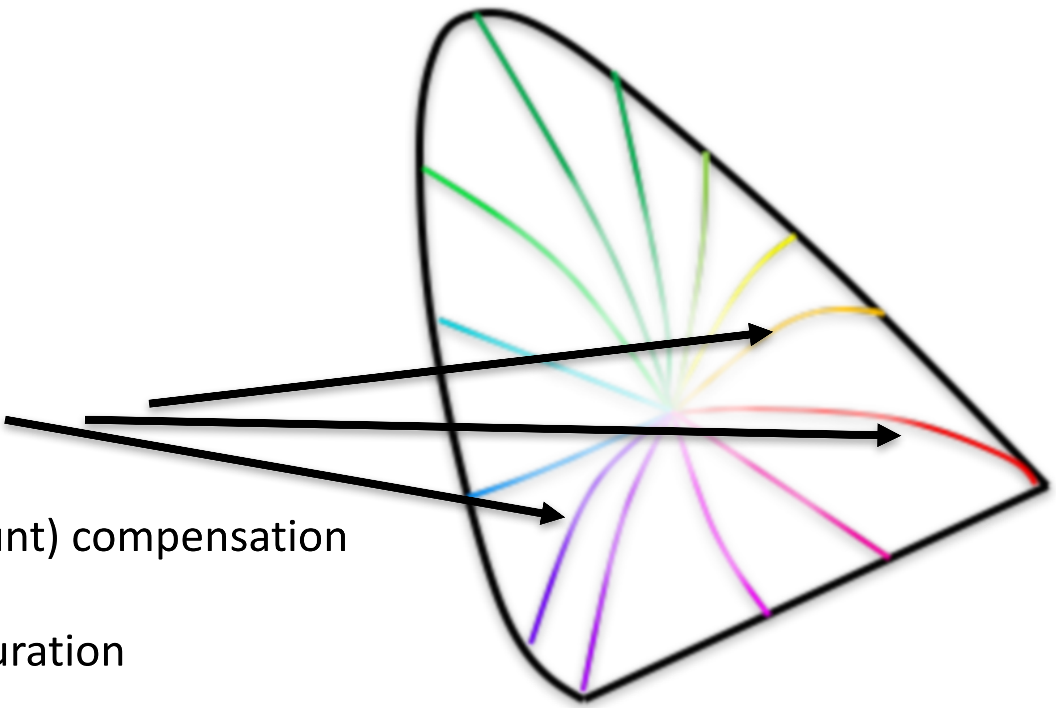


Several x_bar, y_bar, z_bar color matching functions showing CIE 1931 x_bar, y_bar, z_bar (2-degree), Vos 1970 version, and CIE 1964 10 -degree version



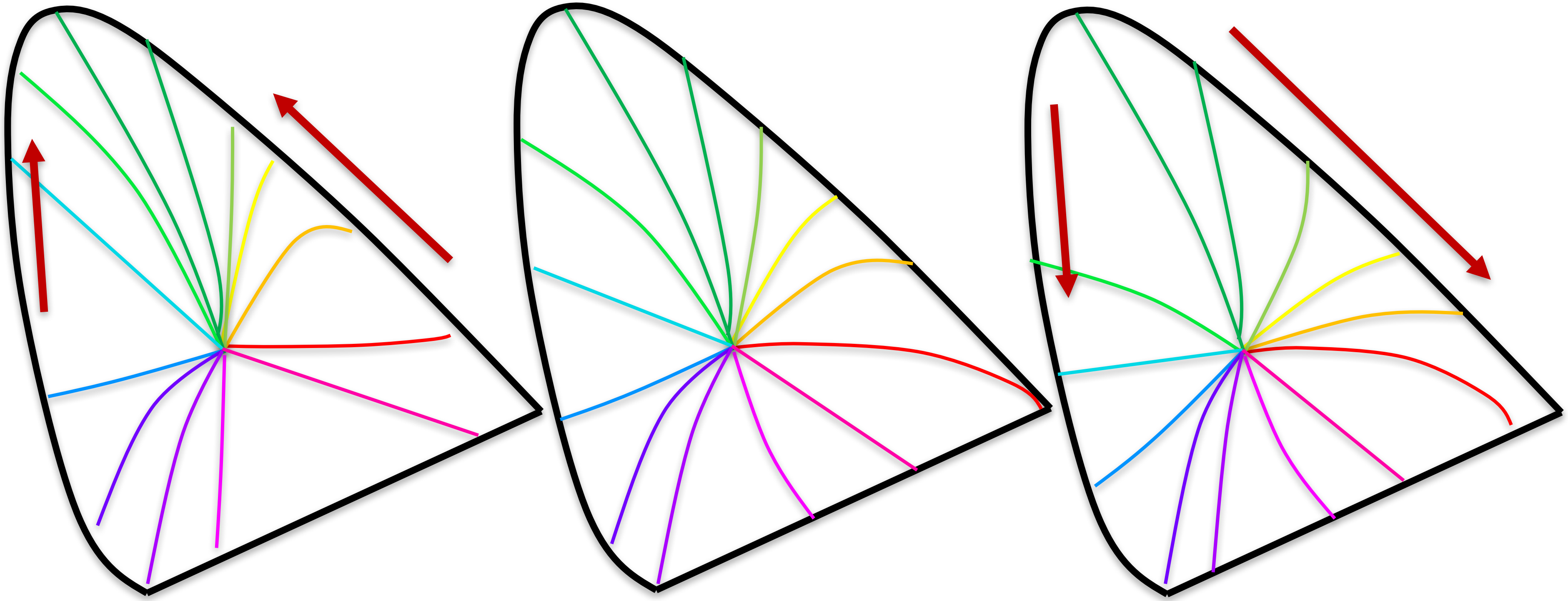
- **Abney: Add white** light to a color *< or >* **widen the spectrum** at the color
- **Hue** is also a function of **where you are looking** (due to the ”yellow spot”)
- **Individual** Color Matching Function (CMF) **variation** is also in effect

Abney



- Lines of constant hue (vs saturation) fall on curves
- Adjusting saturation is required for colorfulness (Hunt) compensation
- Luminance must be considered when adjusting saturation
- Bezold-Brucke implies that these curves change with brightness
- Also applies to gamut reduction (a form of desaturation)
- Hue changes depending on where you are looking (due to the “yellow spot”)
- Clearly more to be done here…

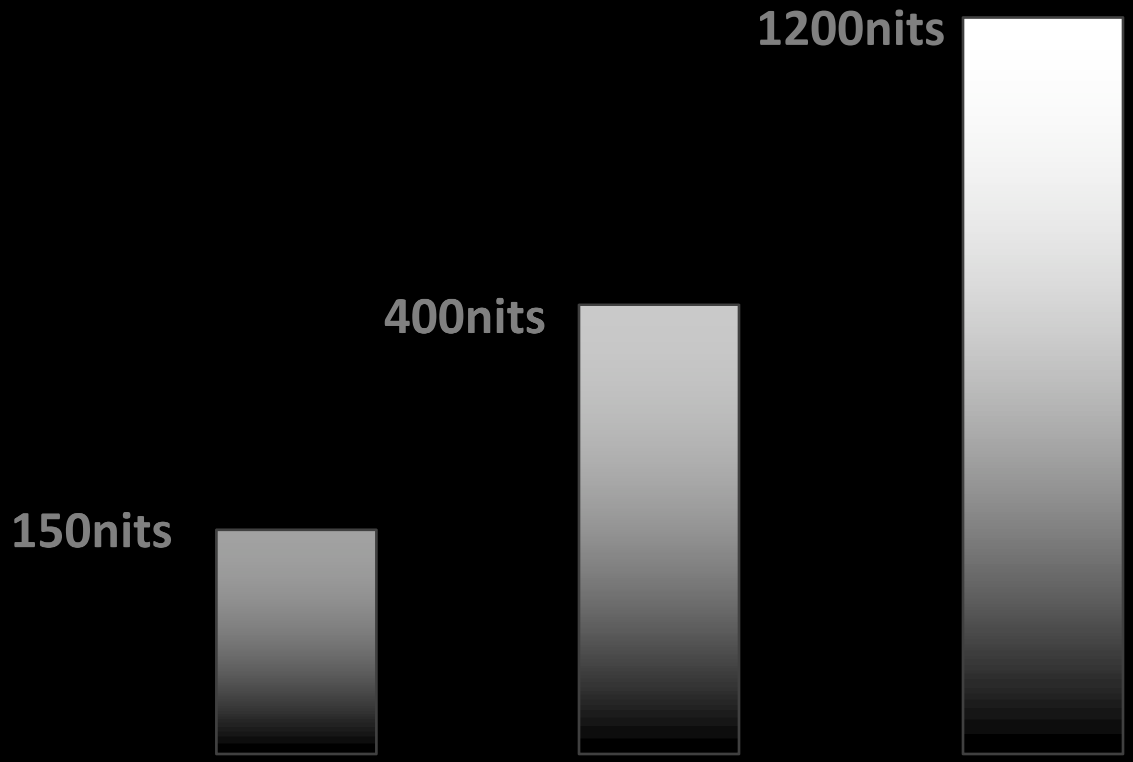
What Bezold-Brucke Implies For Abney



Dimmer Medium Brightness Brighter

- *Needs fresh exploration at the bright and dark ends of HDR's range*
- *What about individual and average variation of CMF's?*

Stevens



Appearance Compensation *(continued)*

Regional appearance effects:

*** Bartleson-Breneman: Contrast increases with surround luminance**

*** Hue and CMF alteration with subtended angle and center of view**

x Appearance effect involving contrast changing with subtended angle?

x Surround white adaptation when different from displayed white

Time-sensitive appearance effects:

- Color and brightness persistence effects (including cone-bleaching)

- Regional optical illusions (often related to localized surround adaptation)

* ***modeled and compensated***

x *to be explored*

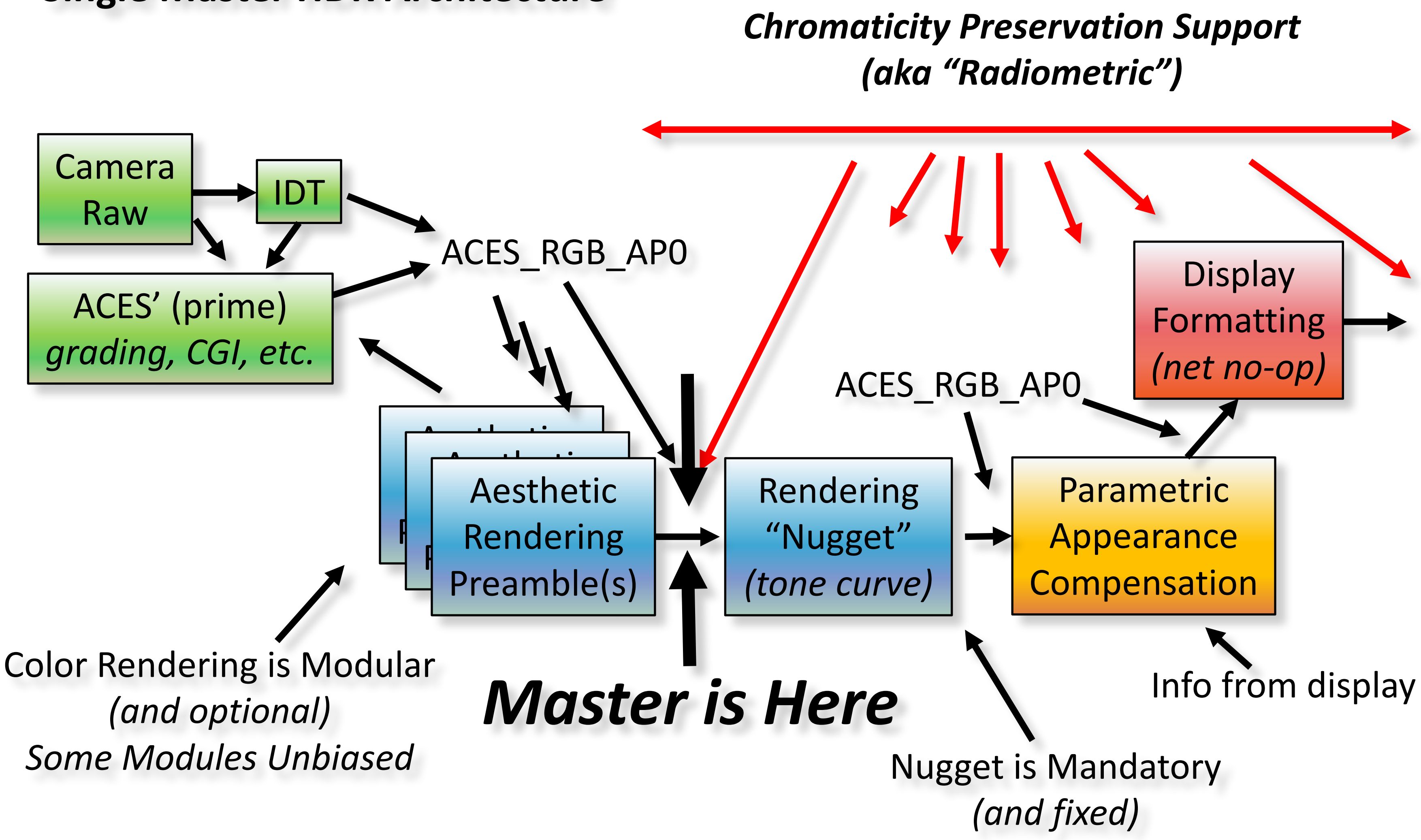
- *not sure what can be done*


Bars Of Constant Value Over Left-To-Right Gradient
Bartleson-Breneman/Simultaneous Contrast

HDR Appearance?

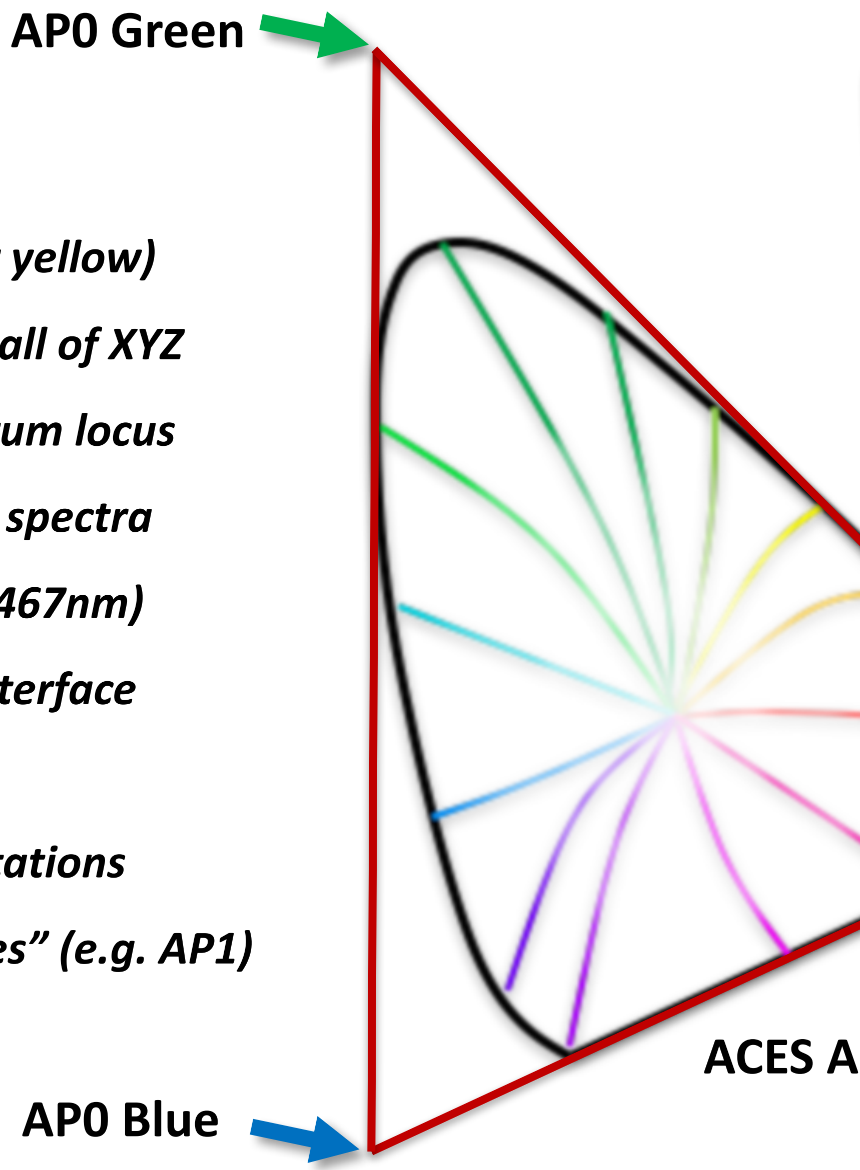
- These appearance phenomena pre-date High Dynamic Range (HDR)
- How does HDR change these?
- Approach here is to assume they all apply
- These effects are likely magnified along with HDR's increased range and gamut
- Refinement/improvement likely as we gain experience with HDR appearance
- In a well architected HDR system, appearance compensation is required
- Most of these effects are neither small nor subtle

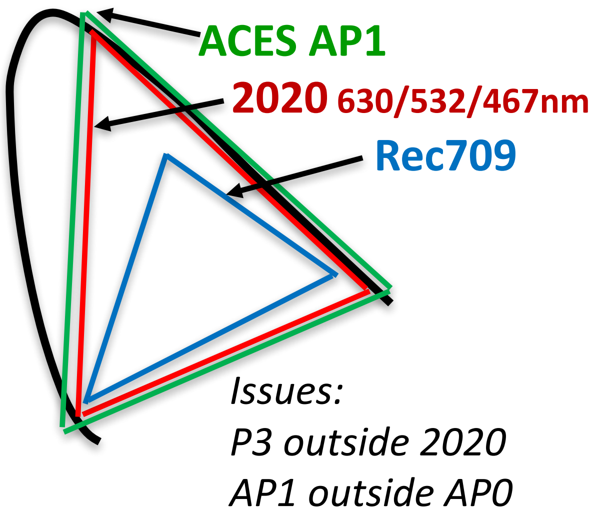
Single Master HDR Architecture



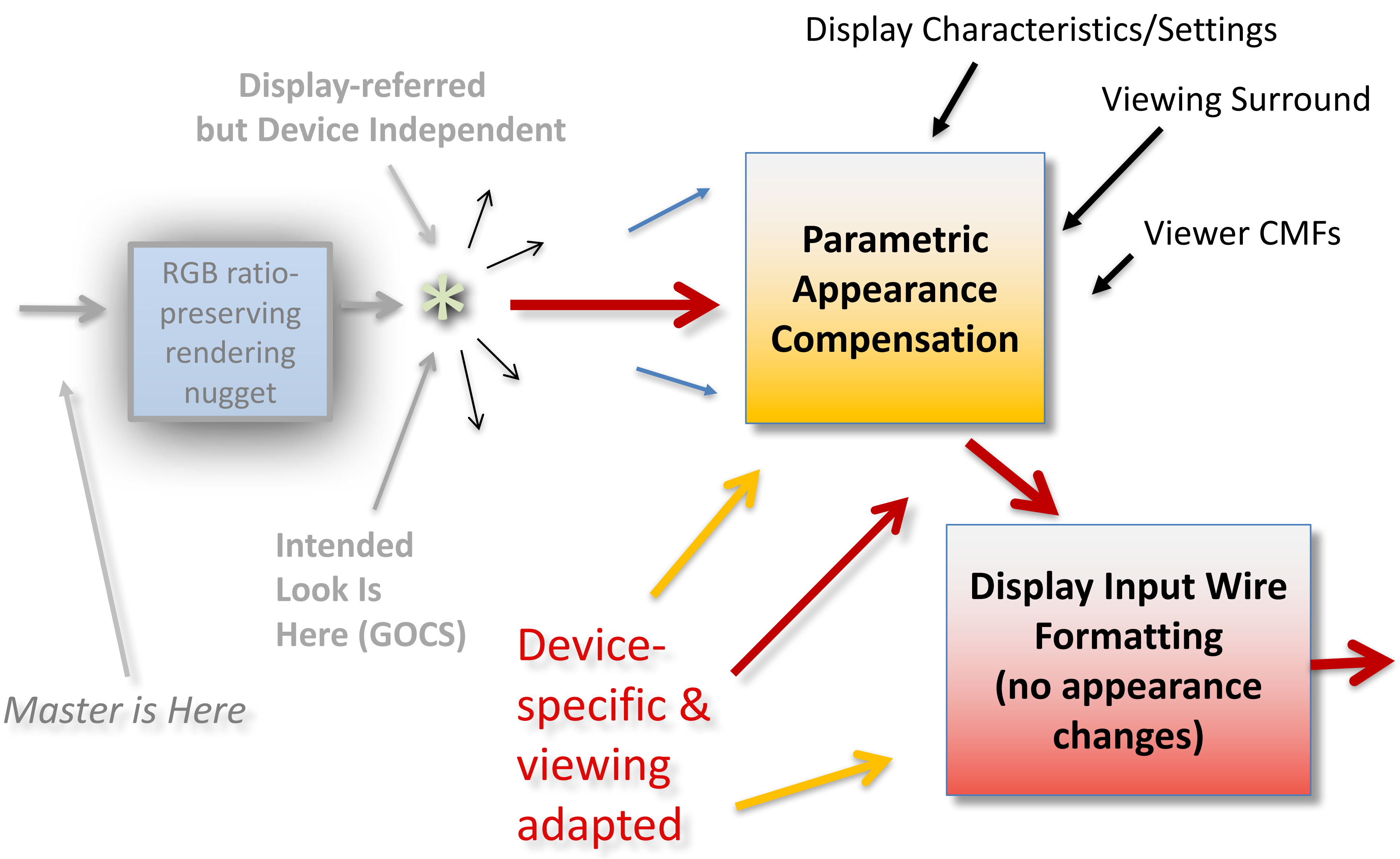
ACES “AP0” RGB Primaries

- *encompasses spectrum locus (except near yellow)*
- *benefits of RGB while maintaining nearly all of XYZ*
- *defined by CIE 1931 CMF’s, fuzzy at spectrum locus*
- *could redefine AP0 as matrix from known spectra (e.g. Equal Energy White, 630nm, 532nm, 467nm)*
- *AP0 used at every major single_master interface (except display formatting output)*
- *AP0 used within every module for computations*
- *avoids weaknesses of “rendering primaries” (e.g. AP1)*
- *industry experience using ACES AP0 RGB*





Modular Architecture *(detail)*



Modular Architecture *(detail)*

end-to-end should be a no-op (coding on the wire)

(with respect to appearance)

Display Input Wire Formatting (no appearance changes)

Display Removes (inverts-out) Formatting (aka "transfer function", EOTF)

Example: inverse-gamma 2.4 gamma 2.4

Caveats:

- *Top end of PQ may be difficult*
- *Gamut boundary soft-clip (if present)*
- *Bit depth <-> perceptual threshold*
- *Dark behavior (near black)*
- *Larger bright area darkening*
- *Function <-> perceptual threshold*

Basic Parametric Appearance Functions

- "Radiometric" capability
- Room ambient compensation
- "Colorfulness" compensation (the Hunt effect, includes Abney)
- Brightness compensation
- CMF compensation (e.g. viewer age, screen subtended angle)
- Display-type transform split into
  - display/projector appearance attributes
  - "coding on the wire" attributes (optimally no affect on appearance)
- What matters is the appearance behavior (not the construction utilized)

Architectural Implications

- **No use of metadata (**except optional mastering CMF info)

- **Each distribution display could/should have a mechanism to compensate**
  - Brightness (including large area brightness dimming)
  - Gamut
  - Ambient surround
  - Bit depth (dithering down from higher bit depth source(s), when avail.)
  - Optional viewer CMF characteristics (e.g. viewer age and screen size)

- **Independent of "coding on the wire"** attributes (e.g. EOTF nulled out)

Single Master Test System Current Parameters

Appearance Compensation Parameters

- **radiometric_proportion** (includes Hunt and Abney compensations)

- **display_brightness** and ambient surround level (combined parameter, includes Stevens and Bartleson-Breneman compensations)

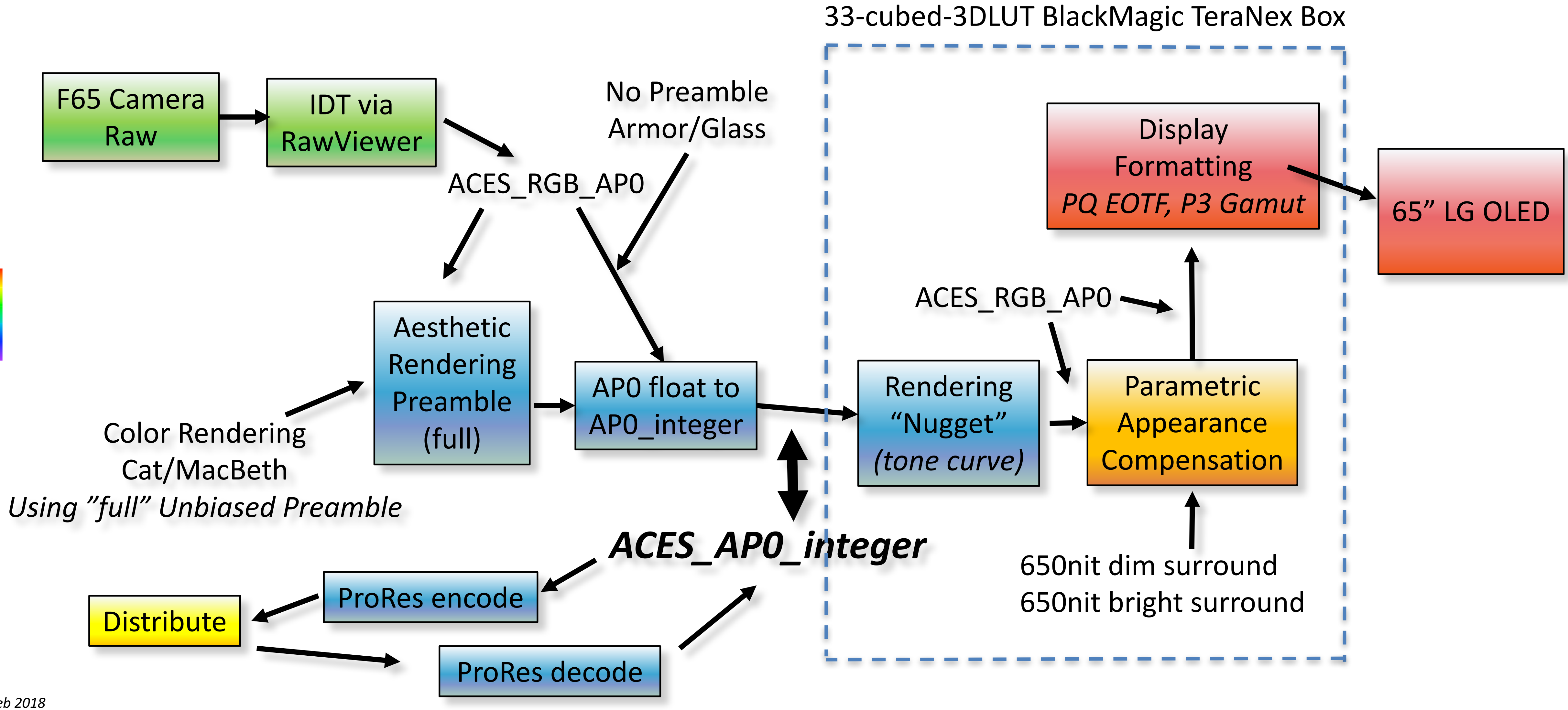
Display Signal Formatting Parameters

- Gamma Value or PQ Range, use negative for SMPTE limited range
  - values above 25 specify PQ "nits" maximum used (inside 10,000)
  - values below 4 specify gamma (e.g. 2.4, 2.6)

- Color gamut (P3, XYZ, BT.2020, Rec709, Adobe RGB)

- Whitepoint for RGB gamuts: D60, D60_on_D65, D60_as_D65,
  (for P3 also D60_on_P3_DCI_Greenish_Calibration_Whitepoint)

ACES_AP0_Integer 3DLUT Demonstration



Summary

• Built on “radiometric” (chromaticity-preserving) spine

This enables:
- colorfulness compensation
- ambient surround compensation
- unambiguous masters
- end-to-end calibration
- optional CMF accuracy improvement

• Display brightness parameter compensates for presentation display brightness differences and for ambient surround differences

• Master, after aesthetic preamble and/or grading defined by linear scene light, diffuse white, mid-grey, and D60 (or D65)

• Future work awaits to refine and broaden scope of color appearance compensation and other key system elements (see appendices)

Many Appearance Effects Are Significant!

Discussion?

Come Visit Demonstration In The Innovation Zone

(additional detail in appendices which follow)

Appendix

Verification and Next Steps

Verification

- Verify current HDR (150nits-1500nits) and SDR (25nits-100nits)
  - display brightness parameter functioning
  - ambient surround compensation at various ambient and brightness levels
    (Stevens/Bartleson-Breneman)
  - radiometric proportion parameter functioning
  - radiometric proportion's implementation of Hunt colorfulness compensation
  - verify end-to-end chromaticity preservation when radiometric set to 1.0
  - verify, try to understand, and possibly improve D60/D65 interoperability
  - verify gamut reduction "top" knee function
  - additional testing of alternate CMF's
- Test and verify use of ACES_AP0_integer with HEVC as an alternative to 2020/PQ

Next Steps

- Test Bezold-Brucke over HDR’s range
- Test Bezold-Brucke’s affect on Abney hue curves
- Test Abney in general as a function of brightness
- Explore above 1500nits
- Explore dark range
- Explore better alternatives to “Lb” for display-specific dark behavior
- Explore how best to use negative RGB values
- Experiment with HDR mastering monitoring configurations
- Investigate large display (e.g. 75”) on-screen area acting as ambient surround
- Alternate whitepoints onscreen and surrounding (D55, D60, D62.5, D65, ?)
- Gamut reduction (e.g. ACES RGB AP0 to P3 RGB), treated as desaturation?
- Test Bezold-Brucke -> Abney -> Hunt Colorfulness, and also Gamut Reduction

Further Steps

- RGBW, RYGCBM, RYGCBMW, etc
- Independence from CIE 1931 (ACES RGB AP0/AP1 are defined with CIE 1931)
- Improvements to the Input Device Transform (IDT) process
- Are we handling Helmholtz-Kohlrausch, or is a compensation needed?
- What about regional phenomena?
    - Appearance effect involving contrast changing with subtended angle?
    - Surround white adaptation when different from displayed white
    - Color and brightness persistence effects (including cone-bleaching)
    - Regional optical illusions (often related to localized surround adaptation)
- Can anything be done about many-second appearance adaptation affects
    - (entering a dark room, cone bleaching, etc.)
- Is this list complete?

Features/Issues With Display Formatting Step In Current Version:

- Matrix from ACES RGB to P3 RGB gamut reduction issues
    - matrix has ~2.0 red-to-red term, handled by "knee"
    - input currently limited to all positive
    - how to soft-clip gamut?
    - how to soft-clip dark range?
    - how to gamut clip on hue curves/luminance?

- D60 (ACES whitepoint) vs. D65

Useful Tools

- Best HDR pro displays (these are 30” at present)
- Projection with Xenon, UHP, Laser, 6P, etc
- Cinema LED walls
- High end consumer HDR displays at various HDR ranges/gamuts
- Adjustable ambient backlight environment
- Neutral density (ND) filters at various densities
- Narrow-band gel color filters (Lee, Rosco, etc.)
- Monachrometer (at various brightness levels if possible)
- Spectral radiometer
- Tuneable lasers

Appendix

What Device-Independent Image Neutral Format Is Distributed?

What Device-Independent Image Neutral Format Is Distributed?

Display Referred?:

- Display-referred with **extended** range and gamut
  - e.g. 2020gamut/PQ10,000nits, displayed on P3 gamut at 800nits
  - what surround?
  - are presentation display settings calibrated providing known look?

- Display-referred with all values falling **within** range and gamut
  - e.g. gamma 2.4 with P3 gamut at full range RGB (0-1023)
  - how bright?
  - what surround?
  - are presentation display settings calibrated?

- Does every presentation display exactly match a one-and-only mastering display type in range, brightness, surround, settings, gamut, etc?
  - *this is/was the Rec709 model, **but has never been realized***

- **Implication: <u>display-referred doesn't work</u>** as an architecture (this includes PQ/2020)

What Device-Independent Image Neutral Format Is Distributed?

Scene Referred?:

- All raw-mode camera images that have been used to make any range and gamut result provide an **existence proof** that there is a path from scene light to any and all such example displayed images

- What is needed is a single **generic neutral form**, similar to camera raw mode

- ACES AP0 RGB floating point provides a useful linear-light form

- Linear light signals will minimize spatial filter aliasing artifacts, and linear representations are also necessary for color matrices and other required transforms

- **ACES-*prime*** (aka graded ACES) is the concept of extending camera raw to any useful digital intermediate form, while maintaining scene-referred integrity

Unbiased Neutral Form

- Lustre-graded ACES-prime (aka graded ACES) was demonstrated with Universal using ICAS resulting in an look-unbiased neutral form

- ACES used the DC2.2 “look reference” in attempt to create an unbiased neutral form.
  - The DC2.2 look reference applied to ut_2-ut_4, v0.1-v0.7
  - DC2.2 is a Standard Dynamic Range (SDR) look reference
  - ACES 1.0x deviated somewhat from the DC2.2 look reference
  - gd9 became the first potential HDR look reference

- Achieving an unbiased neutral form defines the system architecture:
  - True to the physical light measurement of the scene
  - Creates an unbiased ACES-prime master
  - Provides an unbiased input to appearance compensation
  - Re-instates the “look reference”, but enables many such “looks”

- If appearance compensation is working:
  - The appearance compensation will reproduce the reference look(s)

Appendix

Mid-Grey (LAD) And Diffuse White Appearance Compensation

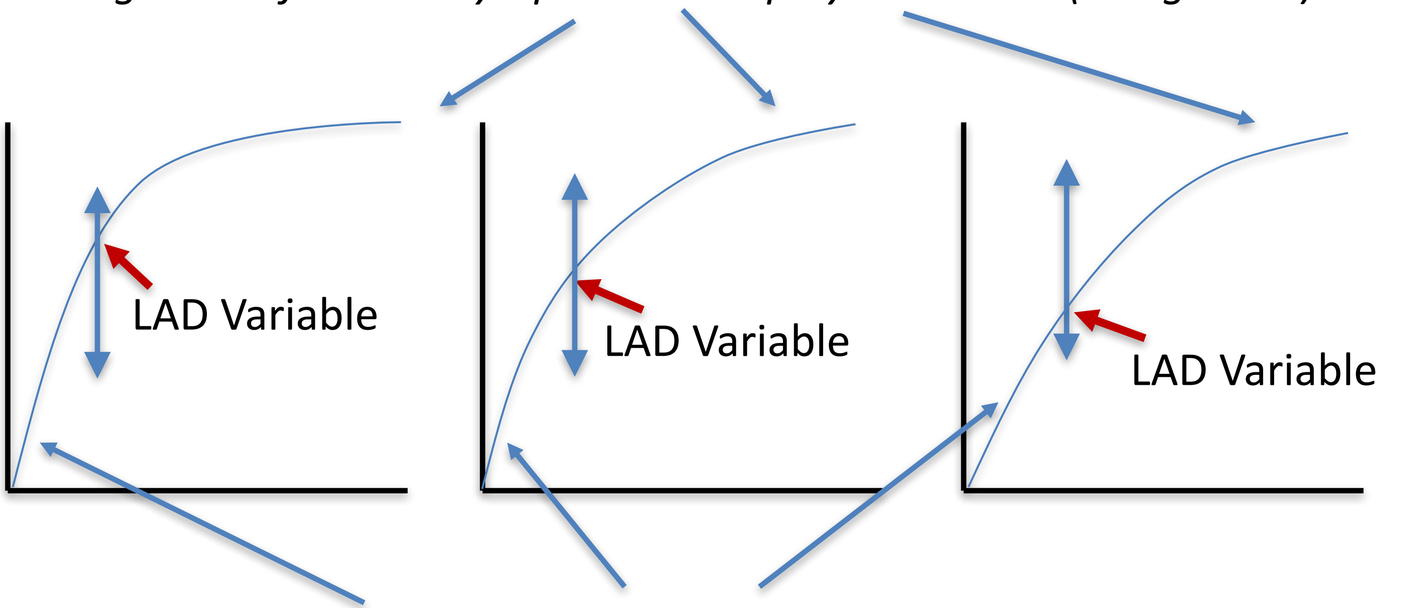
LAD Must Move!

- LAD (Laboratory Aim Density, mid-grey)
  - LAD was the main brightness anchor for 48nit/14fl film
- LAD needs to vary somewhere in-between absolute nits (e.g. PQ) and percent of max (e.g. film LAD is set at 10% of Max)
- ***LAD (mid-grey) would be 1000nits (10% of Max) if scaling up film to max 10,000!***
- ***LAD would be deep 0.05% black if held at film's <u>5nits</u> vs PQ max 10,000!***
- There is a vast region between 0.05% of peak and 10% of peak
  - 0.05% to 10% is 200-to-1 range!
  - LAD (mid-grey) belongs somewhere in this range
  - However, LAD should not be fixed as percentage of Max, nor absolute nits
- LAD needs to move with respect to display maximum, and ambient surround

Brightness Compensation

Appearance Brightness Compensation Built On Variable Asymptote (thus, LAD Moves):

High End of Curve Asymptotic to Display Maximum (using norm)



Low Portion is Straight Line To Zero

- *no s-curve at bottom*
- *lifted display black compensation requires better than crude Lb*
- *dark appearance and compensation is an open topic*

Diffuse White vs. Lights and Highlights

- Diffuse white (e.g. a white shirt in the scene) needs to move similar to LAD

- Lights and Highlights can vary in brightness
  - but not too much
  - must think about the 5stop max range we are considering:
    - 50nits to 1600nits
    - consider 100nit diffuse white is 1% of 10,000nits!
    - 1% black is mid-black (between ½% black and 2% high black)
  - need to balance max bright capability with natural appearance
  - the ambient surround level also is a factor

- When mastering, need to specify allowed variability for diffuse white, lights, and highlights
  - Lock down the diffuse white allowed variability when making the master
  - Lock down the shiny reflective highlight behavior also
  - Lock down the behavior of white and colorful (e.g. neon) lights
  - Enforce consistent bright regions between different composite elements
  - Manage brightness of highlight glints on the eyes of actors in close-ups

Appendix

Color and Colorfulness

Multiple Meanings of “Color”

- As perceived (appearance)

- As a measurable “chromaticity”

- Chromaticities imply Color Matching Functions (“CMF’s)

- There are multiple relevant CMF’s (e.g. 1931 2deg, 1964 10deg, 170-1)

- As linear weights of sensing or emissive spectra, measurable with a spectral radiometer or monachrometer

- As the combined meaning of illuminating light spectra together with surface spectral absorption/reflectance

- As surface spectral absorption itself

- Emissive color lights (e.g. neon), etc.

Bright and Too Colorful

Hunt Effect (colorfulness):

- Function of absolute brightness
- Applies equally to saturated and desaturated colors
- Applies more to brighter parts within a frame
- Compensation via desat needs to follow constant-hue curves (Abney) and applies luminance brightness adjustment (e.g. desat blue darkens)
- Seems to affect colorfulness over very large dark to bright range

Colorfulness questions to explore:

- Do people partially adapt to saturation levels at higher brightnesses?
- If so, is such adaptation affected by the surround appearance?
- Is it useful to darken bright saturated colors?
    - HLG asserts this
    - Should desaturation and darkening of bright colors be combined?
- Is a simple overall (all brightnesses for a given peak) desaturation sometimes adequate? Over what range if so?
- Test Bezold-Brucke -> Abney -> Hunt

Appendix

Multiple Versions

Multiple Versions

- Current HDR programs distributed point-to-point over the internet
  - could also broadcast multiple versions simultaneously

- Viewer could select a version matching their display's capabilities and their current ambient surround level

- Could create multiple grades to match multiple
  - display brightness levels
  - display dark performance
  - display gamut
  - ambient surround levels
  - full range vs. SMPTE limited range
  - white points (e.g. D60/D65) onscreen and in ambient surround
  - ages and viewing subtended angles (affecting CMF's)

<or>

- ***Create multiple versions parametrically as described here***

- ***Multiple versions could include multiple codecs (migrate to better codecs)***

Appendix

What Is Known, Where Is It Known?

Scene Light, Mastering Displayed Light, Presentation Displayed Light

Scene Light, Mastering Displayed Light, Presentation Displayed Light

Scene Light

- Consider scene light to be a natural indoor or outdoor scene

  - ignore the camera's frame edge

  (no assumption about outside the frame)

- Appearance issues within the scene's frame are ignored
- Treat the image as being primarily composed of accurate light physics

Light From Reference Display During Mastering (see next appendix)

Presentation Display Light

- Appearance compensation is required here, so do it fully in this one spot
- Appearance issues applied (by type) to multiple display types
- Appearance issues within and surrounding frame are compensated
- Appearance compensation yields intended (mastered) appearance

What Is Known, Where Is It Known?

Known At Presentation:

- Presentation display's **capabilities** (brightness range, gamut, bit depth, spectra)
  - known only at a specific display

- Each presentation display's current **settings**
  - known only at a specific display

- Each presentation display's **ambient surround** (level, color, uniformity)
  - known only at a specific display

- These must be compensated to yield the creative intent for appearance

- Viewer's approx. CMF's could be known (at least age, subtended angle)

- Appearance compensation thus needs to be appropriate for specific presentation

- The signal provided to each presentation display must be in a form useful for this ("neutral")

What Is Known, Where Is It Known?

Known At Mastering (also see next appendix):

- Mastering display's **capabilities** (brightness range, gamut, bit depth)
- Mastering display's current **settings**, should be at known "detent" (i.e. set to a calibration)
- Mastering display's **ambient surround** (level, color, uniformity)
- Person(s) setting the look, and what are their actual CMF's or generic for their age and that size screen
- Primary emission spectra of mastering display(s)
- Mastered at multiple facilities?
- More than one reference display type used during rendering/mastering?
- ***Creative intent*** defined during mastering using mastering display(s)
- Scene-referred input (synthetic and/or camera raw, usually graded)
- ***Neutral form*** enables distribution to heterogeneous presentation displays (and surrounds)

Appendix

Using Mastering Display(s)

There Is No "Minimum Gamut/Range" In The PQ/2020 Format

- A mastering display may be limited to 1000nits and P3 gamut
  - even though PQ goes to 10,000nits,
  - even though the gamut goes all the way to spectrum locus in BT.2020

- During mastering in this way, some pixel values are not accurately seen
  - out of display gamut clipped (in some undefined way) to P3
  - out of display range clipped (in some undefined way) to 1000nits

- DCinema defined with P3 as a "minimum gamut"
  - All colors accurately visible and distinct within P3 during mastering

- DCinema defined with 14fl/48nit brightness maximum
  - All brightnesses visible during mastering, and during presentation
  - Dark surround during mastering and during presentation

- No concept of "minimum gamut" in PQ/2020 during mastering/presentation
  - no consistent range during mastering, no consistent gamut
  - no consistent ambient surround during mastering nor presentation

Signal Format(s) For Monitoring During Mastering

- Need appearance compensation/information for the mastering display(s)
  - ambient surround level(s) during mastering
  - screen subtended angle (affects viewer CMFs)
  - age of key mastering personnel (affects viewer CMFs)
  - individual key personal CMFs if available (to remove individual CMF variation)
  - center of viewing interest (affects CMFs)

- What is graded needs to yield a neutral form
  - not tied to any specific display
  - not limited to the mastering display (unless that is intended)
  - have chosen ACES RGB AP0 as an appropriate neutral form

- Neutral form becomes the input to presentation display appearance compensation
  - must be in a neutral form that is amenable to every target display

- Format “Generic Output Color Space” (GOCS), not limited in gamut nor range

Helpful procedures for HDR display during mastering:

- Test various surround levels (e.g. adjusting onscreen appearance vs. surround brightness, using the methods described here)

- Lift darks by two or three stops to inspect

- Drop brights by two or three stops to inspect

- Inspect HDR composites lifted, darkened, desaturated, and at reduced contrast

- Attempt to inspect every mastered pixel value within display's range/gamut

- Alternatively, put mastering display into a mode where every pixel value is visibly distinct, and limit the master to that range/gamut

  - e.g. P3 gamut 10/12bit gamma 2.6 w/small range/gamut edge margin

  - Not sure how to obtain a neutral form (e.g. scene-referred) doing this

Multiple Simultaneous Monitors And Backgrounds During Mastering

- Small (e.g. 30”), medium (e.g. 55”), large (e.g. 75”) simultaneously?
- Bright and dark surrounds simultaneously?
- ND filter(s) that can be optionally placed over the face of the display
- Multiple sets of emission spectra
- Multiple numbers of primaries
  (e.g. one or more displays with more than the RGB three)
- At least one display with excellent dark color and detail
  (e.g. OLED)
- At least one display at or near maximum intended brightness
- Multiple representative viewer CMFs (e.g. different ages)

Appendix

Distribution Codec

What Device-Independent Image Format Is Distributed?

Floating Point:

- Can use a floating-point codec (as shown in innovation zone demonstration)

- Core rendering tone-curve “nugget” process is fixed and invertible
  - SMPTE Oct2017 presentation with Doug Walker
  - input side is scene-referred linear light
  - output side is generic display-referred linear light (not display specific)
  - invertibility allows interoperation of both sides

- Direct use of ACES AP0 RGB with nugget process unlimited in gamut and range

What Device-Independent Image Format Is Distributed?

Integers:

- Can convert floats to log, quasi-log, and other useful integer formats
  - PQ/2020 (although interpreted differently)
  - ACES_AP0_integer quasi-log and similar (probably best approach)
- Integers will inherently have bit-depth and range limits
- Integers could be used with existing HEVC codec for distribution
- Will still need new processing after decoding

  (using parameters corresponding to each display's properties and surround)
- Such new processing is becoming feasible

ACES_AP0_integer

Developed in Adv Imaging Committee of ASC MITC, as proposed by Josh Pines:

```
/* convert to ACES_AP0_INTEGER function as used in ACEScct as described in
 ACES document S-2016-001 (for floating point), range 0.0 to 1.0 */
    if (red <= 0.0078125f) { /* quasi-log slope-matched linear dark toe */
      red = MAX(0.0f, 10.5402377416545f * red + 0.0729055341958355f);
    } else { /* > 0.0078125f */
      red = MIN(1.0f, (9.72f + log2f(red)) / 17.52f); /* logarithmic */
    } /* then green, then blue, then scale up to 1023 or 4095 integer */

/* convert from ACES_AP0_INTEGER function as used in ACEScct as described in
  ACES document S-2016-001 (for floating point), range 0.0 to 1.0 */
/* first divide integer by 1023.0 or 4095.0 */
    if (red <= 0.155251141552511f) {
      red = (red -  0.0729055341958355f) / 10.5402377416545f; /* linear */
    } else { /* > 0.155251141552511f */
      red = powf(2.0f, red * 17.52f - 9.72f); /* anti-log (exponent) */
    } /* then green, then blue */
```

-.006917 -> 0, 0

0.0 -> 299, 74

0.18 -> 918, 229

1.0 -> 2272, 568

8.0 -> 2974, 743

64.0 -> 3673, 918

222.9 -> 4095, 1023

What Device-Independent Image Format Is Distributed?

Which Side of the Nugget Tone-Curve Process?

- Either side of the nugget can be distributed if floating point

- Input side is scene-referred, and linear with respect to spatial filtering

- Output side is display referred, and is no longer linear for filtering

- Output side is, however, suitable for color matrices and other color processing, since the linear relative ratios of R, G, and B are intact through the nugget tone-curve process

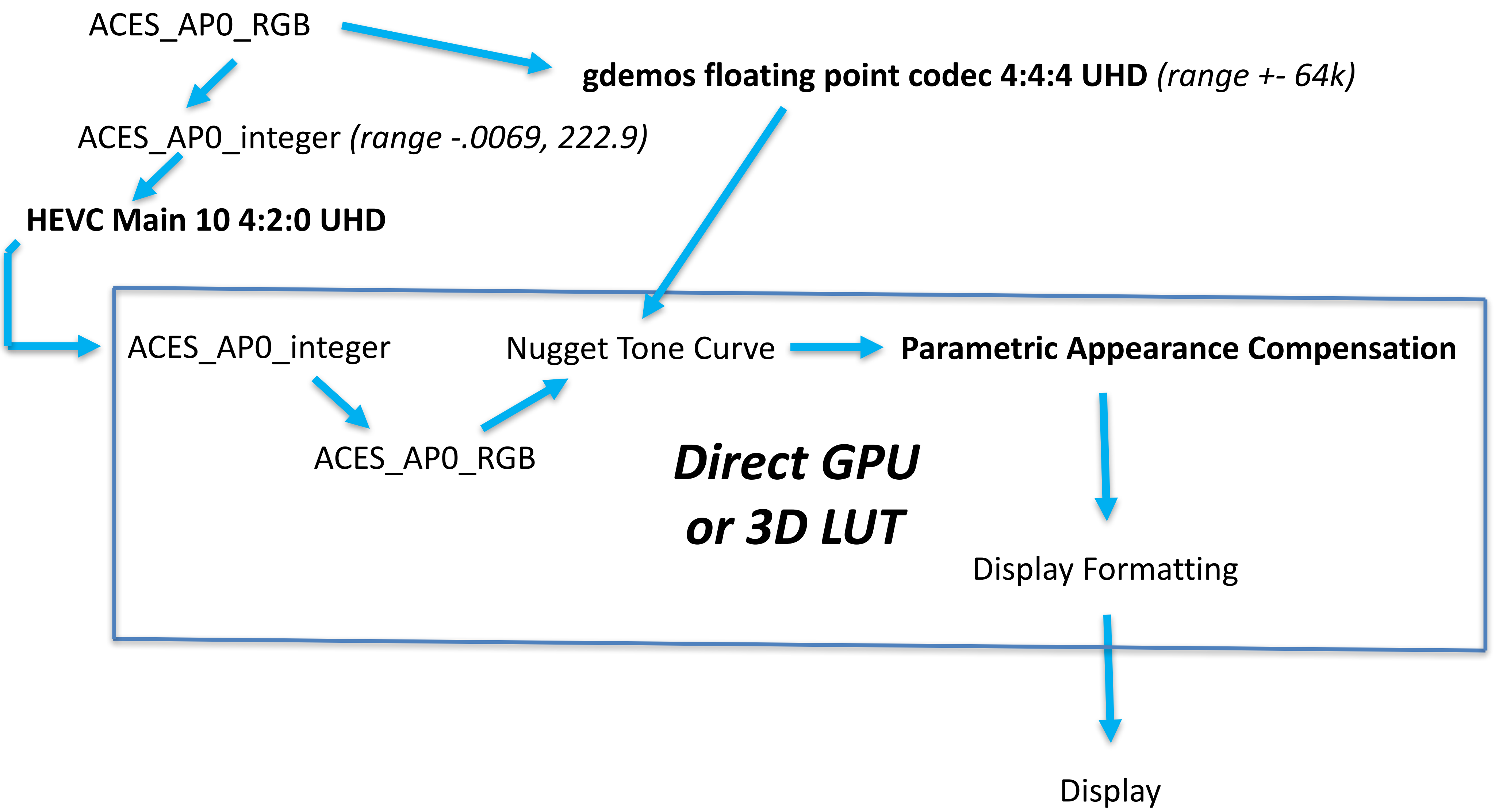
- Invertibility takes the pressure off which side for floating point, but the input side is more physically true, and therefore is inherently more broadly useful

- Quasi-log integers such as ACES_AP0_integer should work on either side

What Device-Independent Image Format Is Distributed?

Assume It Gets There:

- HDR requires a wide-range signal to be distributed
- Let's assume that some form of our wide-range signal gets to every display
- Let's assume that we can turn the decoded image into
    - wide-range floating point, even if an integer codec is used for distribution
    - input to a loadable 3D LUT
- Then we are ready for presentation with appearance compensation


ACES_AP0_RGB
gdemos floating point codec 4:4:4 UHD (range +- 64k)
ACES_AP0_integer (range -.0069, 222.9)
HEVC Main 10 4:2:0 UHD
ACES_AP0_integer
Nugget Tone Curve
Parametric Appearance Compensation
ACES_AP0_RGB
Direct GPU
or 3D LUT
Display Formatting
Display

Input: ACES_AP0_integer

↓

33x33x33 LUTs:

ACES_AP0_INTEGER_3D_LUT_1000NITS_BRIGHT_SURROUND_D60onD65_pt3_2pt2_1_pt75_1.txt
ACES_AP0_INTEGER_3D_LUT_1000NITS_BRIGHT_SURROUND_pt3_2pt2_0_pt75_1.txt
ACES_AP0_INTEGER_3D_LUT_1000NITS_DIM_SURROUND_D60onD65_pt15_2pt2_1_1pt0_1.txt
ACES_AP0_INTEGER_3D_LUT_1000NITS_DIM_SURROUND_pt15_2pt2_0_1pt0_1.txt
ACES_AP0_INTEGER_3D_LUT_250NITS_BRIGHT_SURROUND_D60onD65_pt8_2pt2_1_pt2_1.txt
ACES_AP0_INTEGER_3D_LUT_250NITS_BRIGHT_SURROUND_pt8_2pt2_0_pt2_1.txt
ACES_AP0_INTEGER_3D_LUT_250NITS_DIM_SURROUND_D60onD65_pt5_2pt2_1_pt5_1.txt
ACES_AP0_INTEGER_3D_LUT_250NITS_DIM_SURROUND_pt5_2pt2_0_pt5_1.txt
ACES_AP0_INTEGER_3D_LUT_500NITS_BRIGHT_SURROUND_D60onD65_pt5_2pt2_1_pt5_1.txt
ACES_AP0_INTEGER_3D_LUT_500NITS_BRIGHT_SURROUND_pt5_2pt2_0_pt5_1.txt
ACES_AP0_INTEGER_3D_LUT_500NITS_DIM_SURROUND_D60onD65_pt3_2pt2_1_pt75_1.txt
ACES_AP0_INTEGER_3D_LUT_500NITS_DIM_SURROUND_pt3_2pt2_0_pt75_1.txt

↓

Output: P3 gamma 2.2 12-bit RGB

Appendix

Demonstrations

Demonstrations

- JKP 8-bit test patterns (note: black level, P3 gamut)
- JKP HDR test patterns (note: 10bit 444 RGB shallow ramps)
- aces_still_frame_collage (interactive demonstration, no one-size-fits-all look)
- aces_baked_hdr comparison full vs aces_1.0.2

Demonstrations (continued)

- Alexa Swordplay (dark detail, spectral color for RGBW 2deg and 10deg)
- NASA/IMAX indoor (HDR bright and dark range, detail)
- NASA/IMAX outdoor (detail and color)
- NASA/IMAX outdoor raw balance (greenish default, onscreen neutral to correct)
- JKP Venice (ambient surround compensation)
- NASA Soyuz launch (highlight color behavior)
- ICAS ACES v0.7 grade vs original w/full (no look bias other than creative intent)
- ICAS diner, ICAS night
- ICAS 1stop ND left (brightness compensation)

Demonstrations (continued)

- Primes Timelapse (dark detail, neon, spectral color for RGBW 2deg and 10deg)
- JKP Europe (spectral color for RGBW 2deg and 10deg)
- JKP Alps (detail, color, grandeur)
- JKP Venice (detail, subtle color)
- JKP LV_Strip Nikon D810 (dark detail, neon detail, spectral color for RGBW 2deg and 10deg)
- JKP LV_Strip 2018 , new Nikon D850
- Sony NYC Stadium, Liberty, Sunset (dark detail, scene detail, color, grandeur)
- ASC MITC UHD w/Adv Img test of ACES_AP0_integer, Cat_MacBeth and Armor_Glass
  - Floating point codec and live GPU adjustable appearance compensation
  - On LG O18 65” with HEVC in-set decode and 33-cubed selectable LUTs for appearance

<End>