VQCB

VideoQ Color Bars

Test Patterns Suite

VQL – VideoQ Test Patterns Library

Training Presentation

December 2024

videoq.com/vqcb.html

videoq.com

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*Click on **VQL Logo** in the upper-left corner of any slide for **Table Of Contents 2***

Table of Contents 2

1. VQCB Suite – General Information

- Video data **analysis** and **fidelity verification** tool for modern **mixed formats** environments
- Easy-to-use tool, instantly revealing your video device / system / workflow **performance**
- VQCB tests can be used for **visual estimation** and/or **instrumental** and **automated** analysis
- They are useful when **streaming** in multiple formats or when **converting** between formats
- **BT.2111, BT.2100, BT.2020, BT.709, SMPTE 431 DCI-P3** compliant tests
- VQCB suite includes combinations of:
- 3 frame sizes: **HD, 4K UHD, 8K UHD**
- 3 dynamic range modes: **HDR-PQ, HDR-HLG, SDR**
- 4 color spaces: **RGB FR, RGB NR, YUV NR BT.2020, YUV NR BT.709**

- Each media file is produced by a **lossless**, variable bitrate encoder
- With a VQCB test you can instantly check that the video circuit is **active** and **audio** is **in sync**

2. Challenge and Solution

Nowadays, moving color images are encountered nearly everywhere, not only in broadcast TV.

With the massive increase of volumes of hardware items and video related software, the strict rules established for the broadcast TV are not always recognized.

The major effort in capturing, delivering, and rendering of high-quality moving images demands the guidance and commonly accepted rules.

This affects camera manufacturers, display manufactures, cloud transcoding, telecom, video conference services providers, content originators, digital cinema systems, even the old movies de-archiving.

The solution is in establishing easy-to-use and straightforward rules and matching tools, such as further derivatives of the ubiquitous **Color Bars Test Pattern**.

The long history of broadcast TV demonstrates the path from the usage of physical reflectance test charts to the extremely successful practice of using color bars test patterns to check, calibrate and ensure reliable exchange of video images on a global scale.

VideoQ has been active in standards and test patterns creation, so we published and released the calibrated **V**ideo**Q** **C**olor **B**ars (**VQCB**) test tools suite that meet this challenge. *The best way to reliable QA is via reliable QC!*

3. Applications

VQCB is the picture quality control, calibration and verification tool for general public, video installers, hardware and software developers, video development labs, production, post-production and content distribution facilities in the fields of:

- Broadcast TV
- Consumer Electronics
- Video Transcoding
- Video Data Compression
- Digital Cinema
- Home Theatres
- IPTV, CDN, VOD, OTT
- Cloud video processing, transcoding and streaming

VQCB tests are useful when broadcasting in multiple formats or when converting between formats. They can simplify test procedures and reduce the opportunity for misinterpretation of signal parameters and misalignment of systems.
They are also useful for establishing that a video circuit is active, and associated audio is available.

4. VQCB HDR-PQ Test Composition

Peak White
100%, 10,000 nit

100% Bars

58% Bars
for Color Calibration

40% Gray Side Panels may contain text messages about video and audio parameters plus customizable info

Reference White
58%, 200 nit

Grayscale

Full Range Ramp

BT.709 Bars mapped to BT.2020

BT.709 Bars mapped to BT.2020

0% -2% +2% +4% 0%
NR PLUGE
or
0% 0% +2% +4% 0%
FR PLUGE

Reference White
58%, 200 nit

Reference Black
0%, 0 nit

5. VQCB HDR-HLG Test Composition

Peak White
1,000 nit, 100% LL

100% Bars

75% Bars
for Color Calibration

40% Gray Side Panels may contain text messages about video and audio parameters plus customizable info

Reference White:
75%, 200 nit, 20% LL

Grayscale

Full Range Ramp

BT/709 Bars mapped to BT.2020

BT.709 Bars mapped to BT.2020

0% -2% +2% +4% 0%
NR PLUGE

Reference White:
75%, 200 nit, 20% LL

Reference Black
0% LL

6. VQCB SDR Test Composition

Reference White
100%, 100% LL

100% Bars

75% Bars
for Color Calibration

40% Gray Side Panels may contain text messages about video and audio parameters plus customizable info

Reference Gray
75%, 50% LL

Grayscale

Full Range Ramp

BT.709 Bars mapped to BT.2020
present only in BT.2020 versions

BT.709 Bars mapped to BT.2020
present only in BT.2020 versions

0% -2% +2% +4% 0%
NR PLUGE
or
0% 0% +2% +4% 0%
FR PLUGE

Reference Gray
75%, 50% LL

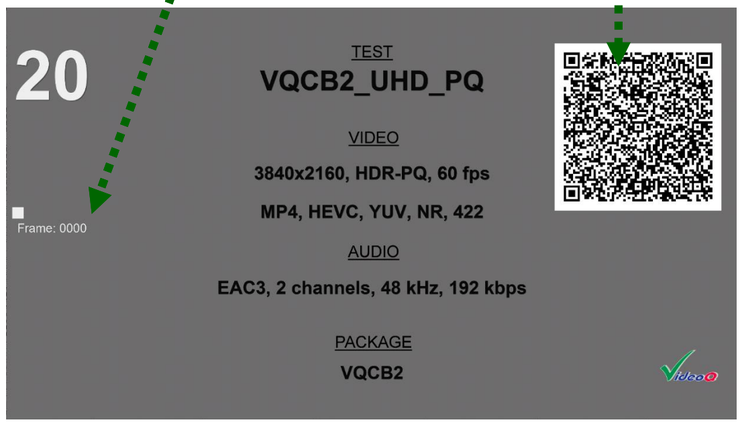
Reference Black
0%, 0% LL

7. VQCB Media File Timeline Segments

VQCB sequence is suitable for automated repetitive lab testing. The sequence consists of three segments:

- 0s~10s: **Text Box** containing all test pattern details and machine-readable **QR Code**,
- 10s~18s: **Color Bars** test pattern,
- 18s~20s: **Black**.

Frames Counter **QR Code**

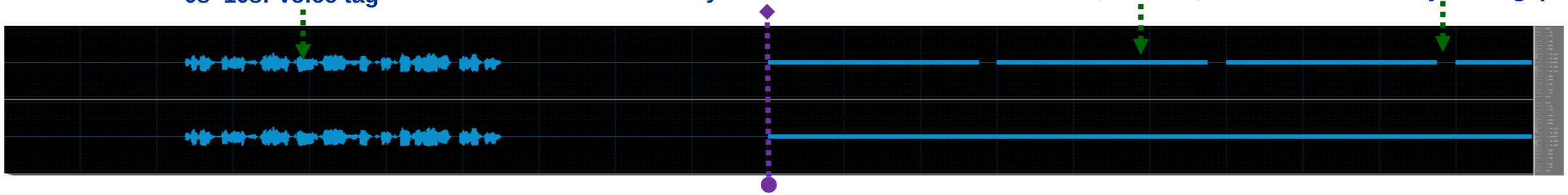


Placeholder for Info and optional Logo

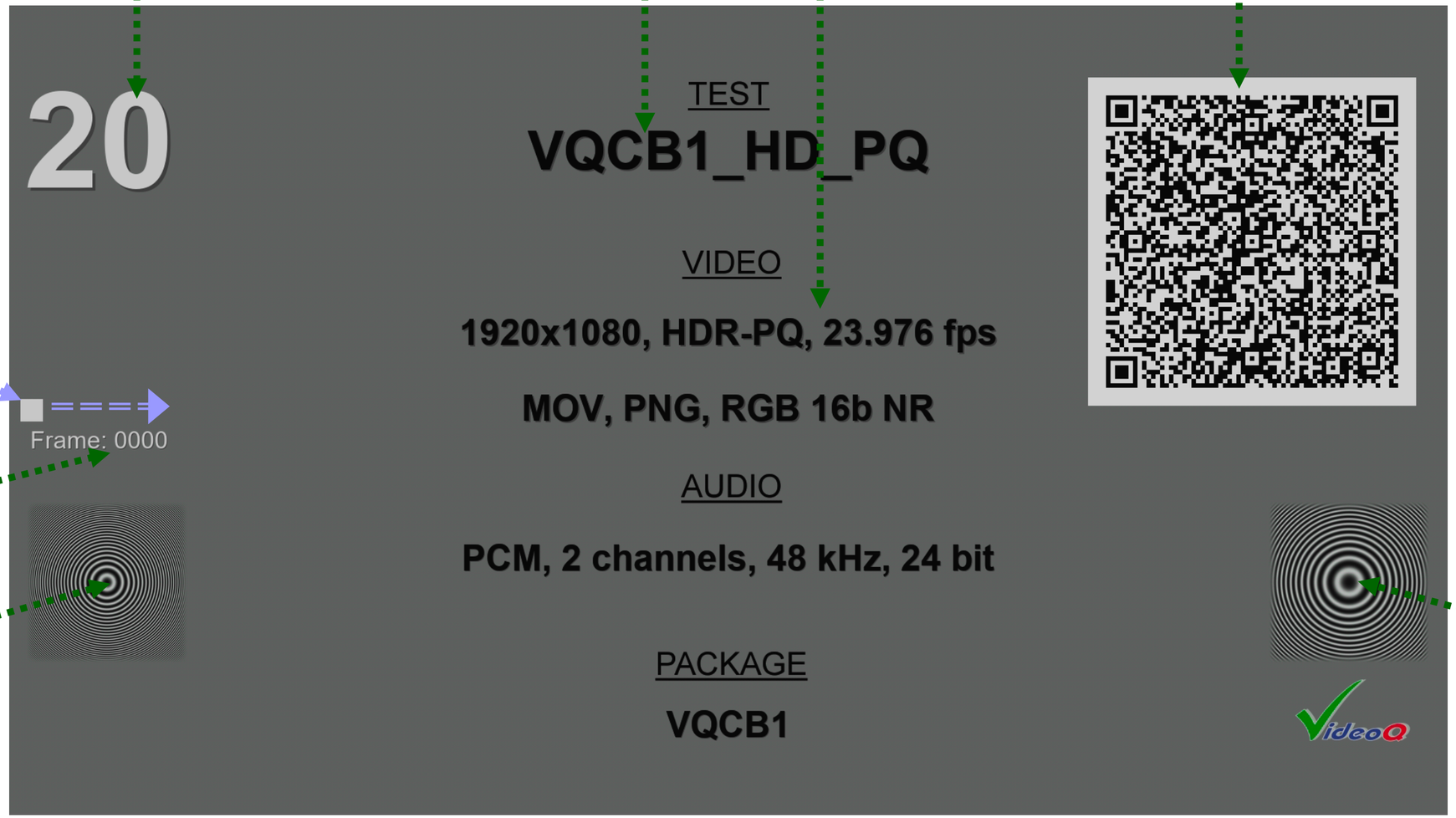
20s Count-down

Optional audio stream composition (LR stereo, 48kHz, PCM 24b or AC3 192kbps):

0s~10s: Voice tag **AV Sync: 0ms** **10s~20s: 1kHz tone, -23dBfs, L channel marked by 0.25s gaps**



8. VQCB Text Box Example



9. VQCB Test Usage Example 1

Hundreds of test sequences have been encoded and used in the consumer devices extensive lab testing.

20s long VQCB leader

…

12min long feature film

20s long **VQCB** test was used as a “**reference leader**” concatenated with the main 12min long movie.

VideoQ encoded this sequence in a variety of formats:

- Frame rates: from **23.976**fps to **120**fps
- Frame sizes and dynamic range versions: **HD** and **UHD**, **HDR10** and **SDR**, **8**bit, **10**bit and **12**bit
- Video codecs: **DoVi**, **H.265**, **VP9**, **AV1**, **VVC**
- Video bitrates: from **6**Mbps to **100**Mbps
- Audio codecs: **AC-3** 2.0 and 5.1, **Atmos** 5.1.4, **DTS-X** 7.1.4, **48**kHz, **96**kHz and **192**kHz sampling rates
- Audio bitrates: from **128**kbps to **1344**kbps

Special attention was given to the insertion of correct metadata and providing the specified bitrates.

Presence of **QR codes** in the VQCB leaders provided for easy handling and analysis of test results data.

10. VQCB Test Usage Example 2

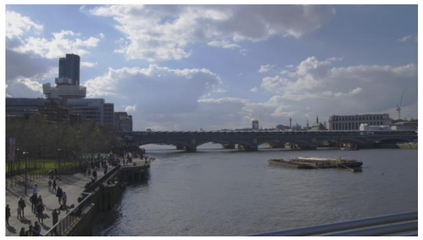
VQCB test is included in 13s long “**reference leader**” concatenated with the main 5min long **test clip**.
The clip was specially created for **International Electrotechnical Commission** standard **IEC 62087-2**:
Audio, video, and related equipment - Determination of power consumption - Part 2: Signals and media.

All models of TV sets should be tested **worldwide** in accordance with the IEC 62087-2 standard**.**

IEC 3s Text Box + 10s VQCB = 13s leader

…

5min long special power consumption test clip



VideoQ encoded this sequence in a variety of formats:

- Frame rates: from **23.976**fps to **59.94**fps
- Frame sizes and dynamic range versions: **UHD**, **HD**, and **SD**, **HDR10, HLG**, and **SDR**, **10**bit and **8**bit
- Video codec: **HEVC**
- Video bitrates: from **9.5**Mbps to **75**Mbps
- Audio codec: **AAC LC** 2.0, sampling rate **48**kHz
- Audio bitrate: **128**kbps

11. VQCB Test Suite Packages

- VQCB suite includes **5 pre-packed sets** of media files; each set aimed at specific field of application:
  - **VQCB8K**: 8K UHD High-end Production and Post-production
  - **VQCB1**: UHD and HD Production and Post-production
  - **VQCB2**: UHD and HD Contribution and Distribution
  - **VQCB2HD**: HD Transcoding and Distribution
  - **VQCB4**: Special Video & DCI Post-production
- Set of **5 VQCB packages** consists of **378** media files/folders
- For a given dynamic range format each sub-set includes 8 variants with different **frame rates**:
  - 23.976, 24, 25, 29.97, 30, 50, 59.94 and 60 fps. *VQCB4: only 23.976 fps*.

12. Standard Packages of VQCB Media Files

VQCB suite includes **4 pre-packed sets** of media files; each set aimed at specific field of application

Package Code Name	VQCB8K	VQCB1		VQCB2		VQCB2HD
Typical Application	High-end Production and Post-production	Production, Post-production		Contribution, Distribution		Transcoding, Distribution
Frame Size	8K	UHD	HD	UHD	HD	HD
Container	MOV	MOV		MP4		MP4
Codec	PNG	PNG, JPEG2K		HEVC		HEVC, AVC
Sampling & Bit Depth	444, 48bpp, 16bpc	444, 48bpp, 16bpc		444, 10bpc		422, 10bpc
RGB, Full & Narrow Range	✓	✓	✓			
YUV, Narrow Range		✓	✓	✓	✓	✓
Media Files Count	48	144		48		48

*Each media file is produced by a **lossless**, **variable bitrate** encoder. Other formats are available upon request for an additional fee.*

*For a given **frame size** each package includes **3 sub-sets** of media files of 3 different **dynamic range** formats: **HDR-PQ**, **HDR-HLG** and **SDR**.*

*For a given **dynamic range** format **each** sub-set includes **8 variants** with different **frame rates**: 23.976, 24, 25, 29.97, 30, 50, 59.94 and 60 fps.*

13. VQCB Test Suite Video Formats

Four standard packages of VQCB suite includes 26 different **combinations** of

- 3 **frame sizes**,
- 3 **dynamic range** modes,
- 4 **color spaces**

	HDR-PQ			HDR-HLG			SDR		
	8K	UHD	HD	8K	UHD	HD	8K	UHD	HD
RGB Full Range	✓	✓	✓				✓	✓	✓
RGB Narrow Range	✓	✓	✓	✓	✓	✓	✓	✓	✓
YUV Narrow Range BT.2020	✓	✓	✓	✓	✓	✓	✓	✓	1)
YUV Narrow Range BT.709								2)	✓

1) Non-standard, but often used, version, e.g. for UHD originated content down-scaled to HD

2) Non-standard seldom used version, e.g. for HD originated content up-scaled to UHD

Special frame sizes, e.g. down-scaled 960x540, are available on request

14. VQCB4 – Special Post-production Test Suite

- All **VQCB4** tests have the **same layout**, consisting of 5 horizontal bands *)
- Test Patterns **pixel positions**: as by **BT.2111** standard *)
- **Sequence duration**: **2020 ms**
- **Frame rate**: **23.976 fps**
- **Frame sizes**: 1**920x1080** (HD) and **3840x2160** (UHD)
- **Dynamic range** and **color components** formats:
    - **SDR**: YUV Narrow Range, RGB Narrow Range, RGB Full Range
    - **HDR-PQ**: YUV Narrow Range, RGB Narrow Range, RGB Full Range
    - **HDR-HLG**: YUV Narrow Range, RGB Narrow Range
- **Color components**, **lossless** video compression **codecs,** and **container** combinations:
    - **YUV** 444 16bpc: **JPEG2000 encoded** video frames in **.MOV container** *and* numbered %08d **.J2K frames** in a **folder**
    - **RGB** 444 16bpc: **PNG encoded** video frames in **.MOV container**, numbered %08d **.PNG** *and* %08d **.TIFF frames** in two **folders**
- **File set**, total **90** RAR archive files:
    - **56 RAR archives**, each archive contains a **folder** with **480** numbered **image files**
    - **34 RAR archives**, each archive contains one **MOV video file**
- Three **separate side-car audio files**: WAV, 48kHz, PCM 24b, 2020 ms, **2.0**, **5.1** and **7.1** variants
- Each **MOV** file contains one **embedded audio stream**: 48kHz, PCM 24b, 2020 ms, **2.0**

*) ***Except special DCI-P3 variants***

15. VQCB4 Test Suite Video Data Formats

VQCB4 suite *(special post-production version)* includes **34 *valid* combinations** of

- 2 frame sizes: **UHD** and **HD**
- 3 dynamic range types: **HDR-PQ**, **HDR-HLG** and **SDR**
  - **HDR-PQ** set is further divided into 2 sub-sets for **2 Target Primaries**:
    - **BT.2020** aka Wide Color Gamut (*also compliant with BT.2111*)
    - **DCI-P3** aka Expanded Color Gamut, further divided into 3 sub-sets:
      - **DCI-P3-D65**, Test Pattern Layout, D65 White Point and Light Levels Range as by **BT.2111** (*only the BT.709 bars components are different*)
      - **DCI-P3-D60-D61-200**, special “greenish” D60-D61 White Bar, Light Levels Range limited to **200 nit**, **SMPTE RP 431-2**.
      - **DCI-P3-D60-D61-48**, special “greenish” D60-D61 White Bar, Light Levels Range limited to **48 nit**, **SMPTE 431-1**.
- 2 video data ranges: **Narrow Range** (NR) and **Full Range** (FR)
- 2 color components types: **RGB** (NR and FR) and **YUV** (NR)

	HDR-PQ *24 variants*		**HDR-HLG** *4 variants*		**SDR** *6 variants*	
	UHD	**HD**	**UHD**	**HD**	**UHD**	**HD**
RGB Full Range	✓	✓			✓	✓
RGB Narrow Range	✓	✓	✓	✓	✓	✓
YUV Narrow Range BT.2020	✓	✓	✓	✓	✓	
YUV Narrow Range BT.709						✓

16. VQCB Suite Custom Formats

On request VQCB test patterns are available as media files in the following formats:

- Frame size: 15360x8640 (16K), 7680x4320 (8K UHD), 3840x2160 (UHD), 1920x1080 (HD)
- Media file parameters:
  - RAW data, interleaved RGB/YUV components, 4:4:4, 16 bpc, 48 bpp, single frame,
    this format is recommended for advanced users, raw data format is *suitable for any bit depth & frame rate*
  - TIFF and PNG image sequences, RGB 48bpp 16bpc
  - AVI container: r210 and v210 lossless “uncompressed 10 bit” codecs
  - MKV container: FFV1 (RGB and YUV 444 48bpp 16bpc) lossless codec
  - MP4, MOV and WEBM containers: PNG, JPEG2000, HEVC, AVC, VP9, AV1, ProRes – lossless or lossy codecs
  - Seamless loop duration: single frame or N seconds
  - Pixel format: RGB 444, YUV 444, 422 or 420, 16b, 12b or 10 bit per component
  - SDR, HDR-PQ or HDR-HLG metadata embedded – as appropriate
- Frame rate: from 23.976 fps to 240 fps, other frame rates available upon request
- Optional audio streams: 2.0, 5.1 and 7.1, 48 ~ 192 kHz, PCM, AC3, EAC3, and OGG
- **Other** video & audio data formats and codecs are available upon request *for an additional fee*

17. VQCB and VQCBA Analyzer

Video**Q** **C**olor **B**ars **A**nalyzer:

- **Companion program** for **VQCB Wonder Bars™** Test Patterns Suite
- **Applications**: Video production, post-production, transcoding, distribution
- **CLI program** for **on premise** and **cloud** tasks, **Windows** and **Linux** versions
- **Video workflow verification** tool for the 8K / 4K / 2K, HDR / SDR environment
- **Software module** of **V**ideo**Q** **P**roductivity **T**ools suite
- **Easy-to-use tool**, instantly revealing your video device / system / workflow **performance**
- **Unattended automated analysis tool**, suitable for **workstations** and **cloud computing**
- **VQCBA auto-detects** and **process 5 different types** of color bars tests (*see next slide*)
- **Frame sizes**: from **480x270** to **8K UHD**
- **Dynamic range formats**: **HDR-PQ**, **HDR-HLG**, and **SDR**
- **Variety** of **color spaces**, **containers** and **encoding formats**, supported by **ffmpeg**










Learn more about VQCBA: videoq.com/vqcba.html

18. About VideoQ

Customers & Partners

Company History

- Founded in 2005
- Formed by an Engineering Awards winning team sharing between them decades of global video technology.
- VideoQ is a renown player in calibration and benchmarking of Video Processors, Transcoders and Displays, providing tools and technologies instantly revealing artifacts, problems and deficiencies, thus raising the bar in productivity and video quality experience.
- VideoQ products and services cover all aspects of video processing and quality assurance - from visual picture quality estimation and quality control to fully automated processing, utilizing advanced VideoQ algorithms and robotic video quality analyzers, including latest UHD and HDR developments.

Operations

- Headquarters in CA, USA
- Software developers in Silicon Valley and worldwide
- Distributors and partners in several countries
- Sales & support offices in USA, UK

A1. Appendix A: Background Info and Interoperability

Color Bars is the most used **Test Pattern** known for more than 60 years.

It can be used in classic full screen variant and it is also an important component of many other tests.

There are many standard and non-standard variants of this test.

The simplest and oldest color bars variant is a sequence of eight vertical bars of 100% (maximum intensity) colors.

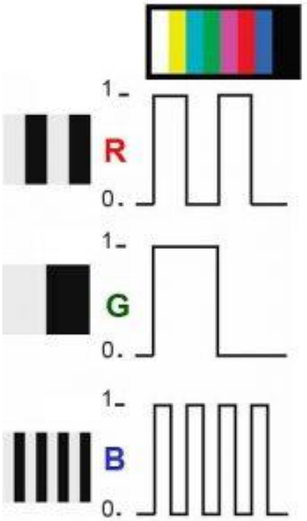
This sequence can be produced in RGB format by a simple 3-bit counter.

The standard color bar sequence is White, Yellow, Cyan, Green, Magenta, Red, Blue, Black.

Six colored bars show 3 Primary Colors – Red, Green, Blue

and 3 Complementary Colors – Cyan, Magenta, Yellow

White and Black bars provide for **Reference White** & **Reference Black** Signal Levels.



The arrival of new **HDR** and **WCG** technologies added new twist to the history of this test. Now we should test not only **RGB** and **YUV** Signal Levels, but also the **Light Levels** (**LL**) of the media files content and rendered images**.**

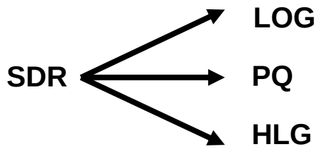
A2. Color Spaces, Data Ranges, and Conversion Options

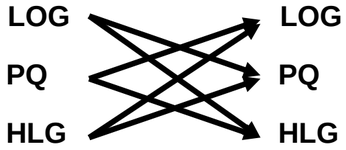
International Telecommunication Union (**ITU**) Recommendation **BT.2020** defines various aspects of ultra-high-definition television (**UHDTV**) with standard dynamic range (**SDR**) and wide color gamut (**WCG**).
It mandates the use of RGB ⇔ YUV Color Space Conversion **BT.2020 Matrices** for the frame sizes greater than HD.
Note that RGB ⇔ YUV conversion in ubiquitous **HD** format relies on significantly different **BT.709 Matrices**.

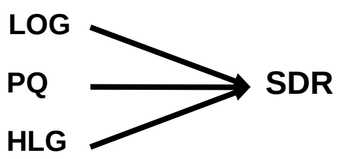
Since the introduction of **BT.601** standard YUV data are generated in **Narrow Range** format (abbreviated as **NR**).
Main advantage of the NR format is the availability of extra levels below **Reference Black** and above **Reference White**.

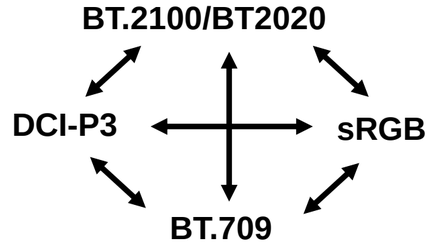
However, the RGB data traditionally used in production and post-production are defined in two formats – **Full Range** format (**FR RGB**, without reserved levels) and **Narrow Range** format (**NR RGB**, similar to NR YUV).
Thus, generic RGB ⇔ YUV conversion workflows should handle FR/NR RGB, NR YUV and BT.2020/BT.709 Matrices.

The **HDR/SDR** conversion processes are even more complicated, note the **Unified Reference White** concept:
videoq.com/hdr_ref_white.html









A3. Color Bars Related Standards

Years ago ITU-R (United Nations agency division) issued Recommendation **BT.471** “Nomenclature and Description of Color Bar Signals”; it covers only **Full Frame Bars** and does not address modern **UHD**, **HDR** and **WCG** issues.

Widely used in several countries multi-band **SMPTE RP219 Bars** (derived from the legacy **SMPTE EG1** Bars) are suitable *only* for **Standard Dynamic Range** (**SDR**) **YUV** formats.

The HDR and WCG issues are mostly covered by ITU-R Recommendation **BT.2111** “Specification of colour bar test pattern for high dynamic range television systems”: https://www.itu.int/rec/R-REC-BT.2111/en

However, the Recommendation BT.2111 specifies the reference test patterns *only* for the **High Dynamic Range** (**HDR**) television systems specified in ITU-R Recommendation **BT.2100**.
This means that currently there is no *officially recommended* Color Bars Test Patterns matching BT.2111 and suitable for widely used **Standard Dynamic Range** workflows in mixed RGB/YUV, UHD/HD and WCG formats.

VideoQ has filled this gap by developing the suite of Color Bars Test Patterns, which includes all **BT.2111 HDR** variants ***as well as*** the newly developed **SDR** variants for the **BT.2020** Color Space ***and*** traditional **BT.709** Color Space.
NB: By some obscure reasons the BT.709 color space was labeled by marketing people as “Narrow Color Gamut”.

The layout, data levels and appearance of the SDR variants of **VQCB** test pattern suite are similar to the HDR variants, which makes much easier the usage of the whole VQCB suite in modern mixed formats environments.

A4. VQCB and other Color Bars Test Patterns

Below is the list of 5 color bars types (with optional audio components):

- **VideoQ VQCB** - dynamic **AV** test patterns: **HDR-PQ**, **HDR-HLG**, **SDR**
  - recommended for the most comprehensive test results, ITU BT.2111 compliant

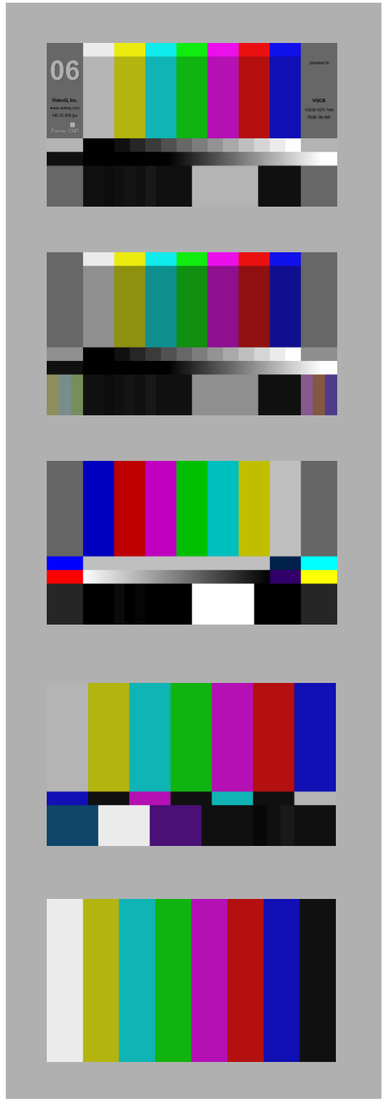
- **ITU BT.2111 HDR-PQ** and **HDR-HLG** color bars test patterns
  *- fully specified, but not yet widely used test patterns, note the absence of **SDR** version*

- **SMPTE RP219**
  *- widely used **SDR** test pattern, **not compatible** with ITU BT.2111 **HDR** bars*

- **SMPTE EG1**
  *- legacy **SDR SD** test pattern, designed for **analog composite NTSC** workflows*

- **Full-frame color bars**
  *- the **oldest** and the **most common** video test pattern*

This tool is simple and convenient, but it may not be the best fit for modern video workflows.



A5. VQCB Tests Interoperability

- All VideoQ Color Bars (VQCB) tests have the **same layout**, consisting of **5 horizontal bands**
- VQCB Test Patterns **pixel positions** strictly match the positions specified in **BT.2111** standard
- RGB and YUV **data levels** are calculated and provided with **16 bpc** (bits per component), i.e. **48 bpp** (bits per pixel), **accuracy**
  For practical usage they may be rounded to **12, 10**, or **8 bit** by appropriate software or hardware devices, e.g. codecs
- Full Range and Narrow Range **RGB data levels** strictly match the **12 bit** values of the **BT.2111** standard tables
- The RGB levels of **SDR** tests are **exact copies** of the **BT.2111 HDR-HLG** test levels, except the **BT.709 Bars**, located in the bottom band
- The SDR tests **BT.709 Bars** RGB levels are calculated with maximal precision using the color space conversion matrices and an assumed SDR display “EOTF model”
- **YUV data levels** (*not specified by BT.2111 standard*) are derived from 16 bit RGB levels with 16 bit accuracy in YUV 444 format
- VQCB tests may contain **customizable texts** within left and right Grey panels, indicating 8K/UHD/HD frame size, HDR/SDR, RGB/YUV, FR/NR and Color Matrix info. Optionally they may contain test originator info and details of the audio stream(s)
  Recommendation BT.2111: “It is desirable that implementers should include in this test signal some visual identification of the signal format (HLG narrow range, PQ narrow range, or PQ full range). The test pattern includes grey bars (top right and top left) that may optionally be used for this and/or other purposes.”

B1. Appendix B: Advanced Analysis Examples

This section provides more details about VQCB test sessions scenarios,
VideoQ software tools usage examples and test patterns features.

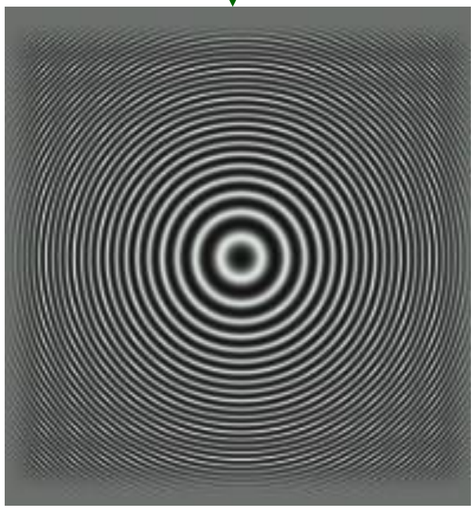
The screenshots and measurement results shown in this section are taken from VideoQ **VQV** – Media Files Viewer-Analyzer:

videoq.com/vqv.html

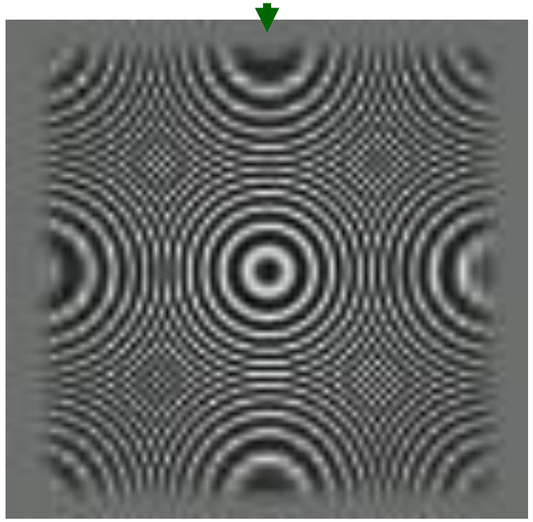
B2. Text Box Zone Plate Test Usage

Player window size scaling distortions:

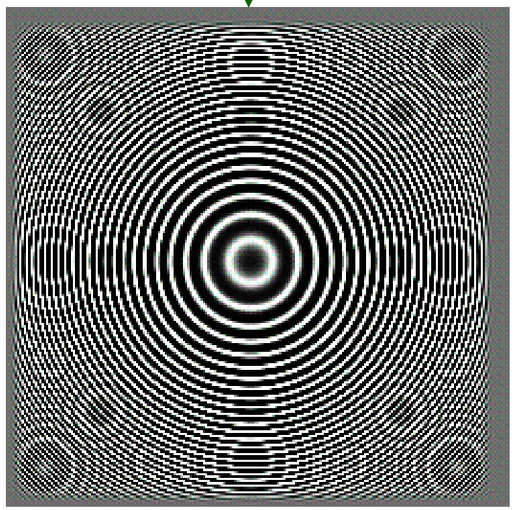
“Banding”



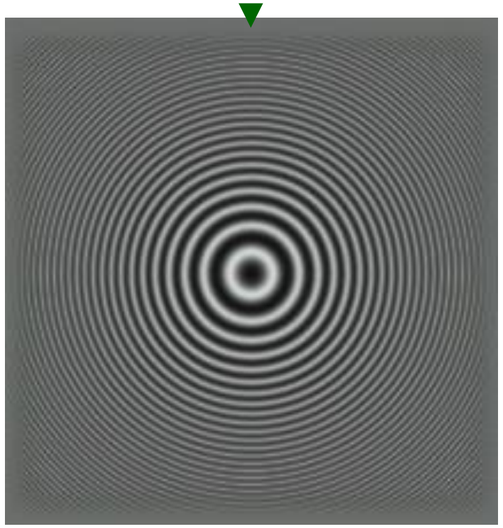
“Beating”



Display over-enhancement



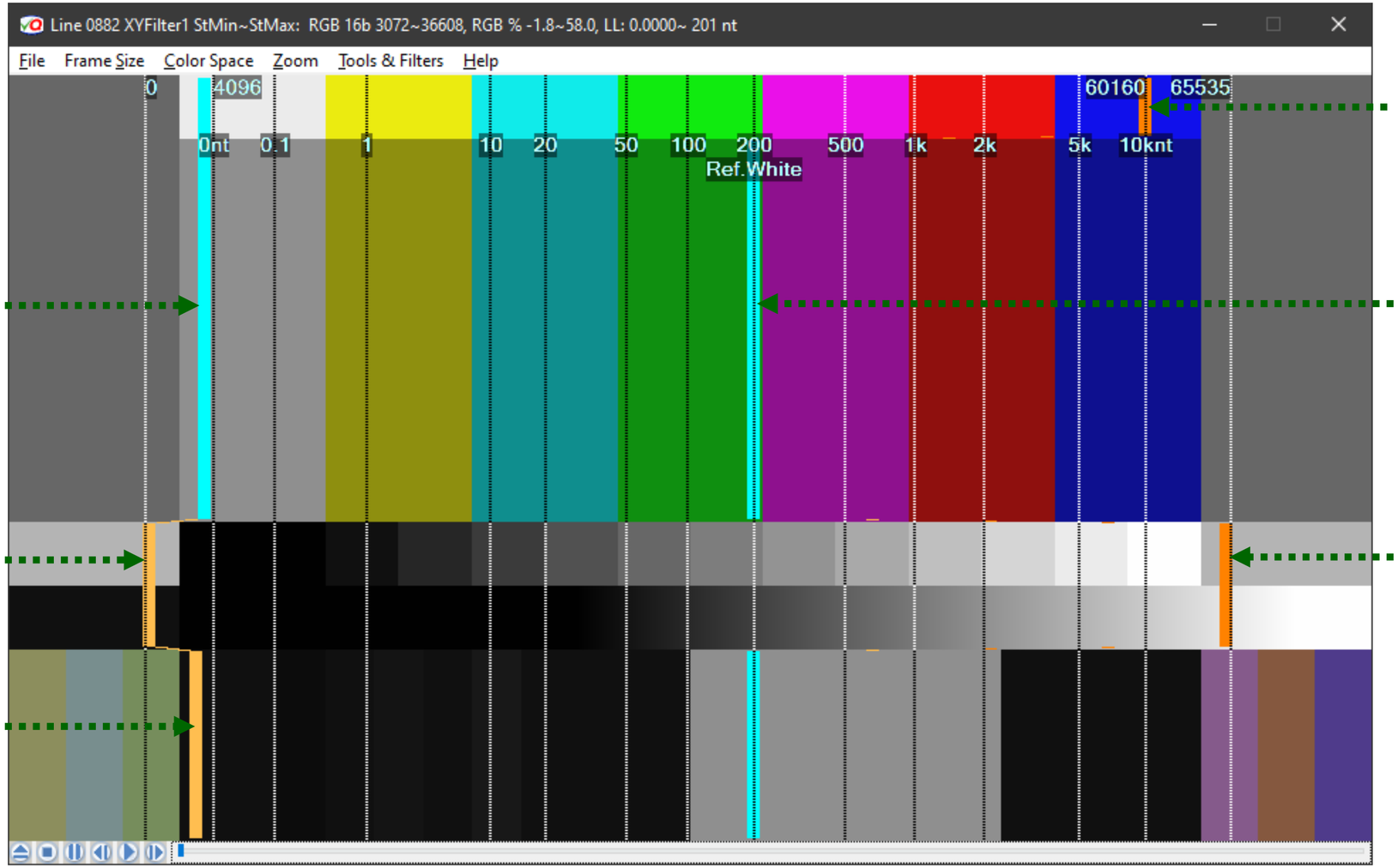
Frame size reduction



B3. VQCB HDR-PQ Test and VQV FrameScope

All data levels (Narrow Range HDR-PQ levels) are compliant with BT.2111 standard

HDR-PQ Mode: **VQV Graticule Units** auto-switched to **nits**, **VQV title bar** shows actual **16b values range** for the currently selected line.



100% Bars & 58% Bars
Min Level: 16b **4096**
12b 256, **10b 64**
0% ⇔ LL **0**nt

Grayscale & Ramp
Min Level: 16b 252
12b 16, **10b 4**
-6.8%

PLUGE
Min Level: 16b 3072
12b 192, 10b 48
-1.8%

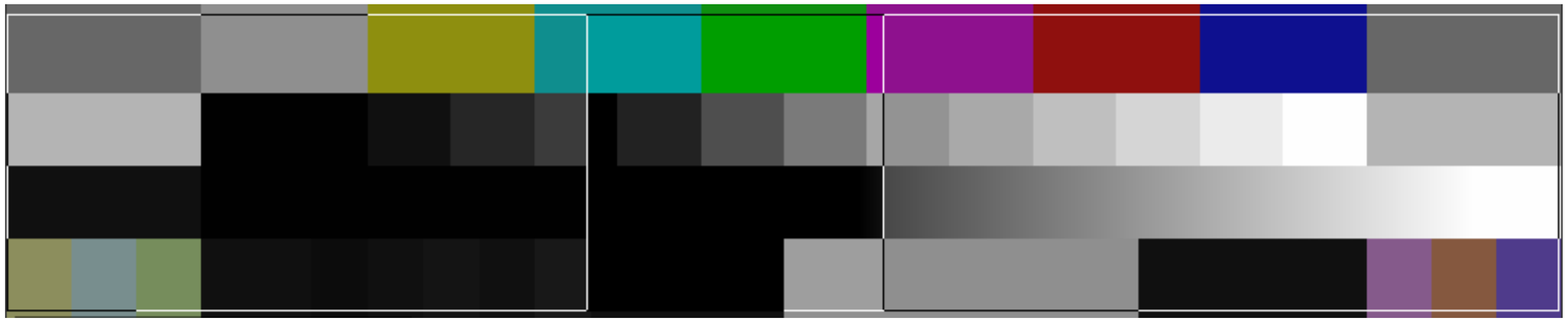
100% Bars
Max Level: **16b 60160**
12b 3760, **10b 940**
100% ⇔ **LL 10,000nt**
Peak White

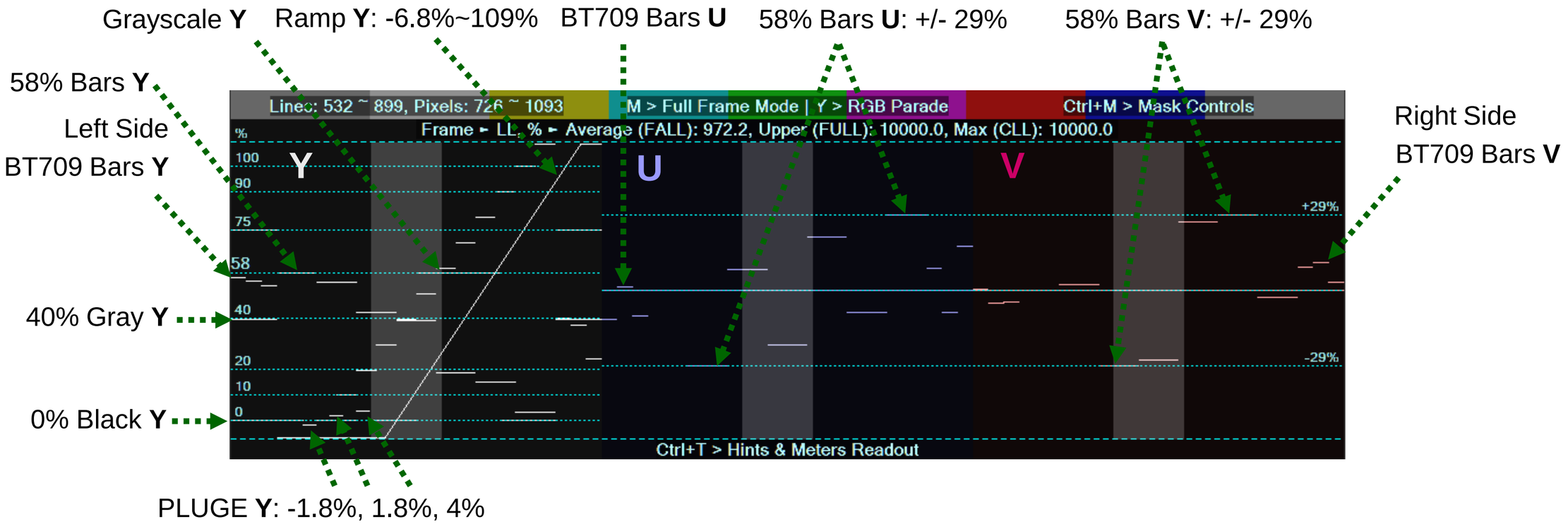
58% Bars
Max Level: **16b 36608**
12b 2288, **10b 572**
58% ⇔ **LL 201nt**
Reference White

Grayscale & Ramp
Max Level: 16b **65024**
12b 4064, **10b 1016**
109%

B4. HDR-PQ YUV Levels on VQV Waveform Monitor

User-selected Waveform Monitor Analysis Area: Lines Range & Pixels Highlight Mask





B5. Checking RGB Data Range with VQV VectorScope

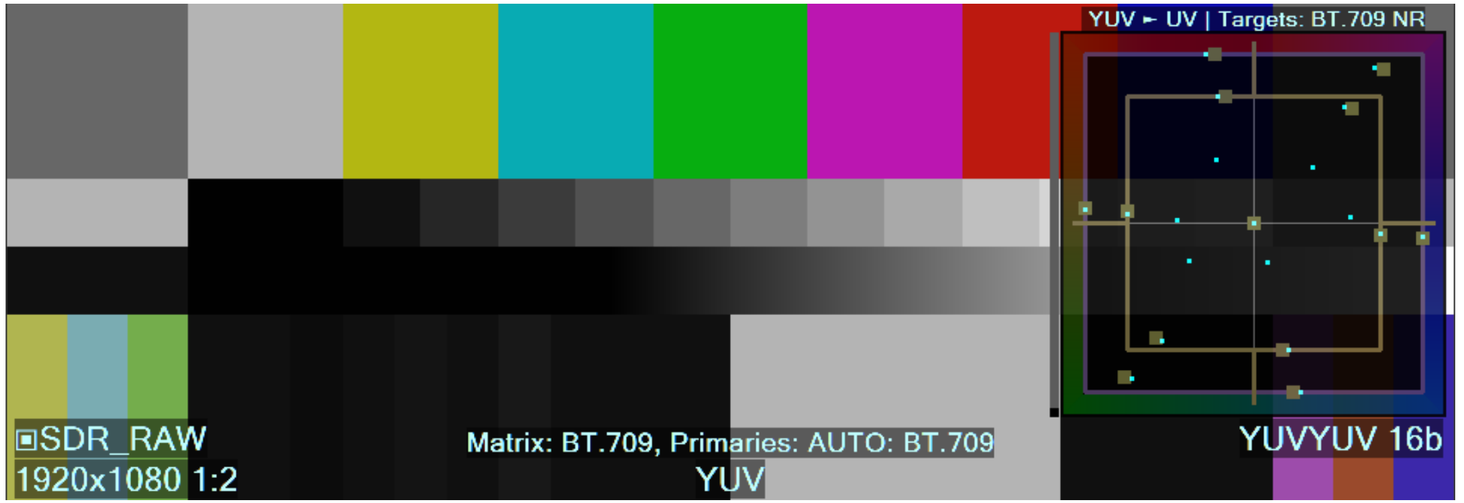
SDR FR RGB data correctly specified as FR

SDR FR RGB data incorrectly specified as NR

B6. Checking Color Matrix with VQV VectorScope

HD file metadata correctly specify Color Matrix as BT.2020 *(probably, due to the down-conversion from UHD source)*

HD file metadata are wrong: Color Matrix incorrectly reported as BT.709 (*default for HD frame size)*



B7. Checking HDR-PQ RGB Data with VQV VectorScope

Media file metadata correctly specify HDR-PQ RGB Narrow Range format.

Both 100% Bars and 58% Bars hit the centers of target boxes.

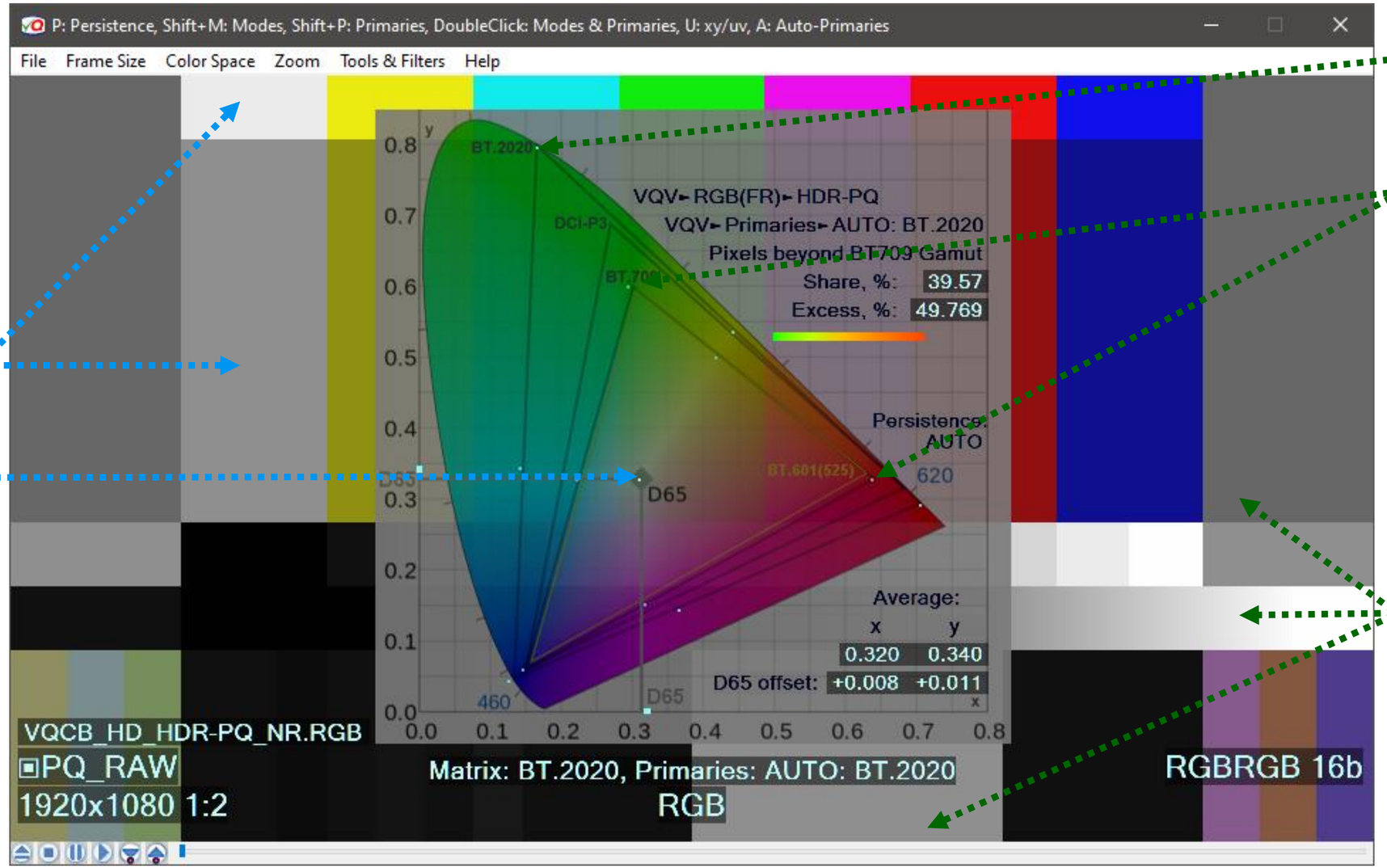
Media file metadata correctly specify HDR-PQ RGB Full Range format.

Both 100% Bars and 58% Bars hit the centers of target boxes.

B8. Checking VQCB HDR-PQ Test with VQV ChromaScope

VQV ChromaScope auto-switched to BT.2020 primaries mode.

Main Bars and BT.2111 compliant BT.2020 ⇔ BT.709 Bars hit vertices and sides of the corresponding triangles.



Main Bars

BT.709 Bars

White Bars

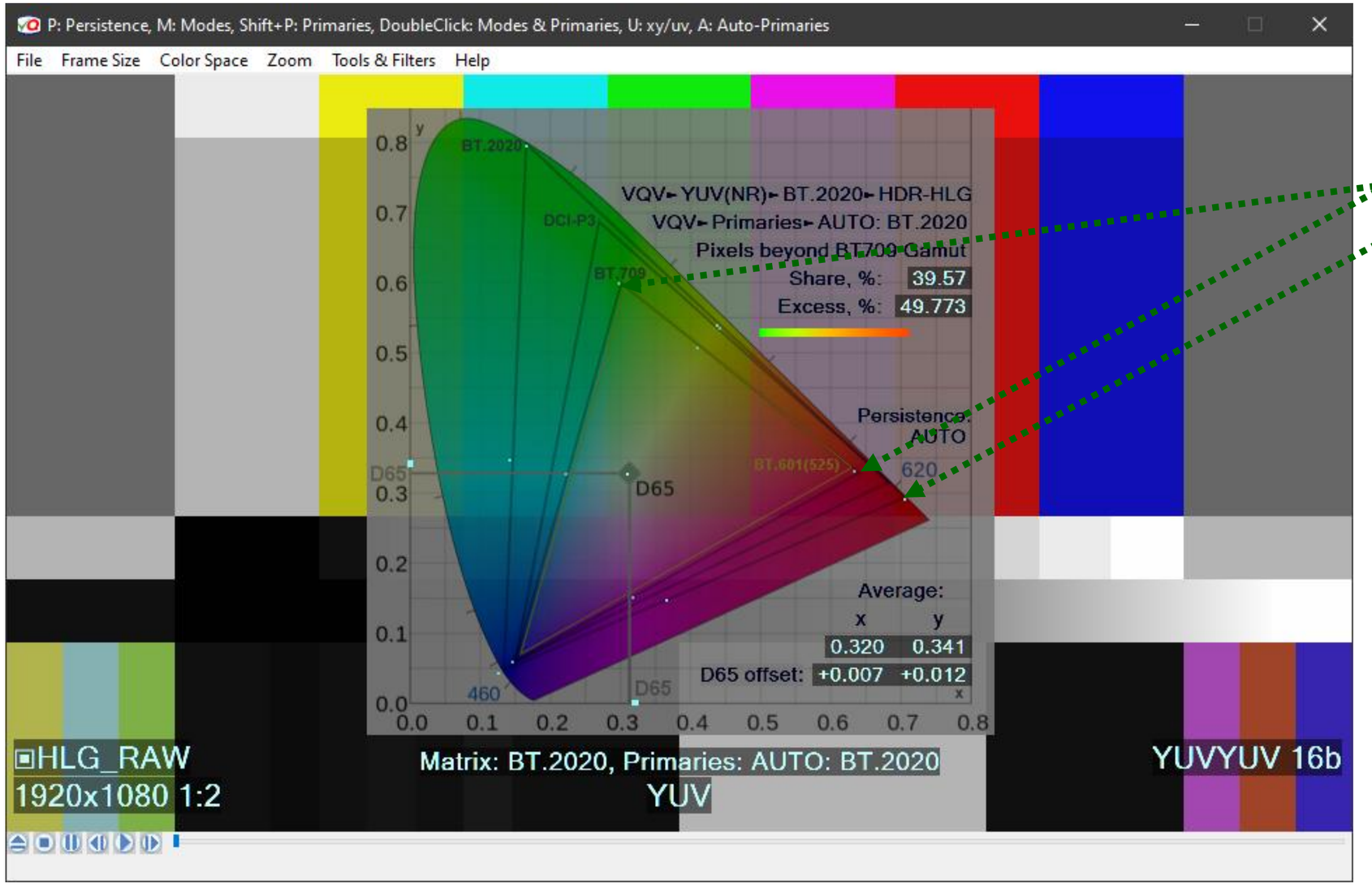
White Point D65 Chromaticity ***complies with BT.2020 & BT.2100***

All R=G=B (grayscale) **components show D65 Chromaticity**

B9. Checking VQCB HDR-HLG Test – ChromaScope

Media file metadata correctly specify HDR-HLG YUV format.

Both BT.2020 Bars and BT.709 Bars hit the corresponding triangles.



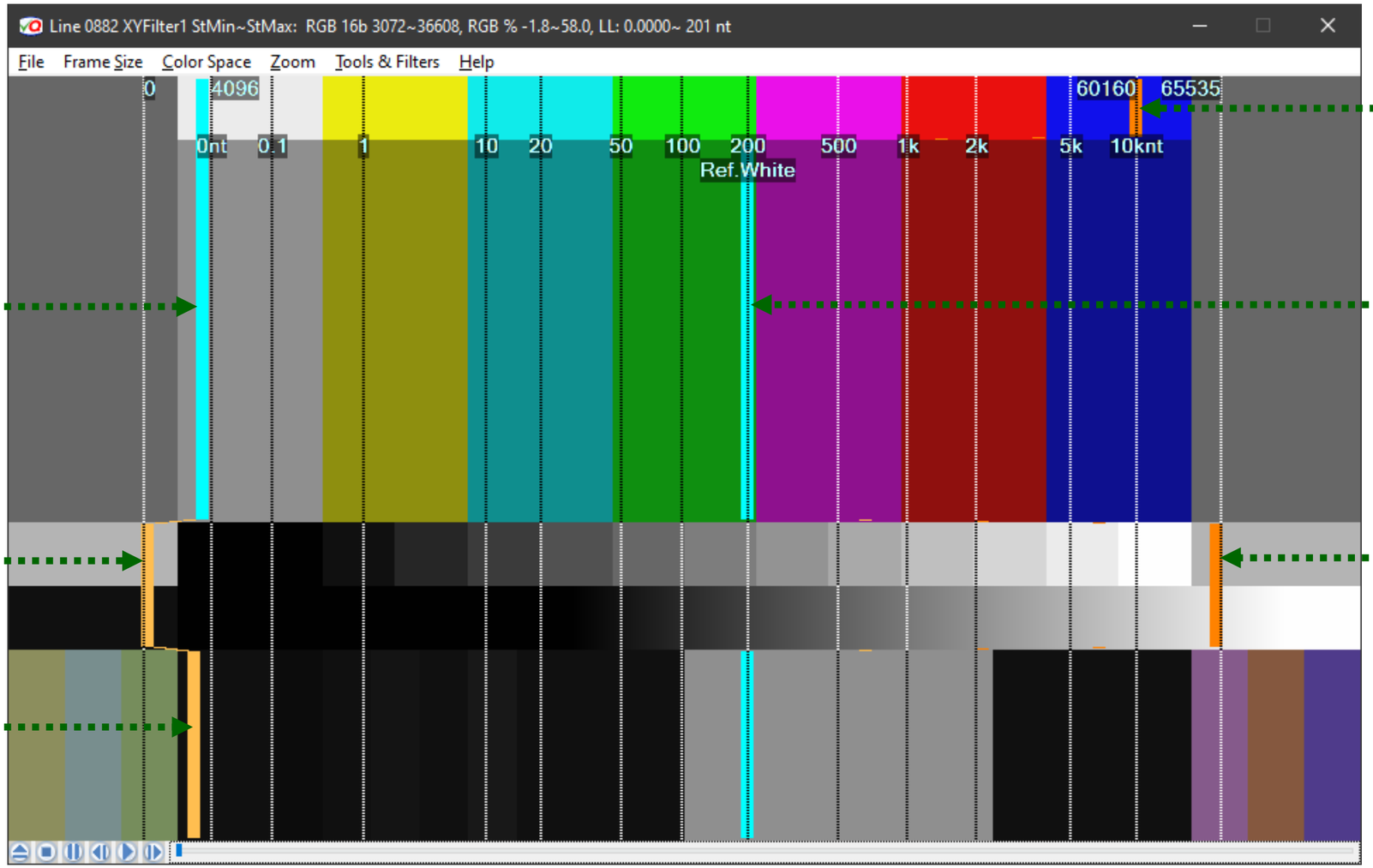
BT.709 Bars

BT.2020 Bars

B10. VQCB4 HDR-PQ DCI-P3-D65 Test – FrameScope

Data levels are compliant with BT.2111 standard, *except* special P3⇔BT.709 Bars *within the 5th band.*

HDR-PQ Mode: **VQV Graticule Units** auto-switched to **nits**, **VQV title bar** shows actual **16b values range** for the currently selected line.



100% Bars & 58% Bars
Min Level: 16b **4096**
12b 256, **10b 64**
0% ⇔ LL 0nt

Grayscale & Ramp
Min Level: 16b 252
12b 16, **10b 4**
-6.8%

PLUGE
Min Level: 16b 3072
12b 192, 10b 48
-1.8%

100% Bars
Max Level: **16b 60160**
12b 3760, **10b 940**
100% ⇔ **LL 10,000nt**
Peak White

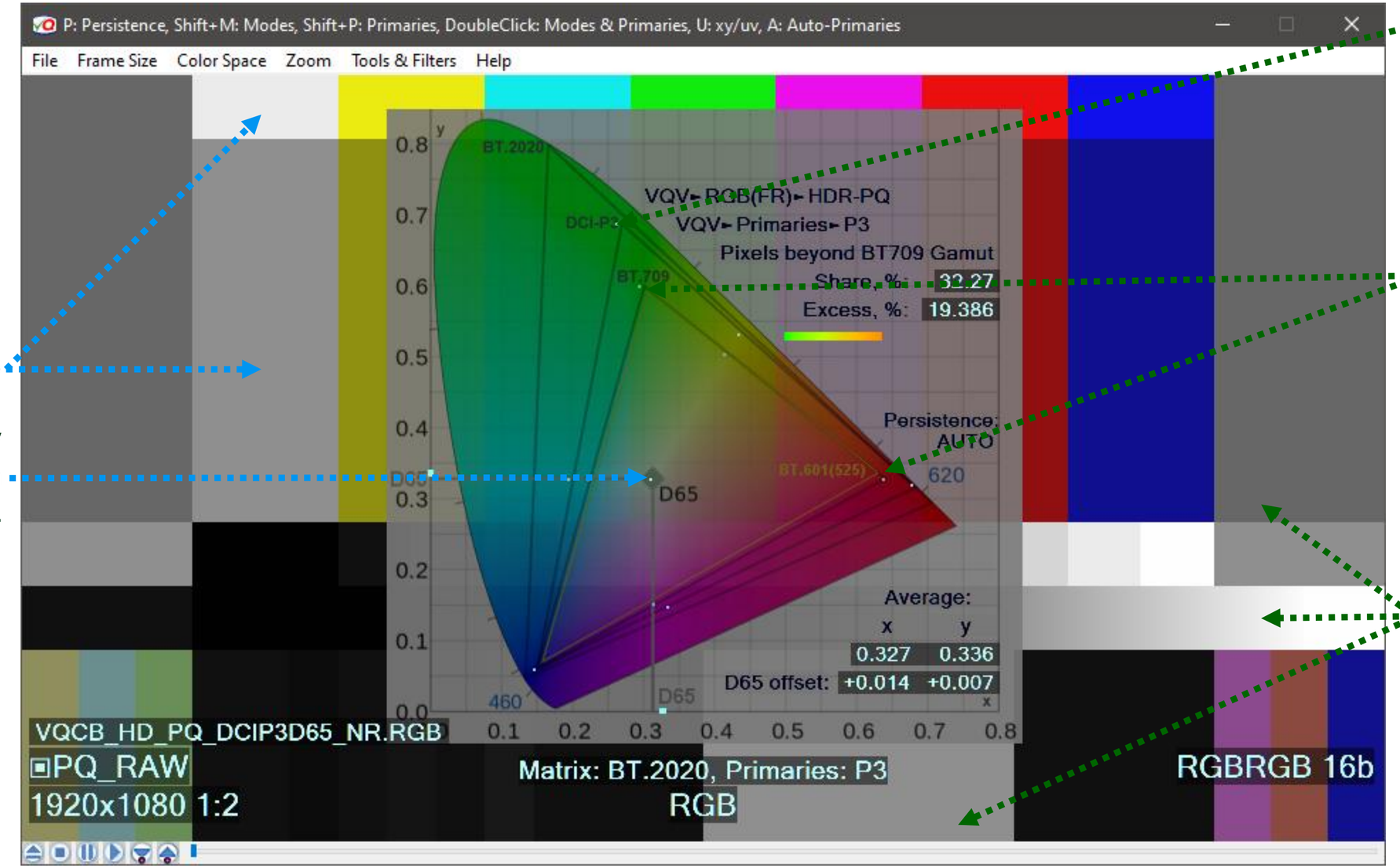
58% Bars
Max Level: **16b 36608**
12b 2288, **10b 572**
58% ⇔ **LL 201nt**
Reference White

Grayscale & Ramp
Max Level: **16b 65024**
12b 4064, **10b 1016**
109%

B11. VQCB4 HDR-PQ DCI-P3-D65 Test – ChromaScope

VQV ChromaScope switched to P3 primaries mode.

Main Bars and special P3⇔BT.709 Bars hit vertices and sides of the corresponding triangles.



White Bars

D65 Chromaticity complies with SMPTE EG 432-1

Main Bars *mapped by VQV ChromaScope to* ***P3 primaries***

BT.709 Bars *mapped by VQV ChromaScope to* ***P3 primaries***

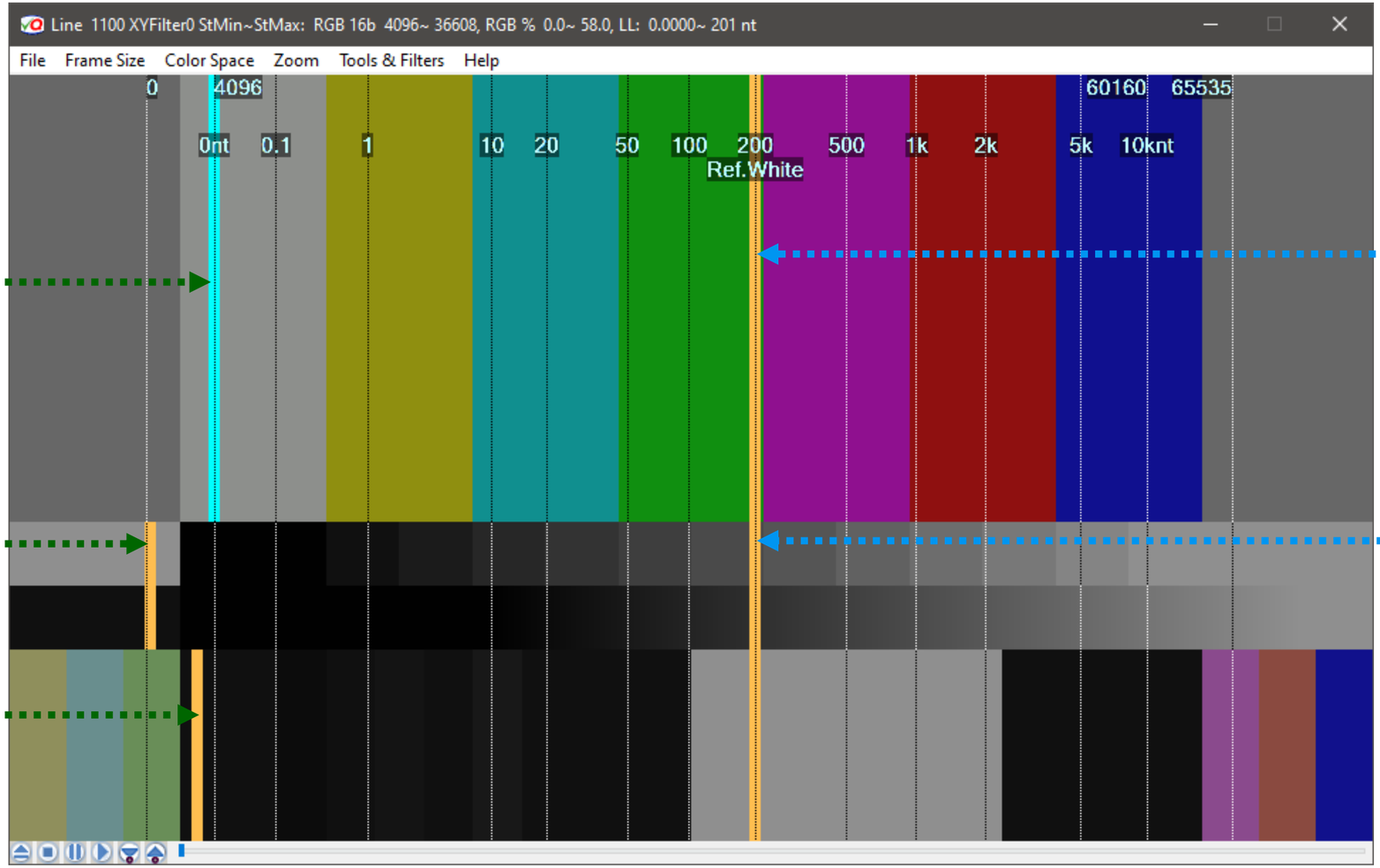
All R=G=B (grayscale) **components show D65 Chromaticity**

B12. VQCB4 HDR-PQ DCI-P3-D60-D61-200 – FrameScope

Pattern layout and data levels are not compliant with BT.2111 standard. Note the absence of 100% bars.

Special P3 ⇔ BT.709 Bars are identical to D65 variant.

Max light level of all test pattern components limited to 200nt (SMPTE RP 431-2).



Main 58% Bars
Min Level: 16b **4096**
12b 256, **10b 64**
0% ⇔ LL 0nt

Grayscale & Ramp
Min Level: 16b 252
12b 16, **10b 4**
-6.8%

PLUGE
Min Level: 16b 3072
12b 192, 10b 48
-1.8%

Main 58% Bars
Max Level: **16b 36608**
12b 2288, **10b 572**
58% ⇔ **LL 201nt**
Reference White

Grayscale & Ramp
Max Level: **16b 36608**
12b 2288, **10b 572**
58% ⇔ **LL 201nt**
Reference White

B13. VQCB4 HDR-PQ DCI-P3-D60-D61-200 – ChromaScope

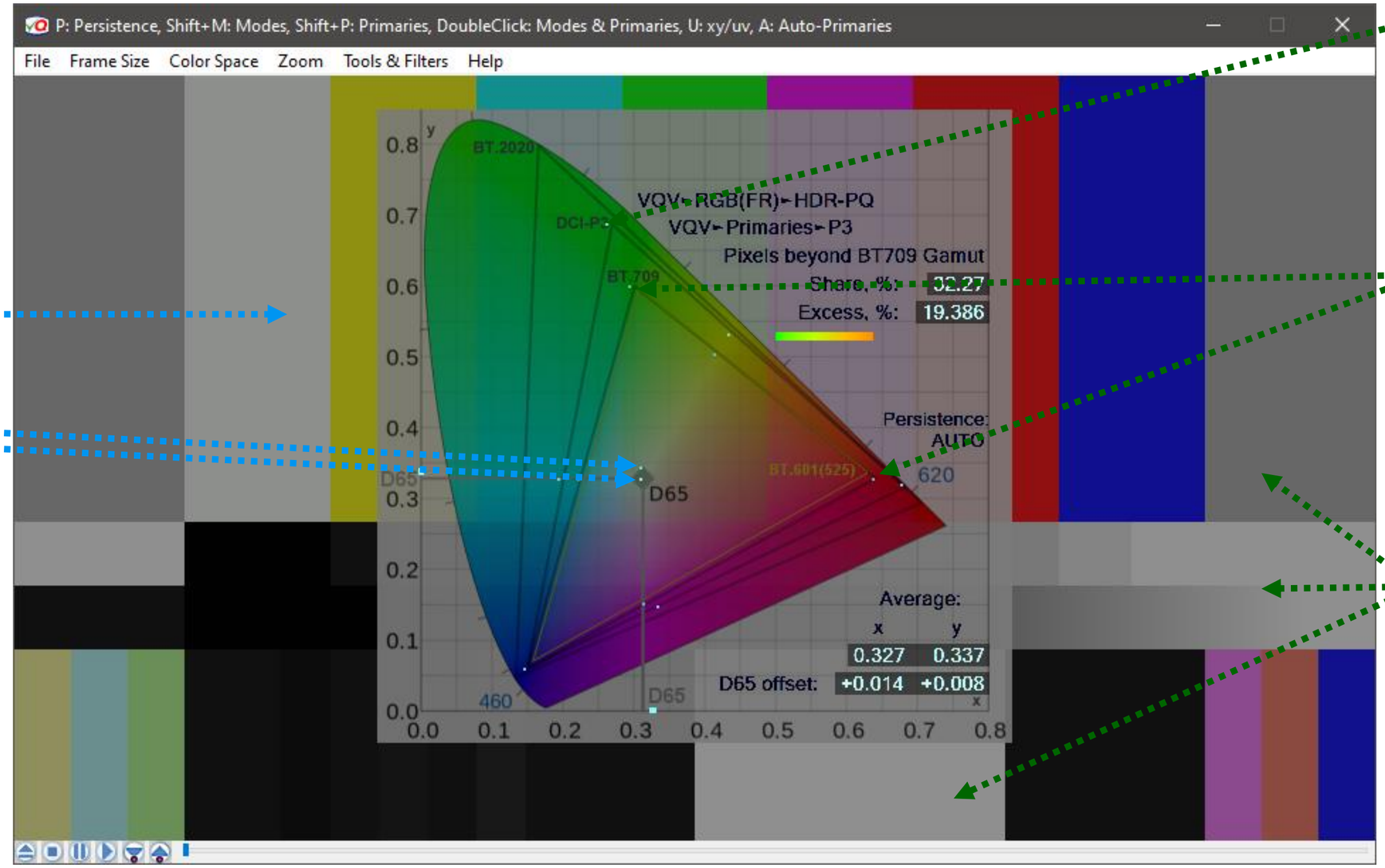
VQV ChromaScope switched to P3 primaries mode.

Main Bars and special P3⇔BT.709 Bars hit vertices and sides of the corresponding triangles.

“Greenish” DCI White Point Reference Bar

Its “D60-D61” Chromaticity complies with SMPTE 431-1

*Note the significant distance between the **DCI White Point** and **D65 White Point** of all other “gray” components*



Main Bars *mapped by VQV ChromaScope to **P3 primaries***

BT.709 Bars *mapped by VQV ChromaScope to **P3 primaries***

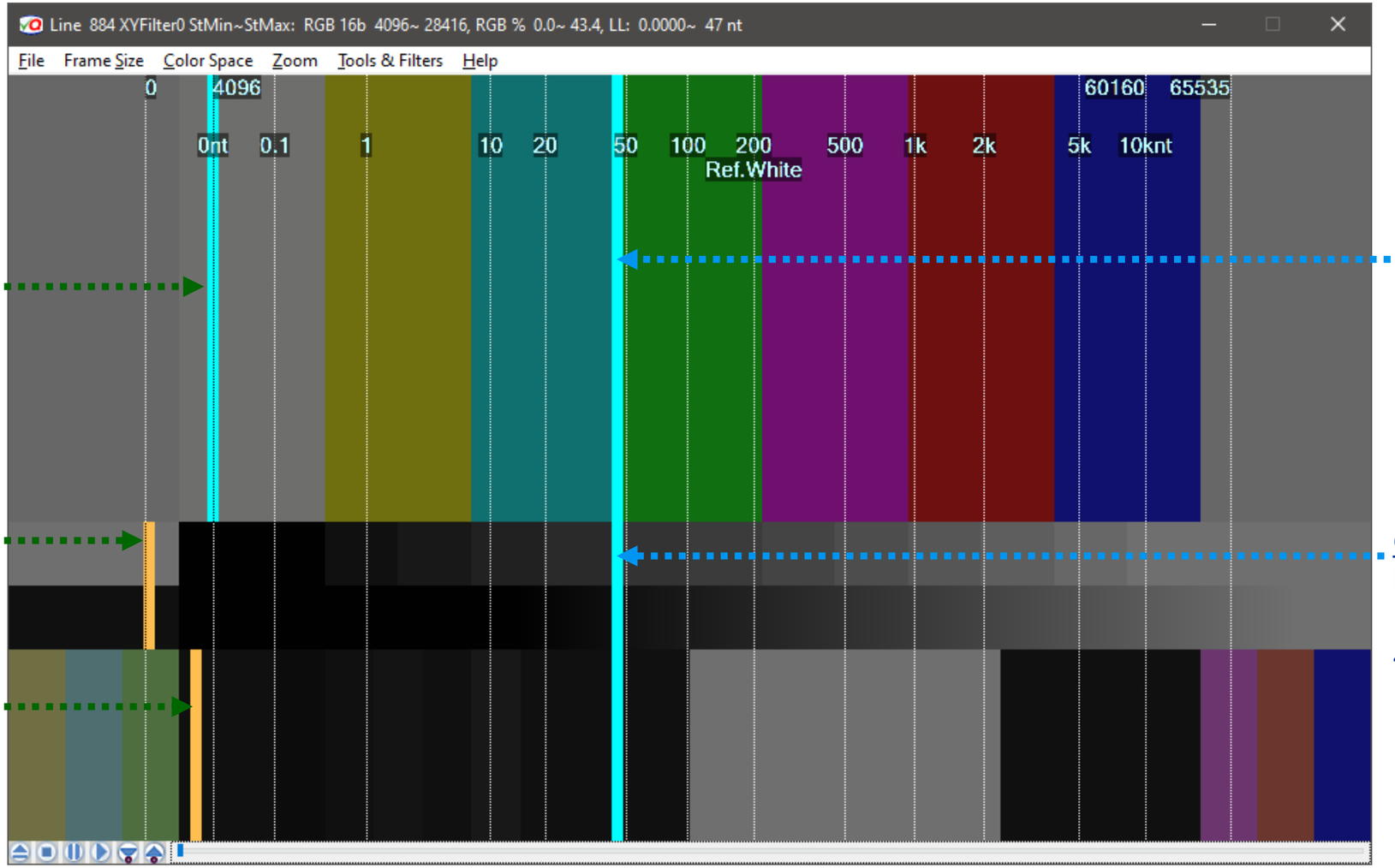
All R=G=B (grayscale) **components show D65 Chromaticity**

B14. VQCB4 HDR-PQ DCI-P3-D60-D61-48 – FrameScope

DCI-P3-D60-D61-48 test pattern is similar to **DCI-P3-D60-D61-200**, except the max level of **43% ⇔ LL 48nt**.

Pattern layout and data levels are not compliant with BT.2111 standard.

Max light level of all test pattern components limited to 48nt (SMPTE RP 431-1).



Main 43% Bars
Min Level: 16b **4096**
12b 256, **10b 64**
0% ⇔ LL 0nt

Grayscale & Ramp
Min Level: 16b 252
12b 16, **10b 4**
-6.8%

PLUGE
Min Level: 16b 3072
12b 192, 10b 48
-1.8%

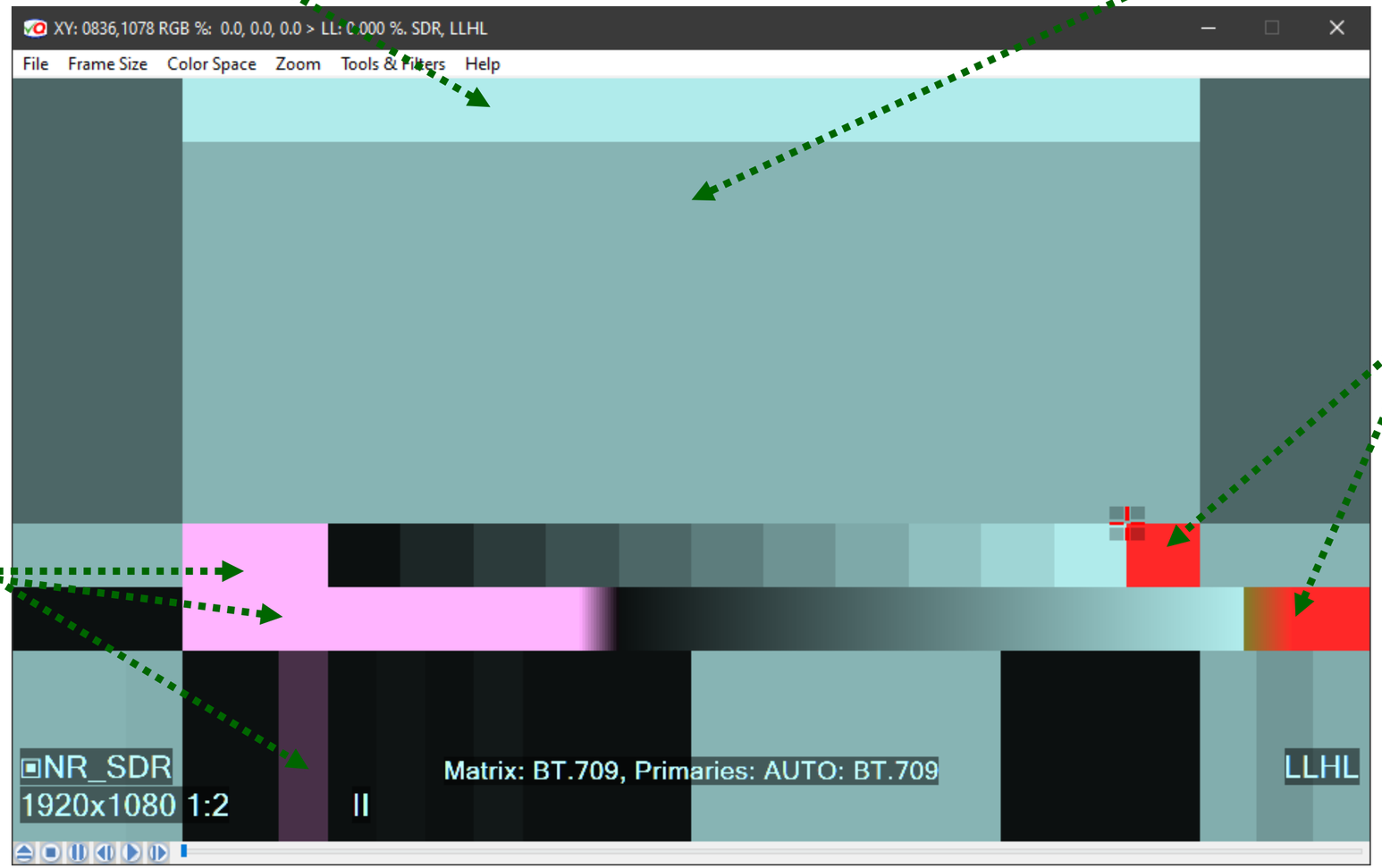
Main 43% Bars
Max Level: **16b 28416**
12b 1776, **10b 444**
43% ⇔ **LL 48nt**

Grayscale & Ramp
Max Level: **16b 28416**
12b 1776, **10b 444**
43% ⇔ **LL 48nt**

B15. SDR Light Levels – Light Levels Highlighter

All six 100% Bars have the same 100% Light Level

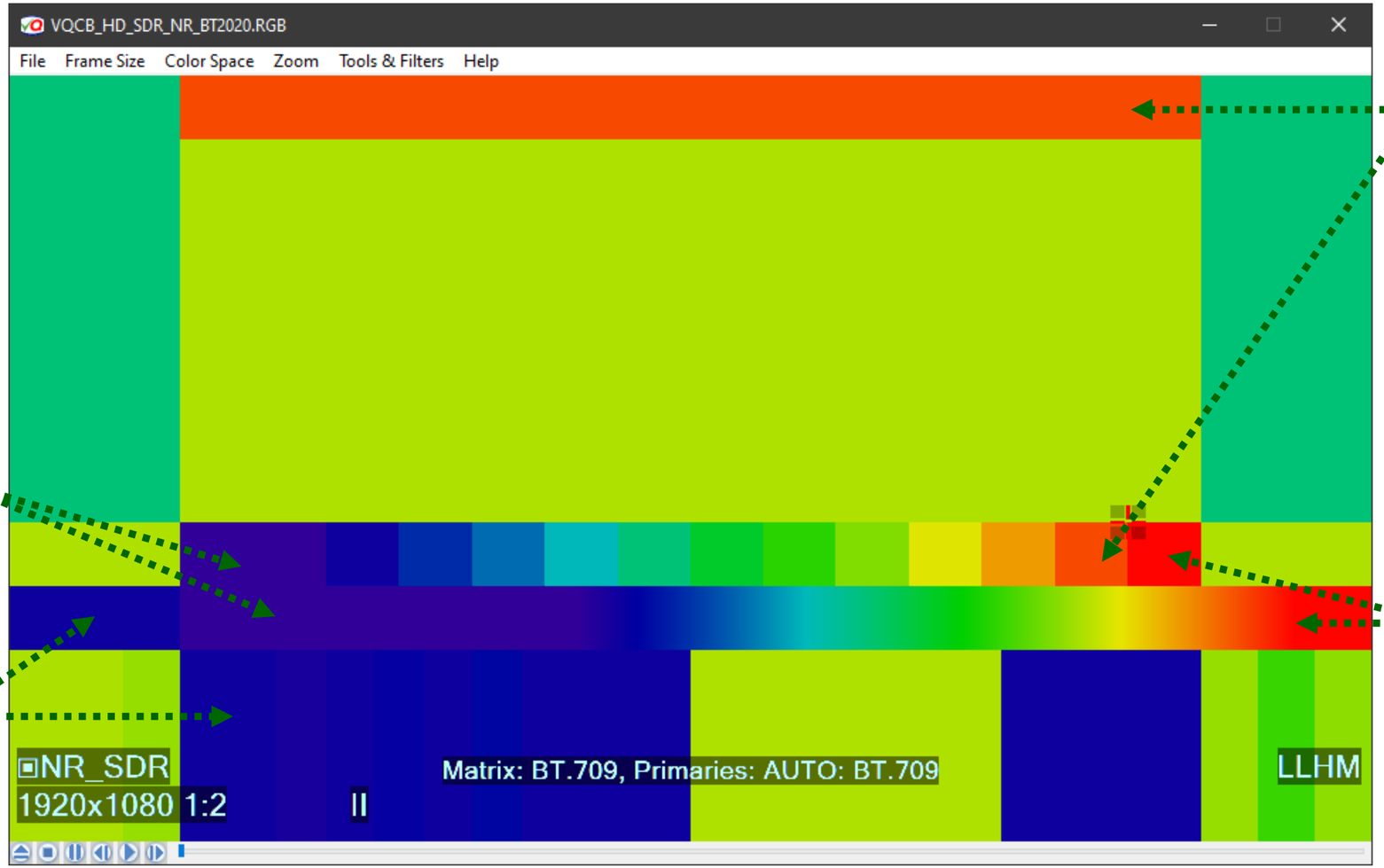
All six 75% Bars have the same 50% Light Level



Light Levels **above** Reference White

Light Levels **below** Reference Black

B16. SDR Light Levels – Light Levels Heat Map



Light Levels **close to** Reference White

Light Levels **below** Reference Black

Light Levels **above** Reference White

Light Levels **close to** Reference Black

B17. HDR-PQ Light Levels – Light Levels Heat Map

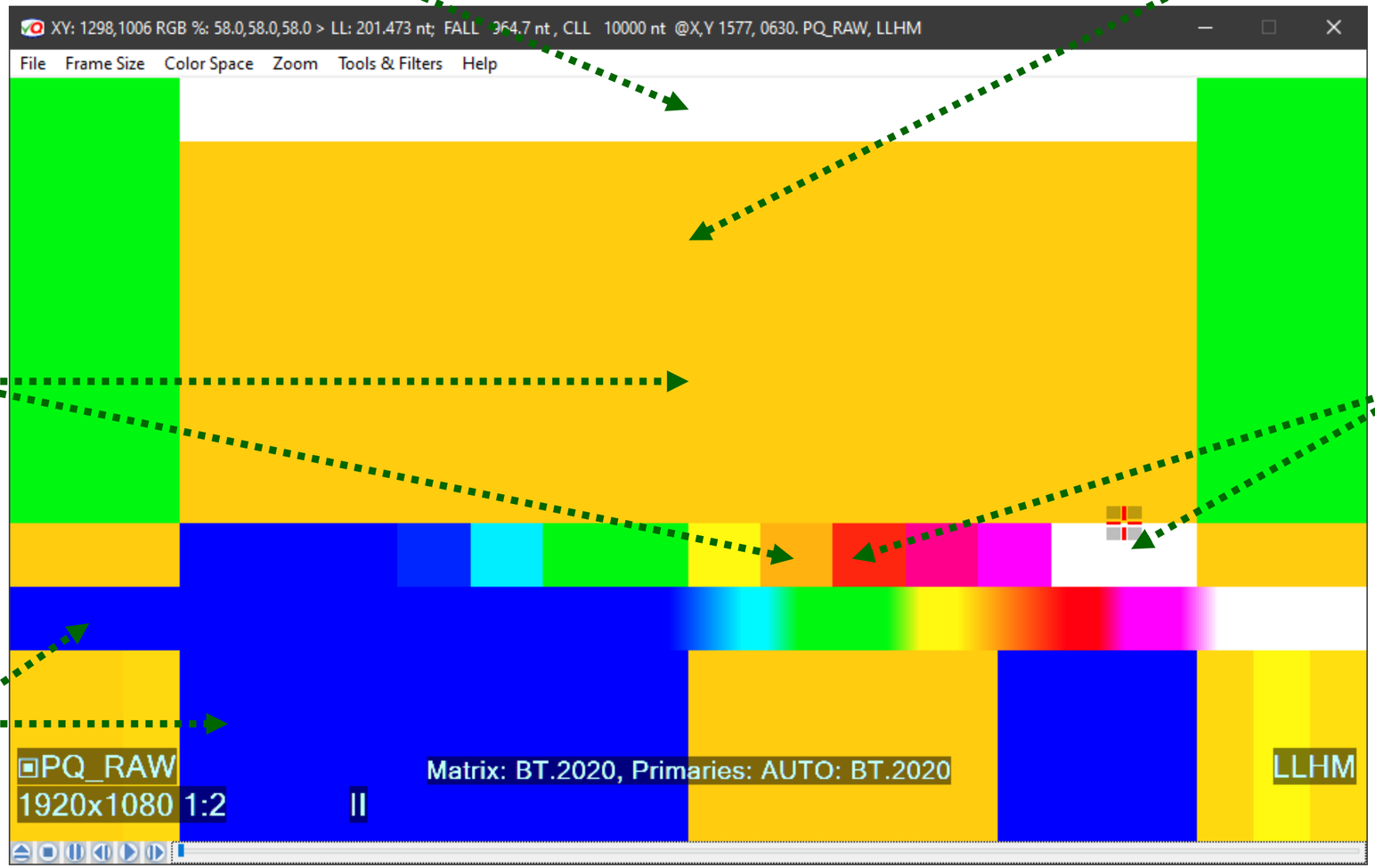
All six 100% Bars have the same 10,000 nit Light Level

All six 58% Bars have the same 200 nit Light Level

Light Levels **close to** Reference White

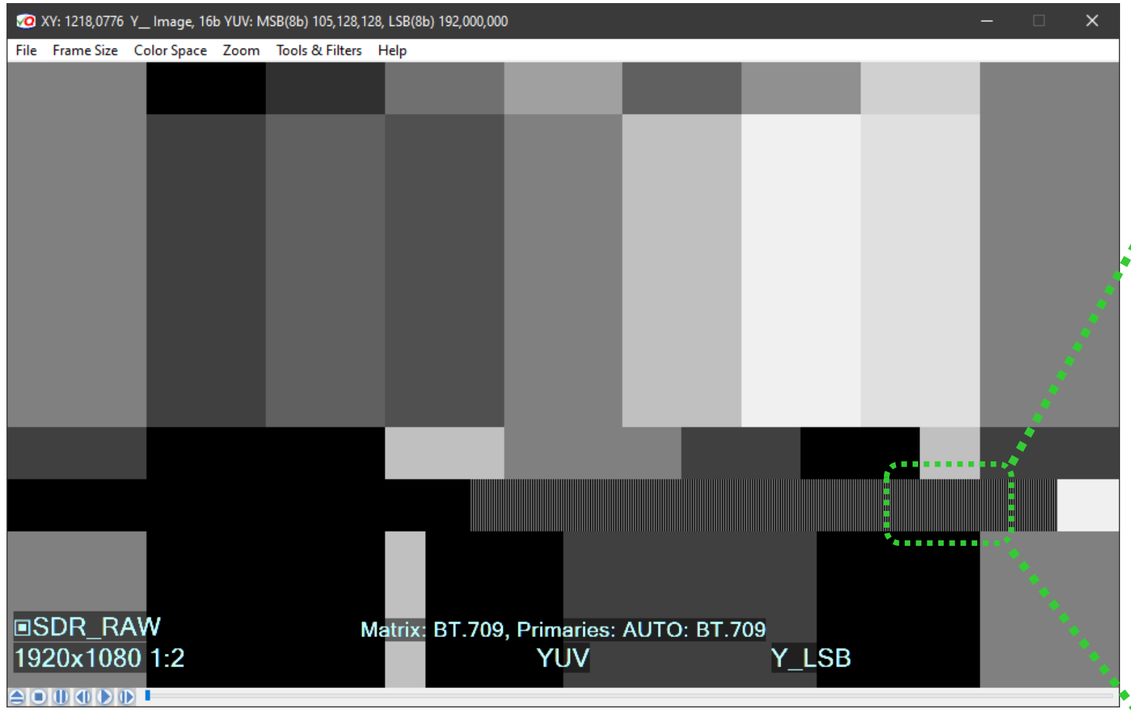
Light Levels **above** Reference White

Light Levels **close to** Reference Black



B18. Checking HD Version Ramp Bit Depth – LSB Image

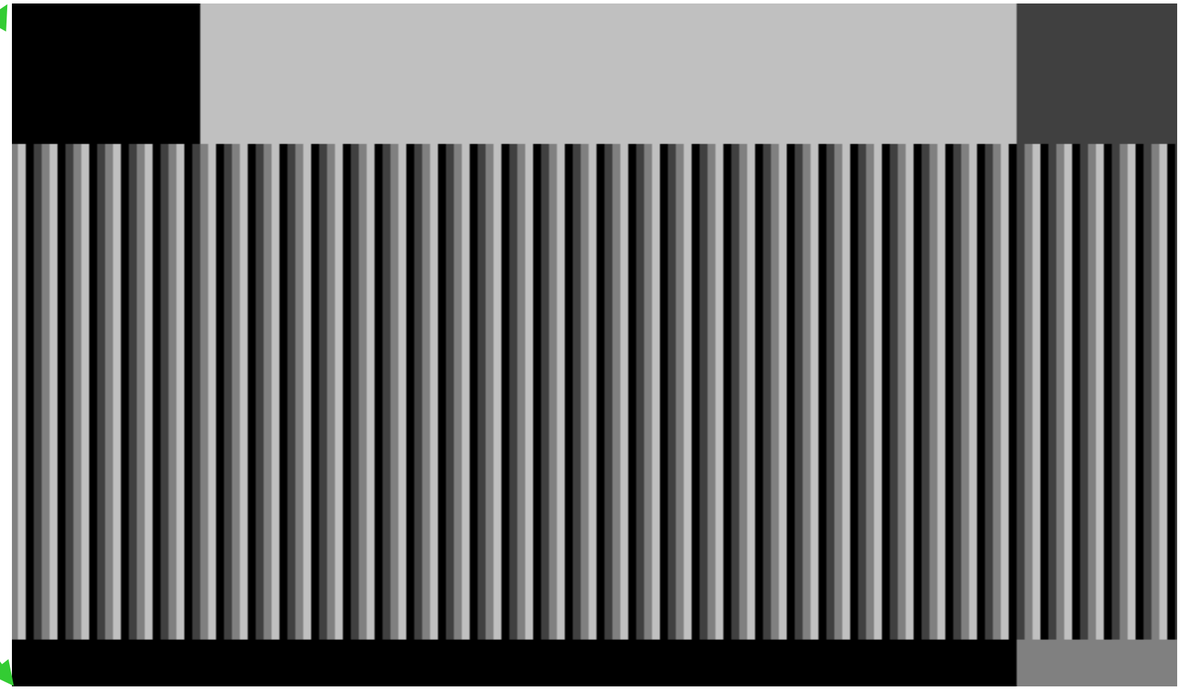
16b YUV source, Y channel 8b LSBs Image



Within the Ramp area

8b LSBs image shows **4 gradations**, i.e. only **2 LSBs** are active.

It means that actual bit depth of the Ramp is: 8 MSBs + 2 LSBs = **10 bit**

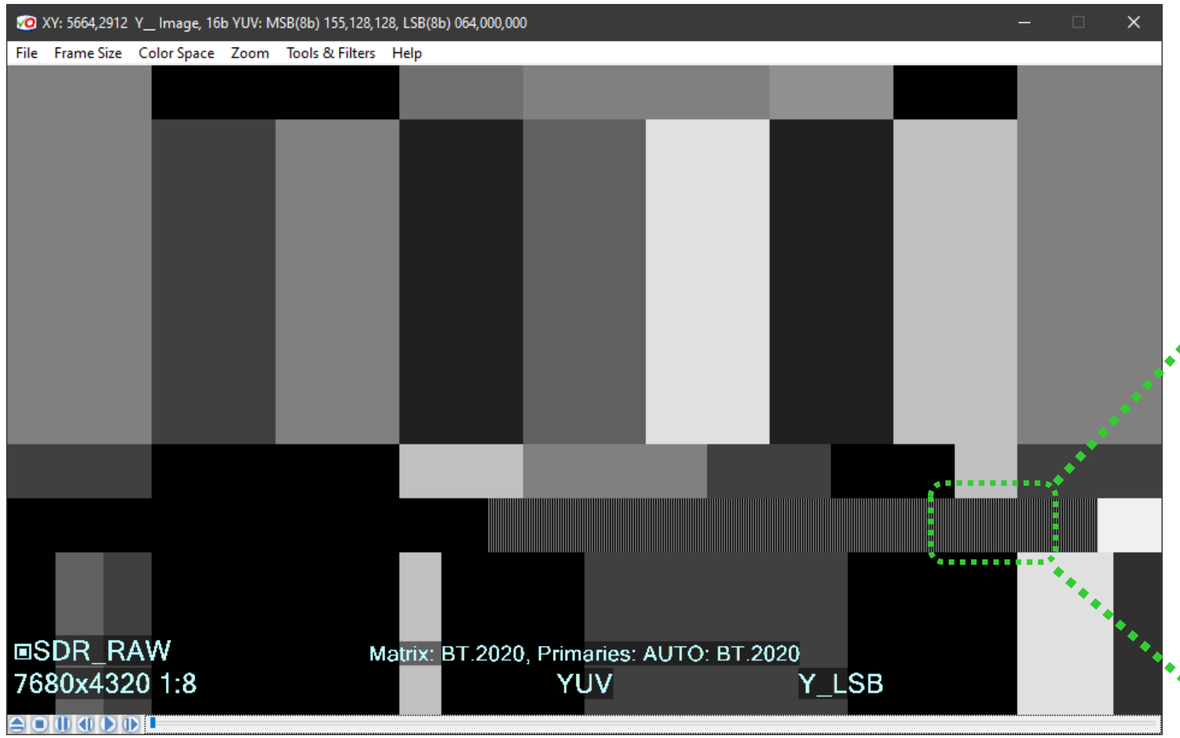


Max 4:1 Zoom centered on the Ramp Area

LSB image gradations pattern is **uniform**, it means that the original data **have been not scaled**: – preserving one 10b increment per pixel

B19. Checking 8K Version Ramp Bit Depth – LSB Image

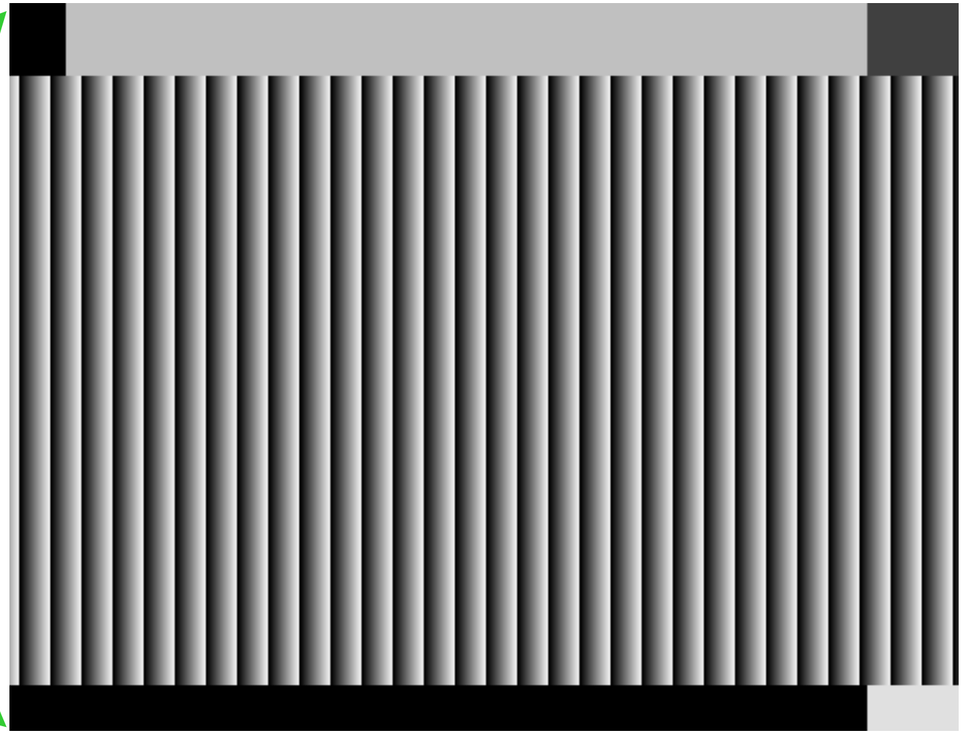
16b YUV source, Y channel 8b LSBs Image



Within the Ramp area

8b LSBs image shows **16 gradations**, i.e. **4 LSBs** are active.

It means that actual bit depth of the Ramp is: 8 MSBs + 4 LSBs = **12 bit**



Max 1:1 Zoom centered on the Ramp Area

LSB image gradations pattern is **uniform**, it means that the original data **have been not scaled**: – preserving one 12b increment per pixel