Media Ambit ™

Advanced Metadata Acquisition & Usage

VideoQ, Inc. Technology Presentation

March 2017

www.videoq.com

About VideoQ

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

VideoQ Philosophy of Media Data Processing

1. Automatically generated **Technical Metadata and Reports** are must be and must cover:

   Image aspect ratio, contrast, sharpness, sound loudness, noise and other unwanted components levels are among the most critical parameters affecting the subjective estimation of AV content quality.

2. Traditional professional image & sound QA/QC methodology, based on the usage of large number of high-grade video & audio monitors, etc, is no longer the answer, ***but we learn that QA/QC is still needed***.
3. In this automated environment a **smaller number of human operators** should focus ***only*** on optional final checks and/or complicated cases.
4. And these operators must be equipped with appropriate **software tools and indicators** presenting all relevant parameters in a time-saving "easy to spot at a glance" way.

*The VideoQ **VQPT** modules answer the need for such automatic tools.*
*Combination of VQPT suite modules with other VideoQ tools, such as **VQV** – Player/Viewer/Analyzer and/or **VQCP** – Secure QC Player, will result in further increase of workflow efficiency.*

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About Media Ambits

What it is:

- [*me·dia am·bit*] noun: Technical and semantic metadata about moving images, sounds, and timed text; embedded in files or externally centralized.
- Sentence example: Their system uses media ambits to automate ingest and delivery.
- Variations: Video Ambit, HDR Ambit, Audio Ambit, Timed Text Ambit, etc.

Ambit's Role for Automated and Automation-Assisted Workflows:

- Robot-assisted human decision-making tools.
- Robots-learning-from-people tools.
- Ambits repositories and machine services optimized for automation, web services, and directed acyclic workflows.
- Automated and manual control of optimized video and audio processing/conversion
- Automated and manual quality assurance and quality control tools
- Measure, annotate and automatically modify files to match target ambits.
- Notify machines, people and dashboards in automated workflows.

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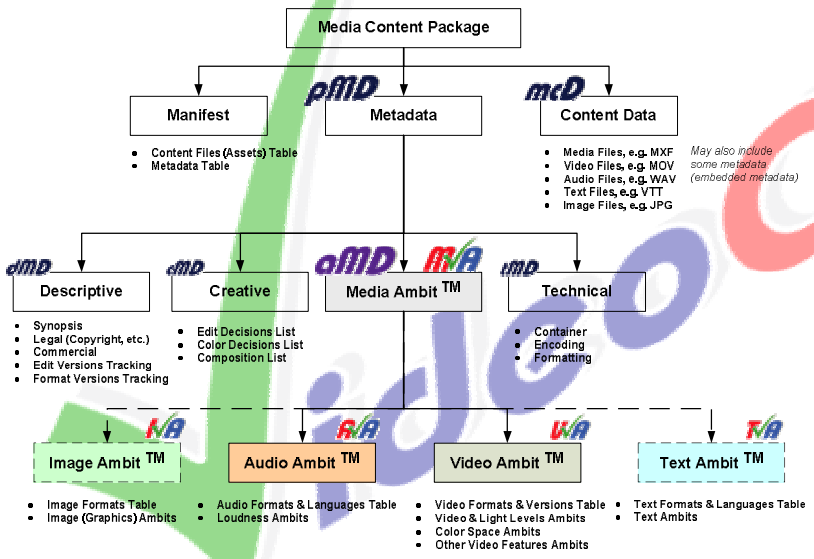
Media Ambit ™ and Media Package Data Structure



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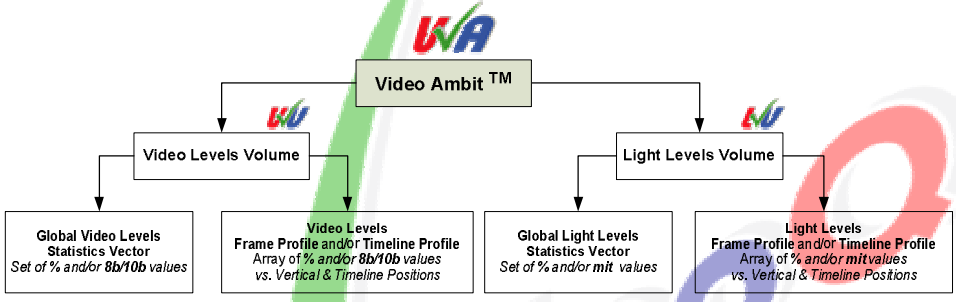
Video Ambit ™ Data Structure



Video Levels in % are calculated by offsetting 8b/10b Video Levels by **Nominal Black** value and division by the specified **Nominal Range** of the corresponding **Channel**.

Model nit (mit) = Video Levels to Light Level Conversion Model output unit.

Standard Conversion Models: **SDR**, **HDR-PQ**, **HDR-HLG**
Light Levels in % are calculated by division of Light Level in nits by the specified **TDMB** (Target Device Max Brightness) value, typically expressed in model nits

Levels Statistics Vector & Profile Channels:

- **Y, U, V** *(typically: primary data read/decoded from media file/stream),*
- **R, G, B** *(typically: secondary data derived from YUV data),*
- **D** = *MinRGB = darkest of 3 image components (bottom envelop),*
- **M** = *MaxRGB = brightest of 3 image components (top envelop),*
- **L** *(Light, typically: tertiary data derived from M data via HDR/SDR model)*

Examples of Video Ambit individual components (parameters):

- **F**rame **A**verage **L**ight **L**evel = **FALL**
- **FALL T**imeline **P**rofile = **FALLTP** *(e.g. for frames taken with 24 frames sampling interval)*
- **G**lobal **M**ax **L**ight **L**evel = **GMLL** *(aka Content Light Level = CLL)*
- **F**rame **A**verage **Y L**evel = **FAYL** *(aka Average Picture Level = APL)*
- **L**ine **U**pper **M L**evel **F**rame **P**rofile = **LUMLFP** *(e.g. for all lines of a specified video frame)*

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About Ambit in Workflows

At the core:

- As amount of content increases, the proliferation of media processes that require automation in all parts of the video logistics chain is in state of boom.
- Our involvement in this process is through development and deployment of sophisticated modular software products that can gather, generate and apply technical metadata from video, audio, captions, and images to facilitate automation at every stage of the workflow.
- These special cross-platform enabled modules are uniquely designed to scale in accordance with customer needs and resources, and flow through machine friendly constructs, while being human readable when desired.
- These modules share common metadata format, which facilitates the interoperability between the modules as well as interaction with other tools used within the processes.
- It is of paramount importance that processes have sensors within the workflow steps to provide necessary feedback and allow systems, as well as humans, to make optimal decisions based on objective data rather than on perception of skilled individual.
- The foundation for such decision making is proper toolset, along with processes, that can easily provide, compare and check the outcome reliably, consistently, and at all times.
- What we propose is a series of interconnected modules designed to operate at any scale in the public or private cloud to augment media processing supply chain, while ensuring high quality output as well as operational savings, transcoding cost reduction, significant bitrate saving and guaranteed delivery to higher number of viewers.

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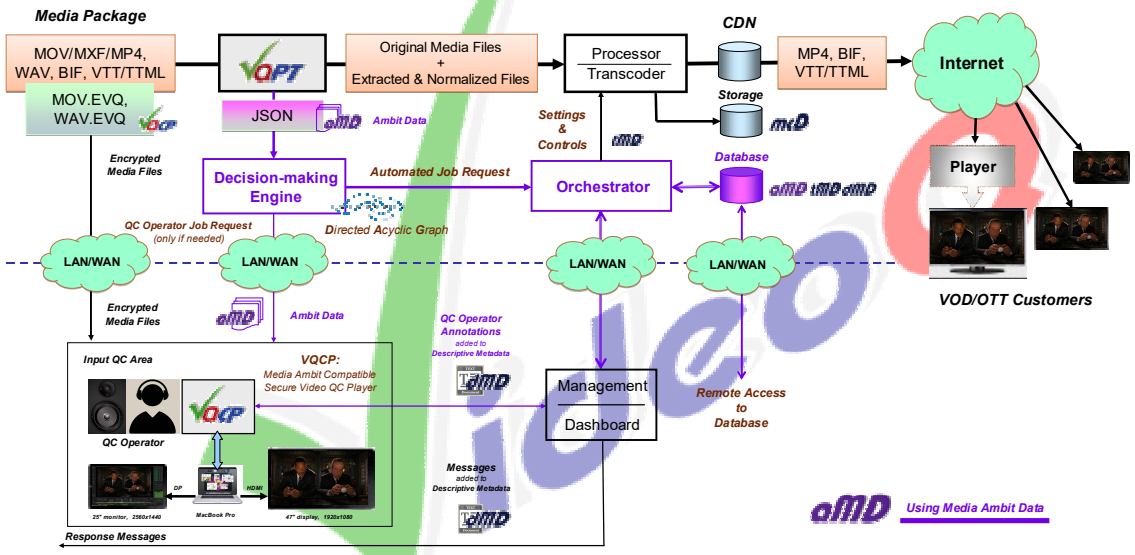
Media Ambit ™ Data Usage Workflow



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Media Ambits and VideoQ

VideoQ developed essential tools for Ambit-based Automated and Automation-Assisted Workflows:

- **VQPT** - VideoQ Productivity Tools, unattended program modules for Windows/Mac/Linux platforms that make Media Ambit metadata, plots, and images required for databases & orchestrators
- **VQMA** - Video Quality Measurement & Analysis Software Tool
- **VQCP** - Video QC player for human review and supervision, compatible with Media Ambit tools and practices.
- **VQV** - Media Files Player/Viewer/Analyzer/Converter for deep analysis QA/QC applications.

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VQPT Core Foundations

1. **V**ideo**Q** **P**roductivity **T**ools are designed "**by engineers, for engineers**"
2. An ever higher number of channels/programs/titles
3. And a permanently growing number of formats, frames sizes, bitrates, etc.
4. Human resources required for input QC and output QC has escalated
5. A new approach and **new tools** are needed *as demanded by our customers*
6. Hence VideoQ has changed the focus from our traditional T&M tools to **Automated Productivity Tools**
7. Automation is essential, but …
8. Human intervention cannot be excluded
9. Thus, our slogan is: "**Robot-assisted human decisions**"

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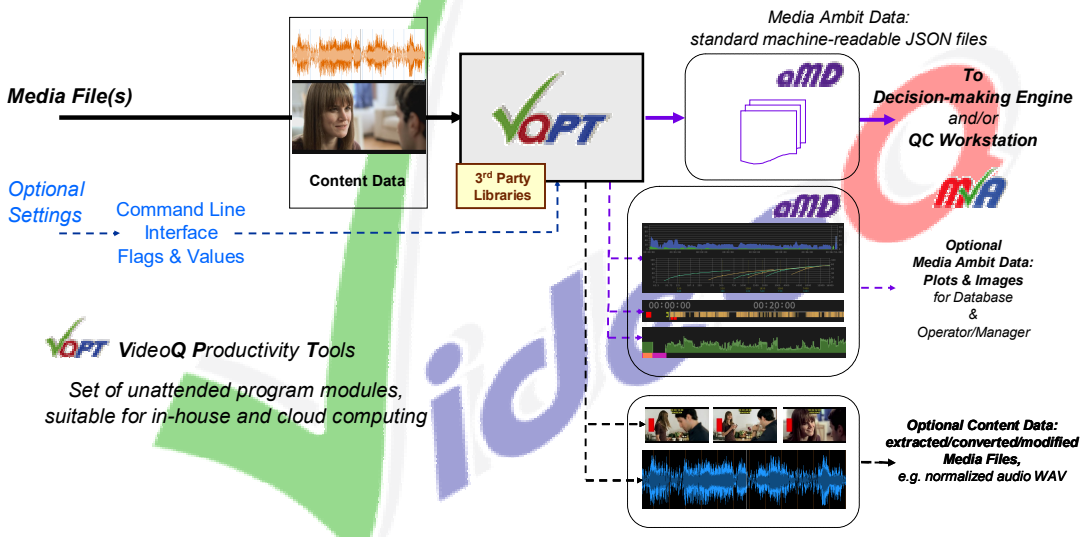
Media Ambit Metadata Acquisition Workflow



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VQPT Suite Entry Level Modules

- **VQMINFO** – Media File Info Report Generator
- **VQBIF** – BIF (Base Index Frames) Files Verifier
- **VQBLA** – Bitrate Ladder Analyzer
- **VQCFA** – Captions Files Analyzer
- **VQFTC** – Frame Types Classifier
- **VQLMN** – Loudness Meter & Normalizer
- **VQLPC** – Loudness Profiles Correlator
- **VQPLA** – Picture Levels Analyzer

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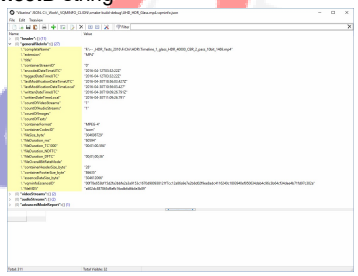
VQMINFO – Media File Info Report Generator

- Reads. a wide variety of media files (MOV, MXF, WAV, JPG, etc), and creates Report in UTF JSON format.
- Full support of HDR & SDR video as well as LOG video
- Program uses Mediainfo and ffmpeg libraries.
- It also uses standard SHA3 and MD5 libraries to calculate unique **vqminfoEssenceID** string and input file MD5 hash string.
- Report file contains the following sections:
  - "header" = Report timestamp and program version info
  - "generalFileInfo" = container parameters, including counts of media data streams
  - "videoStreams" = technical parameters of video stream(s)
  - "audioStreams" = technical parameters of audio stream(s)
  - "textStreams" = technical parameters of text stream(s)
  - "imageStreams" = technical parameters of image stream(s)
  - "advancedModeReport" (*raw Mediainfo strings, useful for manual analysis of complicated cases*)



Simple CLI interface: **vqminfo** [-md5] -i inFilePath [-o [outFilePath]

VQBIF – BIF (Base Index Frames) Files Verifier

- Reads 1, 2 or 3 .BIF thumbnails files, and creates Report in JSON format (Image Ambit).
- Validate BIF files for:
  - File integrity
  - Size [each frame/picture]
    - For high bitrate it should be …
    - For low bitrate it should be …
  - Coding quality [jpeg compression quality]
    - For high bitrate it should be …
    - For low bitrate it should be …
  - Offset (time offset between each grab)
- Check for time offset correlation (*function of the specified media file duration*)
- Check for cumulative amount of index frame images
- Decode the BIF file(s) as a reference decoder (*extract several sets of numbered .JPG files*)

CLI interface: **VQBIF** -i in1.BIF [in2.BIF] [in3.BIF] [-o outPath] [-j/-q] [jpeg_folder] [-r Ref_Framewise_Separation_ms]

VQBLA – Bitrate Ladder Analyzer

- Reads .MOV, MXF, etc. media file, and analyzes its content enabling optimal downstream transcoder settings
- Measures Intra-frame and Inter-frame Activities
- Builds statistics (histograms) for a range of critical video parameters
- The key stage of VQBLA work is estimation of expected levels of compression and down-scaling distortions
- Finally, VQBLA creates machine-readable Report in JSON format showing:
  - Measured video parameters statistics: Intra-frame Activity and Inter-frame Activity, in percents
  - The BLA Draft Bitrate Ladder as an array of the expected Quality Score vs. Bitrate and Frame Size
- VQBLA also creates an optional .PNG image file showing (see next slide):
  - Activities Timeline Profile Plot
  - Activities Statistics Bargraphs
  - Bitrate Ladder Plot with critical bitrate values marked

CLI interface: **VQBLA** [-cs NumOfSec] [-p] -i inFilePath [-o [outFilePath]]

[-cs NumOfSec]] Chunk Size option; set assumed chunk (GOP) size in integer seconds, default = 2 s

[-p] option enables Plot File output

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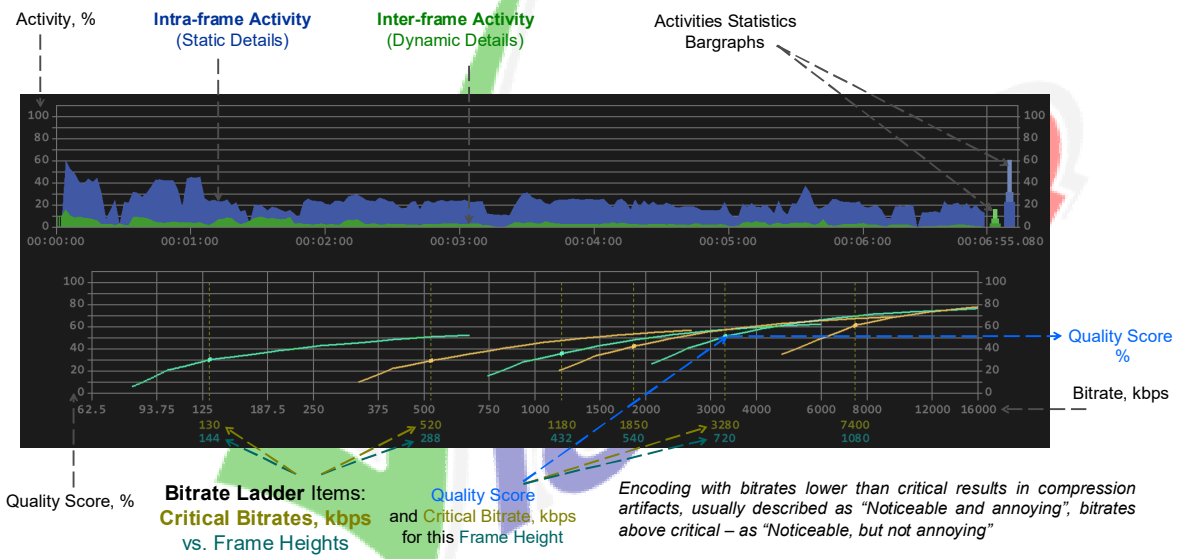
Example of Video Activities by VQBLA



Encoding with bitrates lower than critical results in compression artifacts, usually described as "Noticeable and annoying", bitrates above critical – as "Noticeable, but not annoying"

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VQCFA – Captions Files Analyzer

- Reads .WebVTT, .VTT, .XML or .TTML caption file
- Measures caption parameters and checks them against the predefined, auto-switchable, and/or CLI specified, thresholds

Finally, VQCFA creates machine-readable Report in JSON format showing the following sections:

- header
- generalInfo
- testConditions
- eventsStatistics
- invalidEvents, which is further sub-divided into two sub-sections:
  - invalidEventsByType
  - invalidEventsByNumber
- Full Captions Event Listing (*decoded unformatted UTF text lines with timestamps*)

CLI interface: **VQCFA** [-p int int] [-lw int -ln int] -i inFilePath [-o [outFilePath]]

[-lw -ln] option sets Line Width Threshold and Lines Number Threshold custom values used for validity tests

[-p] option enables Plot File output; full duration or zoomed on specified timeline segment

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Example of Text Ambit ™ by VQCFA

Captions file analyzed: No problems found, all caption events parameters are within specs

```
VideoQ, Inc. Productivity Tools (c) 2015-2017, VQCFA - Caption File Analyzer v.1.2.3
example608.utt.vqcfa.json
00:00:00    00:10:00    00:20:00    00:30:00    00:40:00    00:50:00    01:00:00    01:10:00    01:20:00    01:30:00    01:40:00    01:48:57.731
    ▪ ▪ ▪ Caption Events Density                                                                    Duration auto fit to the last event end
Validation Thresholds:
Max Line Width: 32 characters (AUTO), Max Lines Number: 4 (AUTO), Min Duration: 500 ms, Max Duration: 10000 ms, Max Reading Speed: 30 cps
Analysis Results:
Max Line Width: 32 characters, Max Lines Number: 4, Min Duration: 701 ms, Max Duration: 9776 ms, Max Reading Speed: 28 cps, Average Reading Speed: 13 cps
WEBVTT, Caption Events Count: 1847, Invalid Caption Events Count: 0                                                    2017-01-28T04:08:36.420Z TZ -08:00
```

Multiple Caption Events are out of specs:
Reading Speed, Min Duration, Max Duration,
Overlapping Events, Max Lines Number, Max Chars Per Line

```
VideoQ, Inc. Productivity Tools (c) 2015-2017, VQCFA - Caption File Analyzer v.1.2.3
VideoQ_CC_TestNo1_Eng.utt.vqcfa.json
00:00:00    00:20:00    00:40:00    01:00:00    01:20:00    01:40:00    02:00:00  02:09:35.617
    ▪ ▪ ▪ Caption Events Density    ▪ Invalid Events                                Duration auto fit to the last event end
Validation Thresholds:
Max Line Width: 42 characters (AUTO), Max Lines Number: 2 (AUTO), Min Duration: 500 ms, Max Duration: 10000 ms, Max Reading Speed: 30 cps
Analysis Results:
Max Line Width: 43 characters, Max Lines Number: 3, Min Duration: 490 ms, Max Duration: 10001 ms, Max Reading Speed: 34 cps, Average Reading Speed: 12 cps
WEBVTT, English, Caption Events Count: 1393, Invalid Caption Events Count: 9                    2017-01-25T10:29:52.881Z TZ -08:00
```

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VQLMN – Loudness Meter & Normalizer

- Reads WAV, W64, AAC, AC3, EAC3, MP4, MOV, MXF, etc. media file, containing audio stream(s)
  - VQLMN supports files of any duration and bit depth, high sampling rates (e.g. 192 kbps) and multi-channel formats: 2.0, 5.1, 7.1
- Measures the audio stream loudness parameters in accordance with Recommendation ITU-R BS.1770-3 (*USA ATSC RP A85, EBU R128*)
- Sorts audio segments by types (regular audio, test tone, mute)
- Finally, VQLMN creates Report in JSON format
- VQLMN Report also includes Momentary Loudness Profile data array at 100 ms step interval
- Optional outputs:
  - Normalized WAV/W64 audio file of desired Integrated Loudness
  - PNG file showing Momentary Loudness time-line profile with special segments highlighted, as well as loudness statistics BarGraph

CLI interface: **VQLMN** [-p] [-tlp] [-il TL LT] [-nao] [-mdt MDT] [-asi ASI]-i inFilePath [-o [outFilePath]]

[-p] option enables Plot File output; full duration or zoomed on specified timeline segment

[-tlp] option enables Timeline Profile section within JSON Report file

[-il TL LT] option sets custom values for TL = target loudness and LT = loudness tolerance

[-nao] option enables Normalized Audio Output (audio file with Integrated Loudness = specified target)

[-mdt MDT] option sets Mute Duration Threshold, [-asi ASI] option defines Audio Stream Index (0, 1, etc.)

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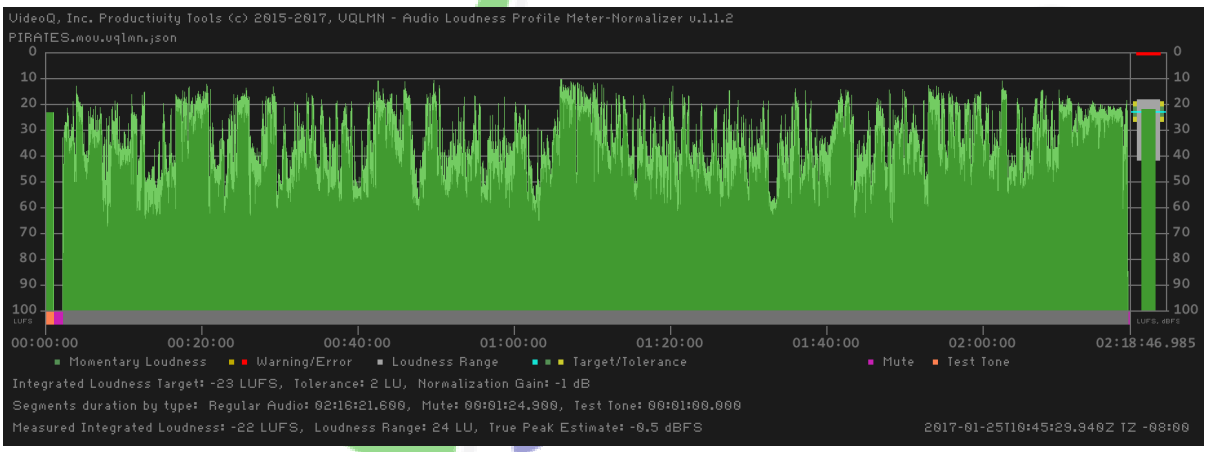
Example of Audio Ambit ™ Data by VQLMN

Integrated Loudness and Momentary Loudness Timeline Profile are within specs, but two Segments and one Parameter are out of specs:
60s long Test Tone at timeline start, then 60s long Mute, then regular audio, and True Peak value is too high



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VQFTC – Frame Types Classifier

- Reads media file (.MOV, .MXF, etc.)
- Measures video frames parameters and creates machine-readable Report in JSON format showing the following sections:
  - header
  - generalInfo
  - videoStream: encoding and format information
  - testConditions
  - videoParameters: bit depth variations, frame cadencies, SNR, sharpness, details activity, up-conversion footprints
  - activeImageFormats: integrated durations and active image sizes of all detected active image formats (LetterBox, PillarBox, etc.)
  - videoLevelsStatistics: Average and Max values in % and global histograms for Y,U,V,R,G,B and MaxRGB channels
  - lightLevelsStatistics: Average and Max values in nits and % of the specified TDMB
  - videoSegments, sorted by type and by number (in order of appearance)
  - timeLineProfiles of video levels, light level, sharpness and details activity

CLI interface: **VQFTC** [-p] [-tlp] [-DRMS TDMB] -i inFilePath [-o] or [-o outFilePath]

[-p] option enables Plot File output; full duration or zoomed on specified timeline segment

[-tlp] option enables Timeline Profile section within JSON Report file

[-DRMS TDMB] option: Dynamic Range Mode Switch (SDT, HDR-PQ, HDR-HLG) and TDMB = Target Device Max Brightness (nit) value

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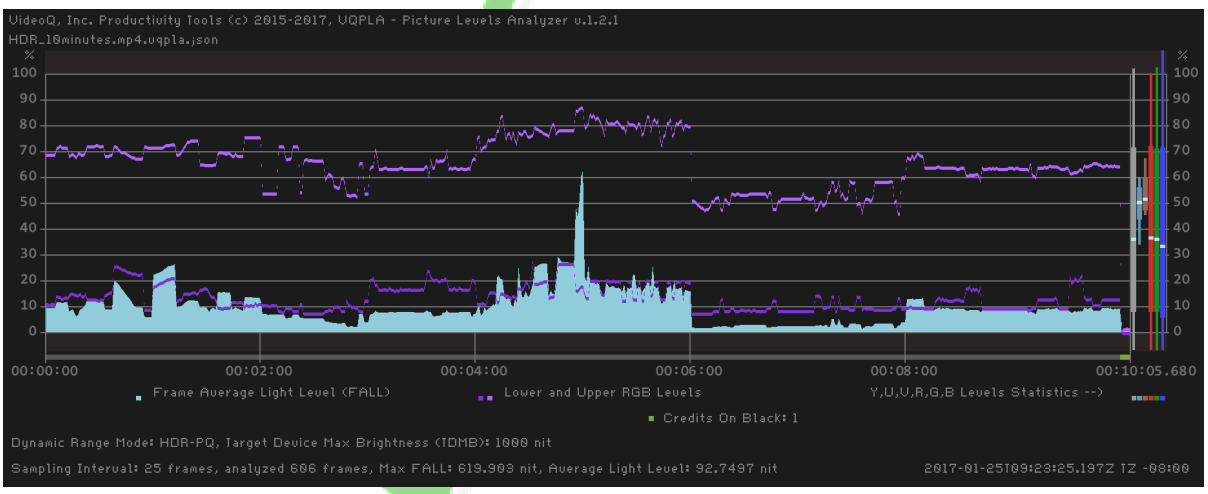
Example of HDR Video File Ambit by VQFTC

Video Volume and Light Volume Global Statistics & Timeline Profiles: No serious problems found.

*Warnings: a) **F**rame **A**verage **L**ight **L**evel varies too much: from 2% to 62%, b) for one episode FALL goes above 600 nit – too much for some displays*



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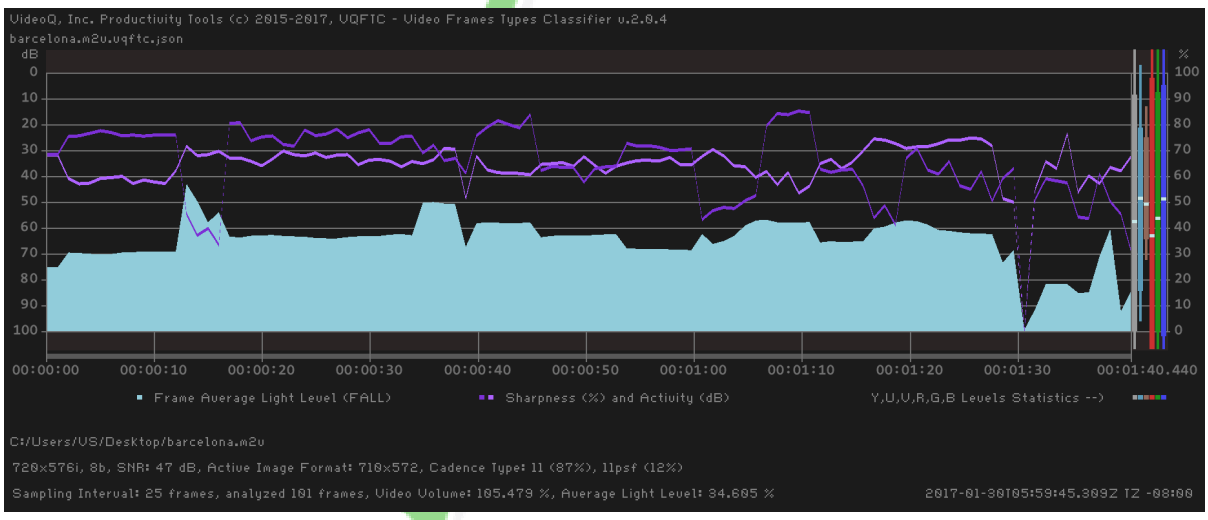
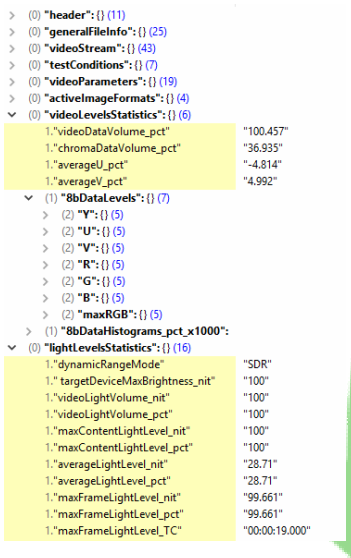
Example of Legacy Video File Ambit by VQFTC

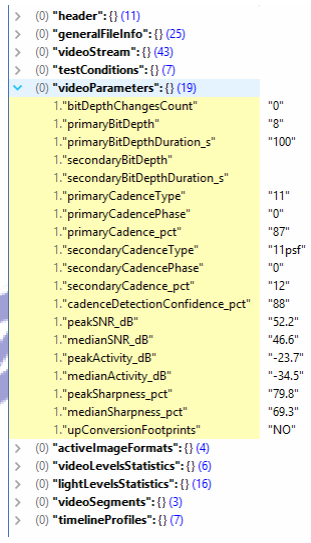
Global Video Volume, Frame Average Light Level Profile, Sharpness Profile, Activity Profile and SNR are OK

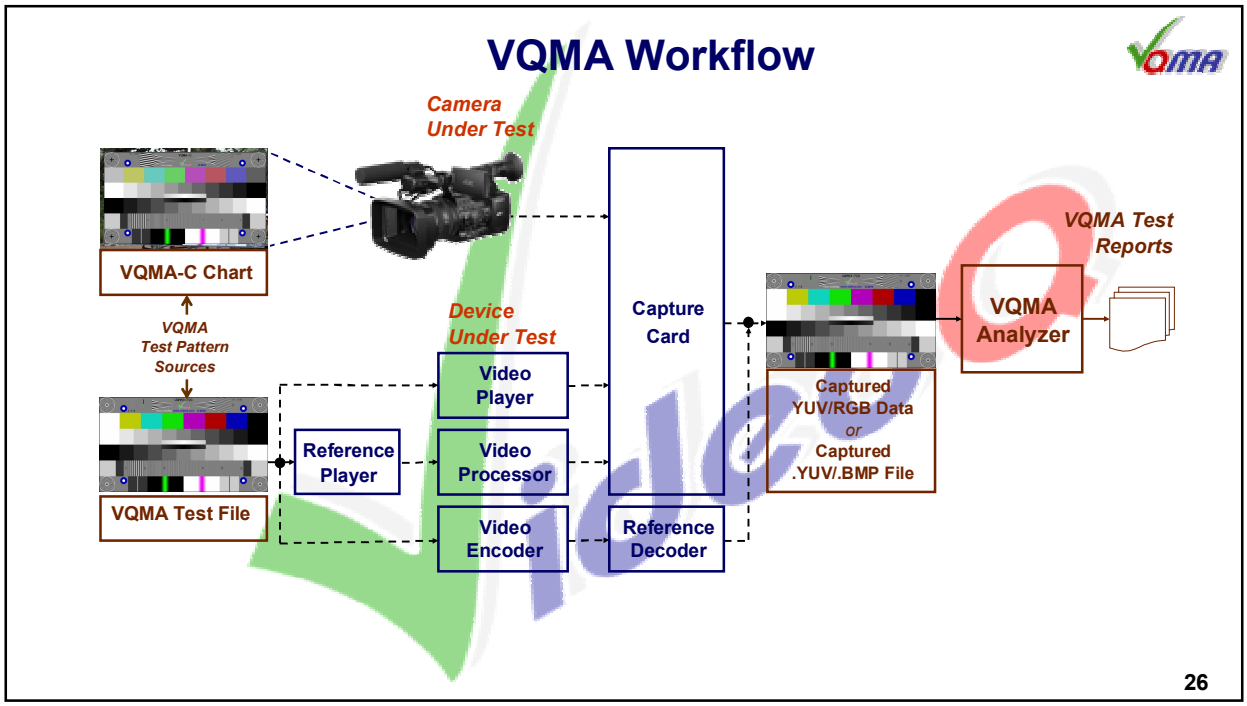
*Warnings: a) **Side Bars** detected, **Frame Size** 720x576, **Active Image** 710x572 b) Inconsistent **Interlaced Fields Cadence**: "11" (87%) & ""11psf" (12%)*



Metadata JSON File of Legacy Video by VQFTC






VQMA Workflow
Camera Under Test
VQMA-C Chart
VQMA Test Pattern Sources
VQMA Test File
Device Under Test
Reference Player
Video Player
Video Processor
Video Encoder
Capture Card
Reference Decoder
Captured YUV/RGB Data or Captured .YUV/.BMP File
VQMA Analyzer
VQMA Test Reports
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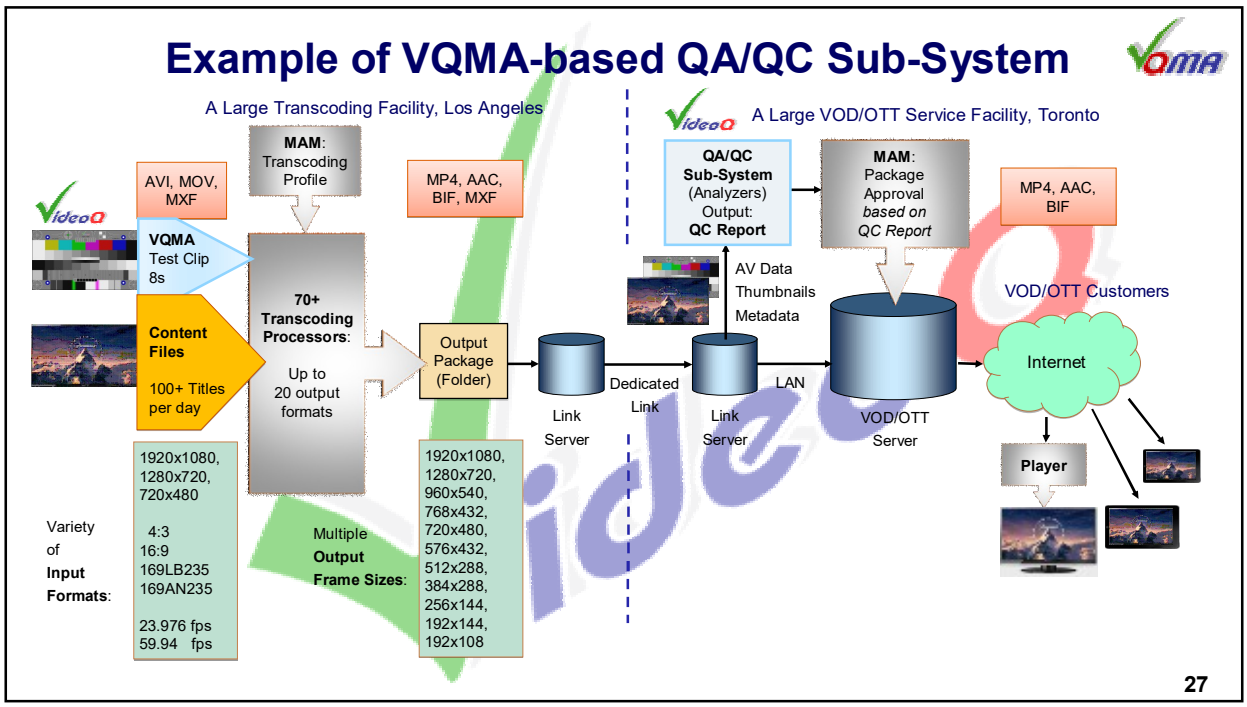
Example of VQMA-based QA/QC Sub-System
A Large Transcoding Facility, Los Angeles
A Large VOD/OTT Service Facility, Toronto
AVI, MOV, MXF
MAM: Transcoding Profile
MP4, AAC, BIF, MXF
VQMA Test Clip 8s
Content Files
100+ Titles per day
70+ Transcoding Processors:
Up to 20 output formats
Output Package (Folder)
Link Server
Dedicated Link
Link Server
LAN
VOD/OTT Server
QA/QC Sub-System (Analyzers) Output: QC Report
AV Data
Thumbnails
Metadata
MAM: Package Approval based on QC Report
MP4, AAC, BIF
VOD/OTT Customers
Internet
Player
Variety of Input Formats:
1920x1080, 1280x720, 720x480
4:3
16:9
169LB235
169AN235
23.976 fps
59.94 fps
Multiple Output Frame Sizes:
1920x1080, 1280x720, 960x540, 768x432, 720x480, 576x432, 512x288, 384x288, 256x144, 192x144, 192x108
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VideoQ Toolkit for UHD & HDR Applications

- Mixed UHD/HD HDR/SDR production, post-production and distribution workflows require new QA/QC and monitoring tools equally suitable for live production and file-based environments.
- Video personnel and other production team members operate in various ambient illumination conditions, especially in case of field production. Video monitors screen sizes are typically limited; viewing distances are about 3-5 screen heights. In such conditions, expensive UHD HDR monitors are hardly useful.
- Thus, there is a need for cost-effective multi-channel converter/adapter taking full quality UHD HDR feeds and outputting standard HD SDR video in SDI/HDMI/LAN/WAN formats suitable for any screen and providing for remote monitoring and remote production.
- Besides this, cameras and other HDR/SDR sources video levels should be measured and presented in intuitive graphic formats allowing at-glance estimation of multiple video feeds/tracks by a single operator as well as data logging for QA/QC purposes.

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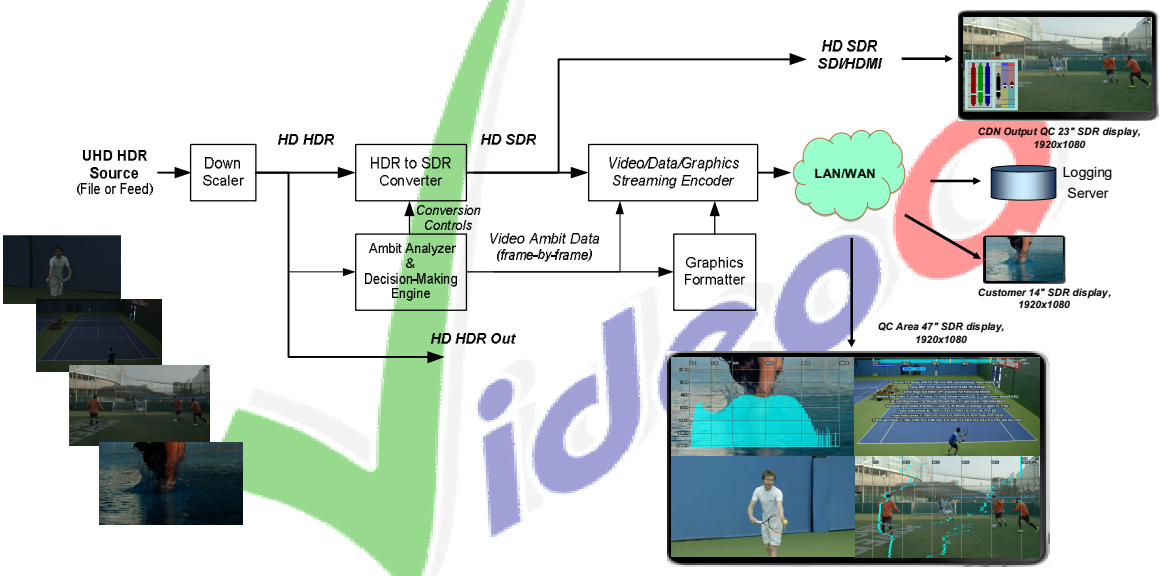
UHD-HDR Downconversion Example



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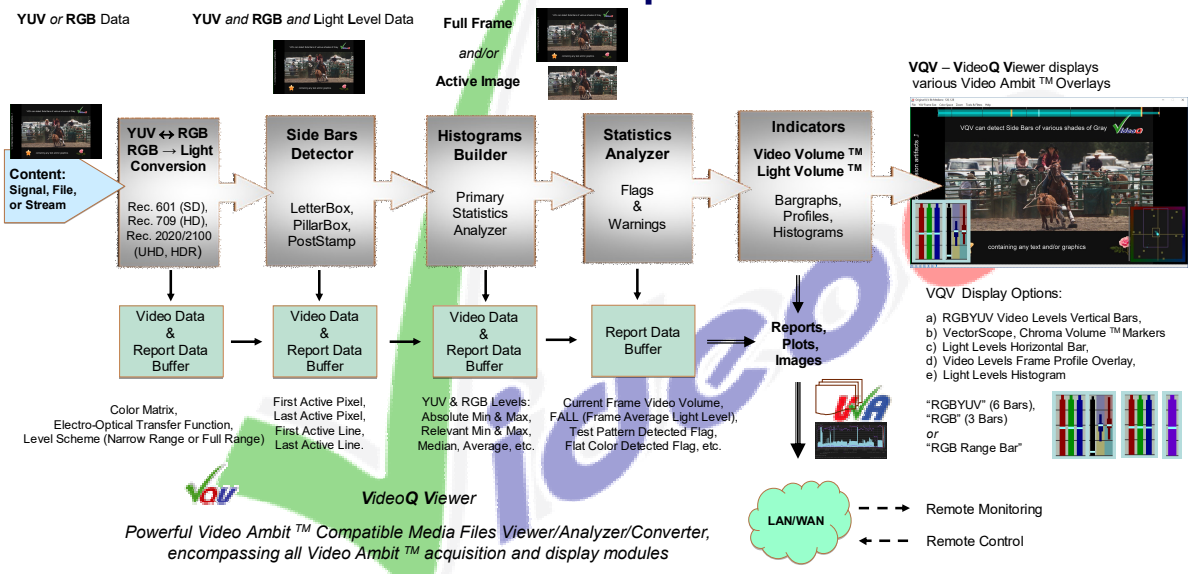
Video Ambit ™ Data Acquisition Workflow



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For more details – see next slides

For the curious ones …

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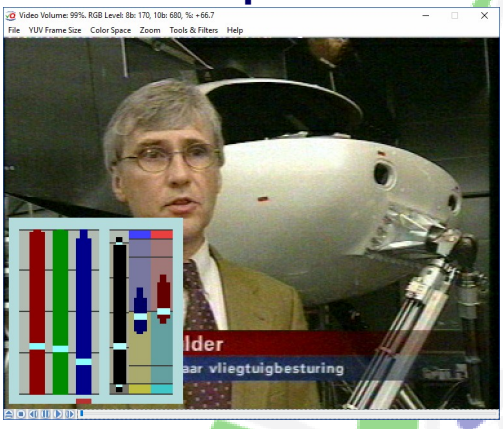
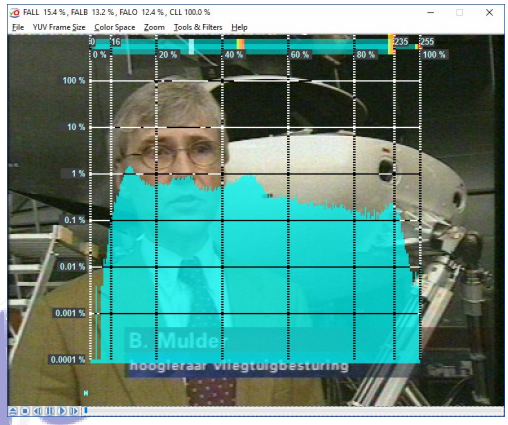
Example – Checking Video & Light Levels





Automatically generated metadata show that this SDR (Standard Dynamic Range) image features medium light output, good contrast and color balance, medium color saturation:
- Histogram goes below Nominal Black (RGB 8b value 16) and Nominal White (RGB 8b value 235), but affected image areas are rather small, histogram bin counts below black and above white are between 0.001% and 0.1%, which means there is no severe clipping, i.e. not so many pixels are affected.
- Frame Average Light Level is low-to-medium: 15.4%, Video Volume is high: 99%.
- All 3 Wide Bars touch Nominal Black meaning that clipping is possible. Black Crush Warning Indicator shows that there is actually mild black clipping, but only in B channel, not in R or G.

Comments (by human operator, not automatically generated):
Contrast is good, but RGB median values are low: about 25% (upper-right & bottom-right corners are in the shadow). Also U channel median is below neutral gray – meaning "yellowish" image. It looks like gamma, color balance and saturation have been tweaked – probably to make the image "vivid and warm".

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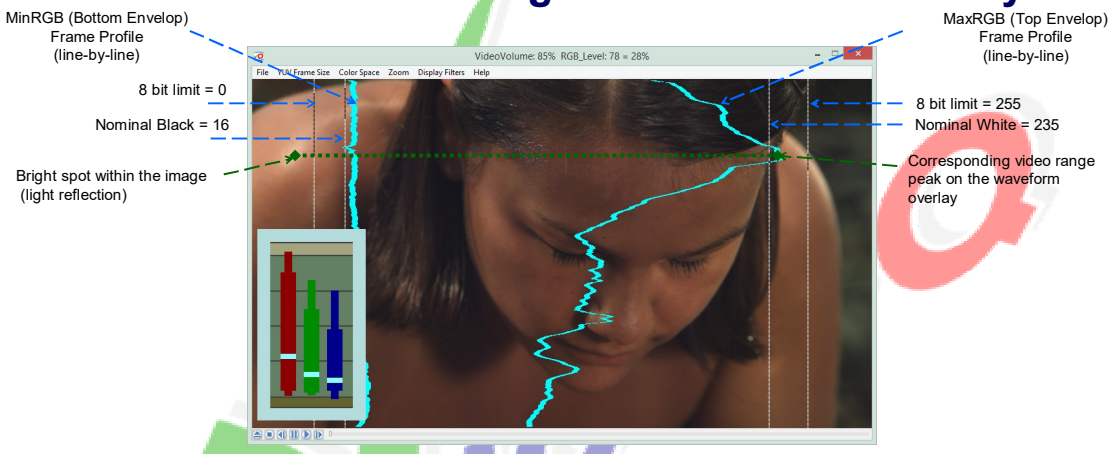
RGB Bars & RGB Range Frame Profile Overlay



Measured levels range waveform overlaying live video image provides for easy visual correlation between particular scene objects and their respective video levels. In this example, high (above Nominal White) peak on vertical profile does not correlate with relatively low values of median levels – highest of three RGB channels Medians is R channel Median, which is rather low: about 30%.
However, Median values and 85% Video Volume value correlate well with general subjective assessment of the picture as a bit *darkish, but not too much.*

This example shows that Waveform Overlay does not replace Video Volume Meter or Triple Bar Overlay, but it helps to resolve special cases.

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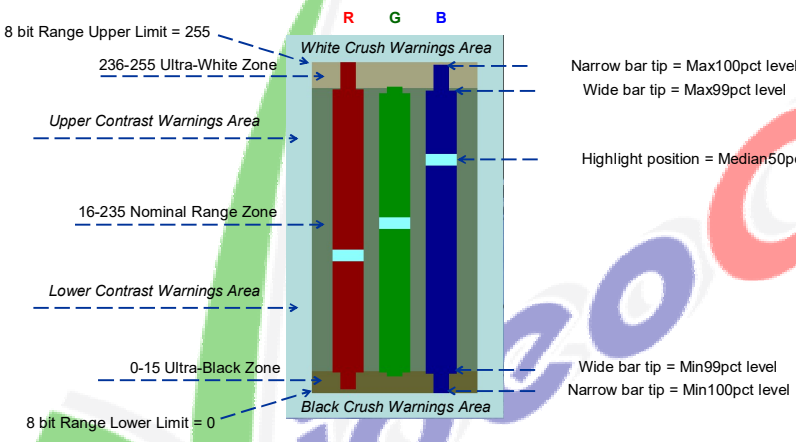
VideoQ Video Volume ™ Triple Bar Display



Each **Wide Bar** represents the color component range for **reliable 98%** of current frame pixels,
whilst corresponding **Narrow Bar** shows ***extreme*** values for **all (100%)** pixels - they are nearly random and may vary a lot.

This explains the drastic difference in the dynamic behavior of two bars on live video playout:
Wide Bar size and position typically do not change significantly from frame to frame, but Narrow Bar tips are moving very fast.

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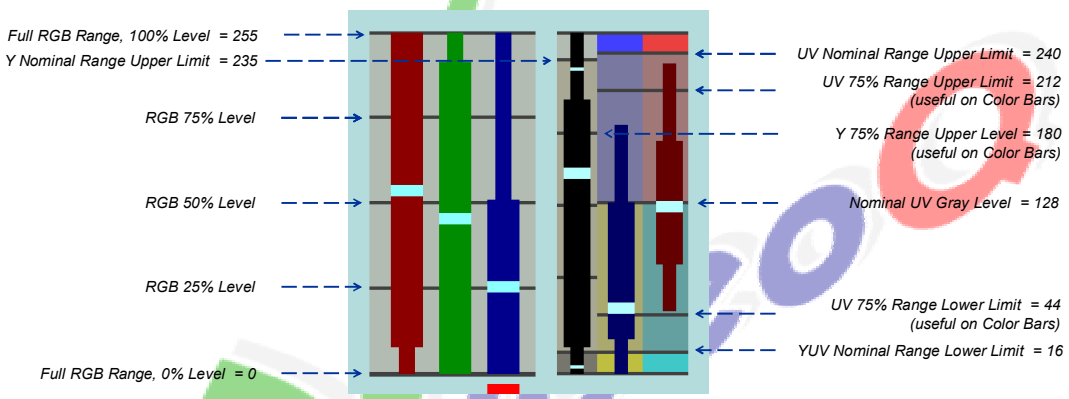
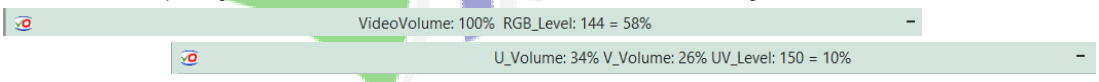
Video Volume ™ Six Bars Display Option

Combination of RGB Range display with YUV Range display provides for fast and complete understanding of color image parameters

R, G, B, Y, U, V : 6 Channels combined



If mouse cursor is within RGB Bars area VQV displays RGB range info; if cursor is in the YUV Bars area it shows YUV info. Vertical cursor position is converted to corresponding RGB or UV level decimal value and % of Nominal RGB or YUV Range:



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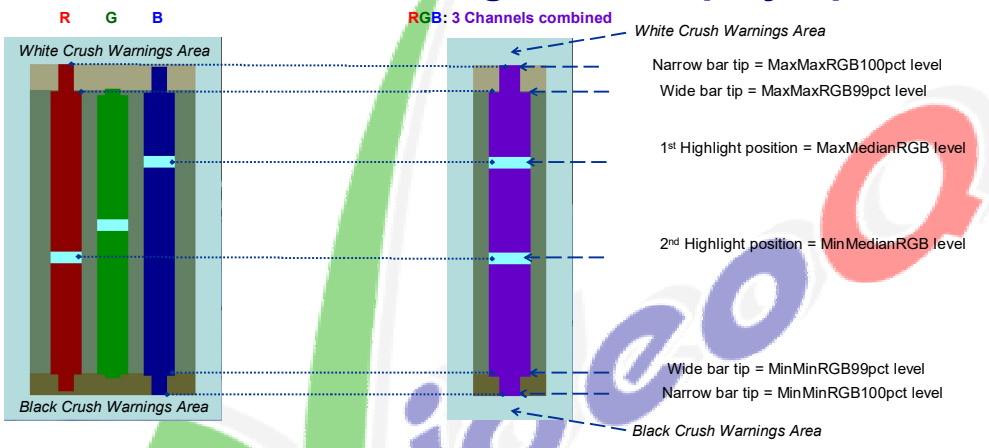
Video Volume ™ Single Bar Display Option



Single Bar Mode requires less time and human brain efforts to grasp current condition of all 3 color channels together, so it is more suitable for CDN facilities QA/QC dealing with hundreds of feeds.

On the other side, Triple Bar display provides more detailed information, so it is more suitable for production QA/QC and R&D labs.
For the example shown here, only the Triple Bar display shows that Green channel 100% range is in fact much smaller than the corresponding ranges of Red and Blue channels and its median level is about half-way between R and median levels, but closer to R.

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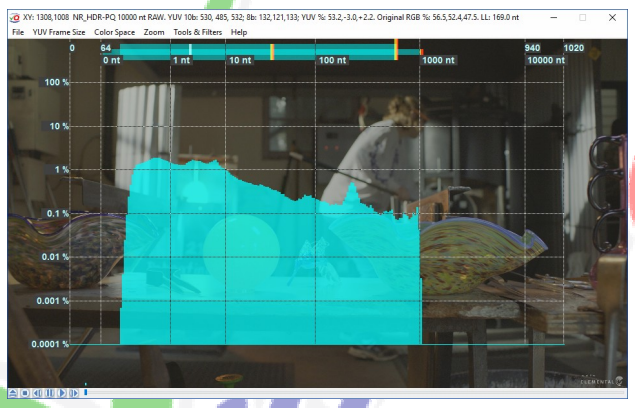
Light Volume ™ Meter & Overlays



Logarithmic scale of **Light Levels Bar** (L-bar) display covers very large range of values: from 0 nt to 10,000 nt (YUV-to-MaxRGB-to-Light Model nits).
Highlight markers show current frame and global Light Levels statistics: Absolute Min, Lower Envelop, Median, Average, Top Envelop, Absolute Max

Logarithmic scale of **Light Levels Histogram** bins display covers very large range of values: from 100 % of screen area (in case of solid flat color the bin count may be in millions) down to 0.0001 % (even single pixel events are visible)

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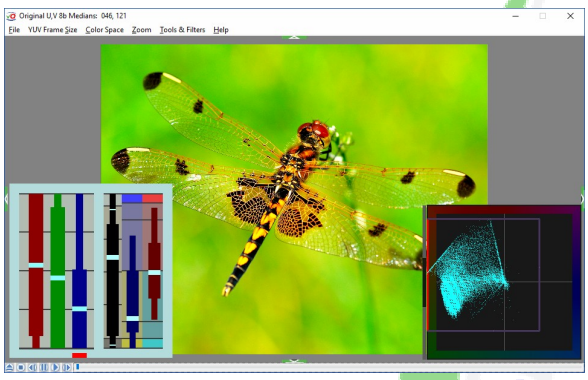
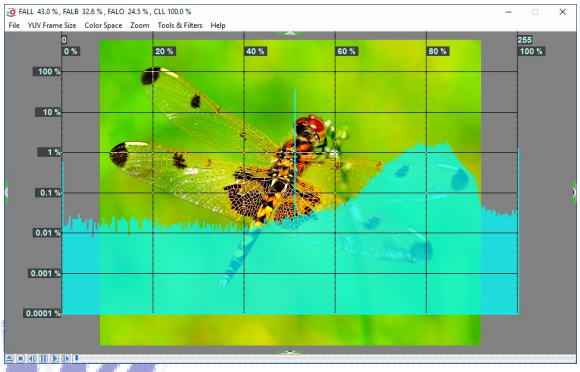
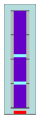
Example – Checking Video & Light Levels







- R, G and B wide bars are not of the same height, B bar is half of the nominal range.
- There is strong Black Crush warning in B channel.
- Median values balance significantly shifted towards Green-Yellow, Median R is the highest, and Median B rather low (without the contribution from the gray background it is in fact about 0%).
- VectorScope (bottom-right insert) shows that:
  - UV center of gravity shifted to Green-Yellow
  - UV Color Gamut severely clipped on Red and Magenta edges

- High quality (but tweaked) image, color balance shifted towards Green-Yellow, which is the dominating color of this picture
- LL (Light Levels) Histogram occupies full nominal range, highest peak relates to background gray – it takes about 40% of image area, also there are two not so strong peaks on 0 % and 100% - indicating strong R,G,B video levels clipping (Black Crush = ~0.7% and White Crush = ~1.5% of the image area) .
- Histogram center of gravity (soft peak) is at ~ 80%, which means that the light output is rather high (thus indicating that OLED type displays power consumption also will go high).

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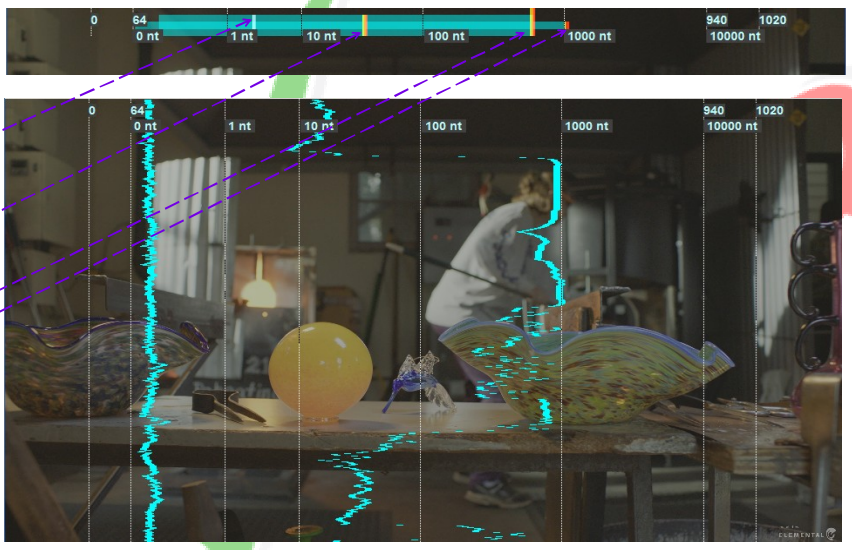
Example – Checking HDR-PQ Light Levels



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Example – HDR-PQ after 1,000 nt LUT

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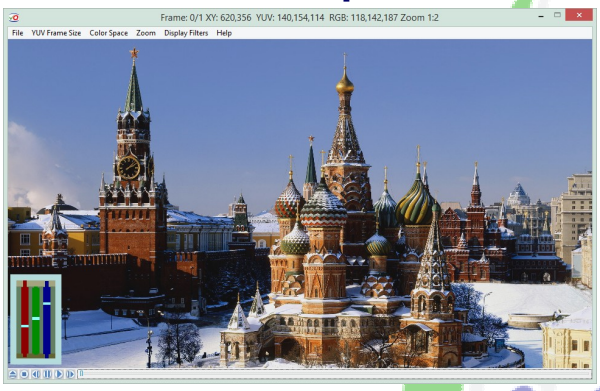
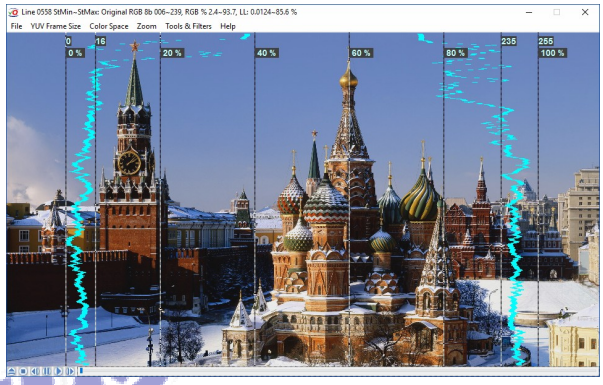
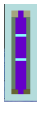
Example – Checking Video Volume 1







- High quality image, good contrast, good color balance.
- R, G and B wide bars are about the same height and each bar occupies nearly full nominal range.
- No Black Crush or White Crush warnings.
- Median values balance shifted towards Blue, which is also one of visually dominating colors of this picture (blue sky). Single (RGB combined) bar indicator clearly shows that median values of 3 channels are rather different.

- Measured levels range waveform overlaying live video image provides for easy visual correlation between particular scene objects and R,G,B video levels.
- In this example, majority of frames lines go slightly below Nominal Black (8b value 16) and slightly above Nominal White (8b value 235), which means that majority of frame lines contain pixels with at least one of 3 R,G,B channels clipped
- However, absence of Black Crush and White Crush warning indicators on the triple bar overlay (bottom- left insert) means that this clipping is not really annoying

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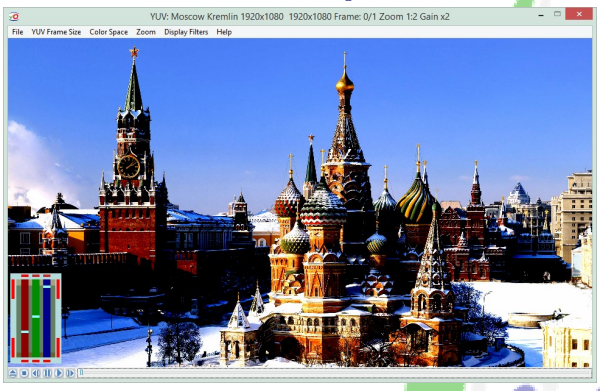
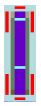
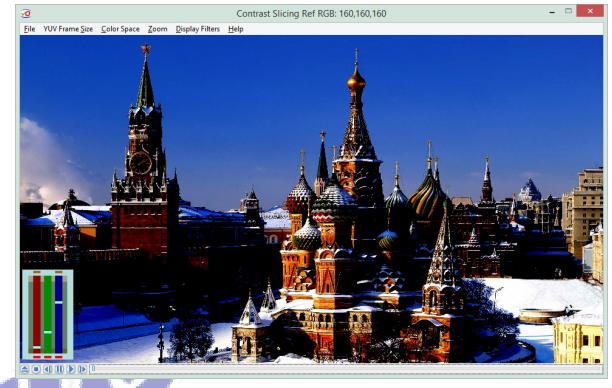
Example – Checking Video Volume 2



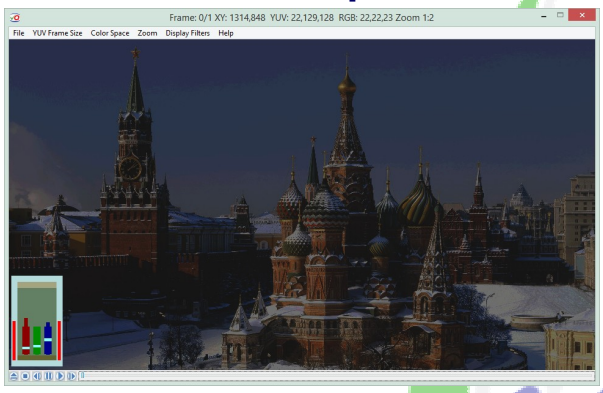


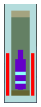
- Severely damaged over-contrasted image.
- R, G and B wide bars are beyond nominal range, reaching 0 and 255 limits.
- Max strength Black Crush and High strength White Crush warnings.
- Excessive Image Contrast warning on both sides.



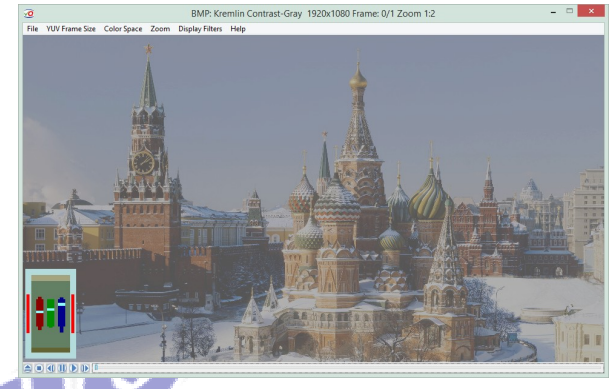
- Dark, very high contrast image.
- Max strength Black Crush warnings for all 3 channels: R, G, and B
- Low strength White Crush warnings, only for R and B.
- Median values in R & G channels significantly shifted towards dark brown shades, blue is high, i.e. it is the dominating color of this picture.

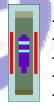
Example – Checking Video Volume 3





- Under-contrasted “darkish” image.
- R, G and B wide bars heights are less than half of the nominal range.
- Median values in all 3 channels are quite low.
- No Black Crush or White Crush warnings.
- Dark-levels Image Range warning.





- Under-contrasted “foggy” image.
- Wide Bars are in the mid-range and of small height.
- Median values in all 3 channels are close to mid-gray level.
- No Black Crush or White Crush warnings.
- Mid-levels Image Range warning.

VideoQ Side Bars Detector Features