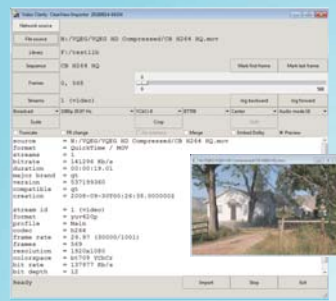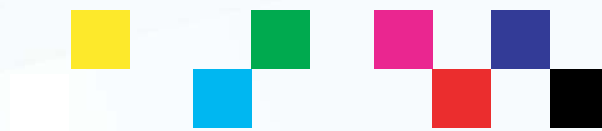# ClearView

Video Quality Analysis Software


Video Clarity

Tools for Video Analysis

ClearView Software is highly advanced test & measurement analyzer for audio and video quality, as well as comparatively viewing two uncompressed video sequences up to the graphics capacity of a users computing platform. The solution, along with its comprehensive file importing application, provides a wide choice of measurements that effectively quantify the human subjective experience.
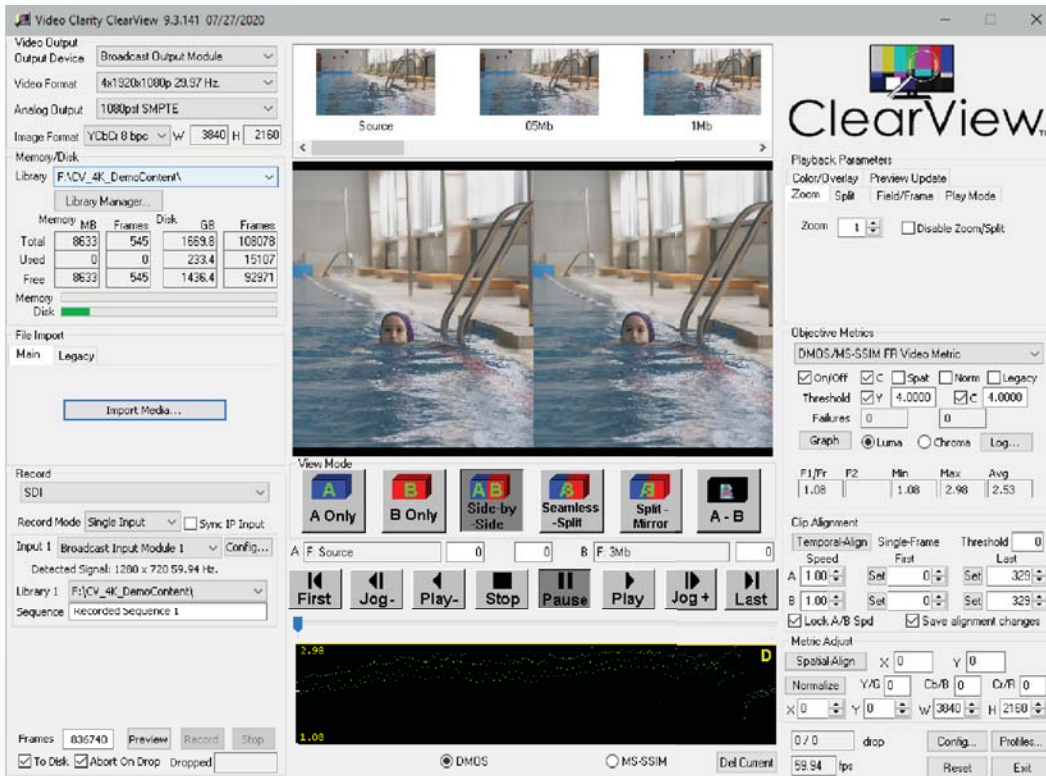
Objective Quality Metrics
- VMAF: Video Multimethod Assessment Fusion is tailored for quality assessments of streaming video services
- MS-SSIM: Provided on a user variable DMOS and MS-SSIM scales
- Sarnoff JND: Picture Quality Rating (PQR) providing the JND vision model (optional)

Performance Metrics
- PSNR: Peak Signal to Noise differences in video
- AFREQ: Audio Frequency conformance measurement to find gross errors in audio performance versus a reference, provides lip-sync measurement in milliseconds

No Reference Metrics
- NIQE: No reference video quality metric from file or in real-time from IP input
- APEAK: Audio loudness measurement per program according to ITU-R BS.1770-4
- Spatial: Calculates the activity power of a frame within each frame
- Temporal: Calculates the changes between successive frames

Subjective Viewing Modes On PC Desktop
- Play sequences to a separate window on the desktop
- Apply multiple subjective viewing modes to assess quality at full resolution
- Use all interactive play modes including zoom, pan, and pixel value tools

Control
ClearView GUI
Play list commands
Load list commands
Batch file commands
- Full Command Line Interface

Operation
Input From IP Network
- Both a source and test stream
- Real-time demux/decode
Importing Files
- Demulitplex MPTS files
- Scale/Crop
- Decode all media file types
Visual Analysis Modes
- Side-by-side
- Over-under
- Split mirror
- A-B with Addback & Threshold
- Field-only play
- Zoom & pan
- Find pixel values via mouse
Perceptual Metrics
- VMAF
- MS-SSIM with DMOS scale
- ΔEITP
- NIQE
Additional Measurements
- APEAK true-peak amplitude
- LKFS loudness test
- AFREQ audio impairment test
- Lip-sync +/- measurement
- PSNR
- Spatial (Activity)
- Temporal (Change)

Test Score Analysis
Log files contain the quality scores and information about each test's setup
- Metric Log Grapher creates multiple test comparisons
- Drag & drop log files back to ClearView to recall previous tests and comparison views

The best way to subjectively analyze and compare two different sequences is to look at them on the same video display. Using two different displays, even of the same type, requires vigilant calibration. Therefore, ClearView has many viewing modes that show the two sequences in a separate playback window on the desktop.
- In side-by-side and split-mirror modes the sequences can be panned as only half of the image is showing.
- In seamless split mode part of the image is from the reference and the rest of the image is from a processed version of the video content.
- ClearView allows the split point to be moved interactively.

Side-By-Side Viewing

Split Mirror Viewing

Seamless Split Viewing

Video sequences can be further analyzed as follows:
- Zooming into any picture area up to 16x
- Panning within the picture during zoom or split screen
- Identifying pixel values via mouse click
- Playing individual fields

Using the included command line interface play lists can be created to allow any view mode to be executed in a series.

ClearView A-B: An easy way to view pixel intensity differences between two images.
- Below a straight subtraction shows one pixel level intensity which may not be possible with some displays.
- Therefore, ClearView systems include A minus B with a Threshold and Addback command allowing users to see differences that are greater or less than a specific pixel intensity threshold as a selectable color.
- This also allows edge differences to stand out.

A minus B with Threshold = 20 View Mode
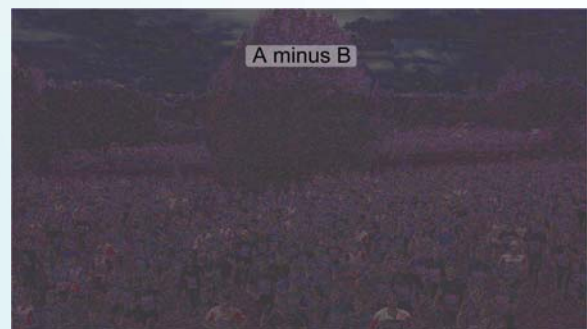

Colors green A>B; yellow B>A
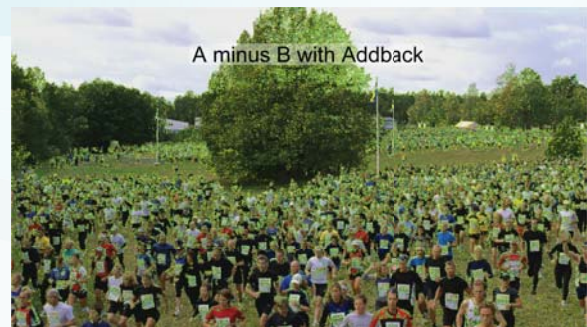
These views are all simultaneously fed to the ClearView graphical user interface and to a separate desktop window.

PSNR: One of the most widely used metrics is PSNR (Peak Signal-to-Noise Ratio). It measures the mean error between input and output expressed as a ratio of the peak signal in dB. PSNR, while not performing a human perceptual video quality prediction, does serve an important role as one of the objective metrics included in all ClearView systems. PSNR provides the absolute difference between two signals and is important for device performance or network path testing where a PASS/FAIL indicator is needed.

NIQE: Natural Image Quality Evaluator is a completely blind, distortion free, no reference, image quality assessment index. This quality evaluator by University of Texas LIVE is of a natural scene statistic (NSS) based modeling framework for an opinion unaware (OU) and distortion unaware (DU) no-reference (NR) image quality assessment (IQA). The result is a first of a kind NSS-driven blind OU-DU IQA model which does not require exposure to distorted images a priori, nor any training on human opinion scores. The new NR OU-DU IQA quality index performs better than peak signal-to-noise-ratio (PSNR) and the non-multi-scale structural similarity (SSIM) index delivering equal performance to top performing NR OA-DA IQA approaches.

VMAF: This full-reference metric is designed by Netflix and implemented on its native scale in ClearView according to the latest published VMAF version. VMAF closely approximates human perception of video quality and is consistent across content types whether for natural videos or animated content. VMAF is particularly tuned to assess quality of video streaming by taking various source content characteristics into account and by focusing on compression and picture scaling artifacts as the dominant degradation components in delivered versions of streamed content.

MS-SSIM, SSIM and DMOS: In Multi-Scale Structural Similarity Image Metric (MS-SSIM), the picture is evaluated at various resolutions and the result is an average of these calibrated steps. MS-SSIM out-performs simple SSIM even when the SSIM is correctly calibrated to the environment and data set. ClearView includes MS-SSIM and SSIM, developed by the University of Texas, and provides both on their native scales with MS-SSIM also mapped to a linear DMOS (Differential Mean Opinion Score). The measurements may be performed on luma and a combined score is provided for color channels.
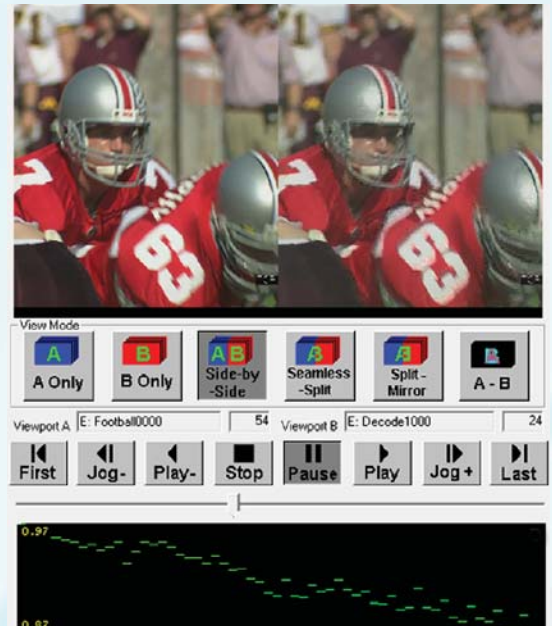
ΔE$_{ITP}$: Following ITU Recommendation BT.2124, ΔE$_{ITP}$ is useful to assess the potential visibility of color differences in HDR television images and signals. The metric returns a just noticeable difference (JND) score that provides an assessment of the differences introduced by signal processing techniques versus camera original content.

**Audio Performance Measurements - Included In All ClearView Models**
aFREQ - Audio Frequency Metric - Gives a comparison of audio versus a reference to find gross audio errors and provide a general performance comparison of source audio channels to processed audio channels.
- Audio/Video Alignment (lip-sync) is a millisecond accurate measurement included in aFREQ.
aPEAK - Audio Peak Metric and Loudness Measurement - Measures the true-peak amplitude, providing a value for each frame and a separate value for each channel. Within the aPEAK measurement there is a selection for **LKFS**, Loudness, K-weighted, relative to Full Scale. LKFS provides a measurement that takes peak loudness over a one second period over all audio channels in a given program and responds with one value over that period. The values returned are based on a logarithmic scale with 0 being the maximum value and -60 being close to silence. The LKFS measurement follows recommendation ITU-R BS.1770-4.

ClearView Importer is a comprehensive tool for importing many media file types. The application is provided with ClearView systems* or software allowing identification of source file types and full control of file importing parameters to store uncompressed sequences that are automatically inserted into a ClearView library for use within a ClearView test routine.

ClearView Importer GUI
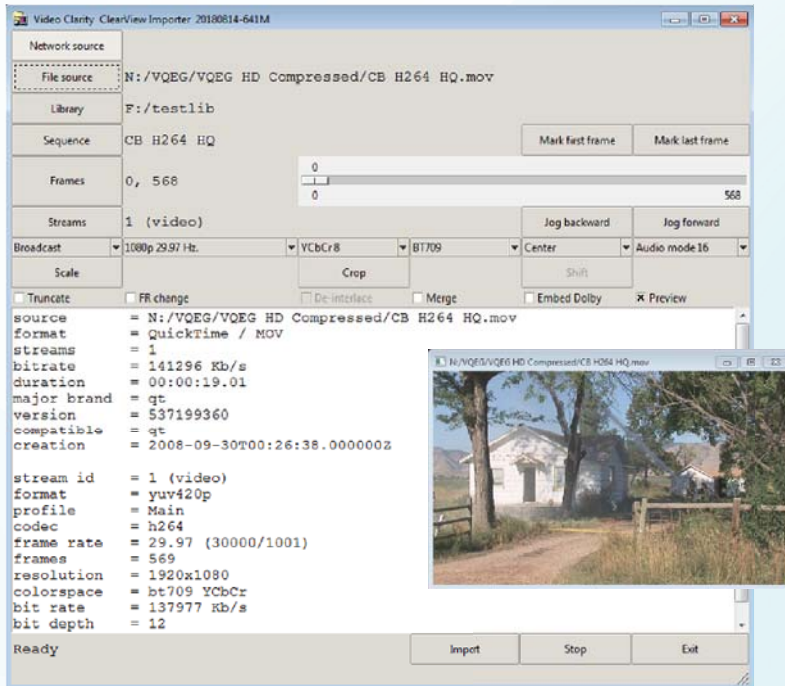
ClearView Importer Highlights

- Wide range of supported video and audio formats
- Fast audio and video decoding speed
- Detailed file import source information with video window
- MPTS import with program stream selector-decoder
- Easy source length import modification
- Detailed per pixel source cropping
- Image quality, size and positioning adjustment
- Up to 16 channels of audio decoding
- Command Line and GUI user interface

User confirmable file adjustments:
- Import HDR video in BT.2020 (PQ) or BT.2100 (HLG)
- Import ICtCp native color format or record it from HDSDI
- Decoded or imported frame size, rate
- First/last frames to import
- 3:2 pull down insertion or removal
- Native bit depth import of 8, 10 or 12 bit video
- Crop source with input values
- Scale video resolution up or down to x, y / w, h
- Variable image and canvas resolution
- Truncate to legal broadcast values (yes/no)
- Import audio and closed caption data

Imported File Formats (partial list):
Accom YUV CCIR 601 8-bit
ARI Raw Bayer Pattern
Avid AVR, DS HD/SD, DV (*.gen), DNxHD
Avid Meridian, Y'CbCr, OMFI (*.omf, *.omfi)
AV1, AVC, AVC-HD, AVR, AVS
Cineon (*.cin), CineWave
DPX RGB 8, RGB 10, Y'CbCr 4:2:2
DV (*.dv, *.dif), Digital Negative (*.dng)
DVS Direct File Format (*.dvs)
DVSD, DV25, DV50, MPEG-I, mJPEG, DigiSuite
GXF Format/SMPTE-360 (*.gxf)
H.261, H.263, H.264, H.265, HDV
Headerless/Raw (*.hdr, *.yuv, *.rgb, *.raw)
HiCon SLB32 RFB format (*.slb)
Image (*.gif, *.jpg, *.png), Jaleo (*.js), JFIF, JPED
JPEG, JPEG2000, LXF, Meridian, Media 100 MJPEG
Microsoft AVI (*.avi), BMP, DIB Files (*.dps)
MJPEG, MPEG 1 4:2:0 (*.mpg, *.mpeg)
MPEG-2 Elem. Stream, (4:2:0/4:2:2), MPEG2 (*.m2v)
MPEG-2 Program Stream, (4:2:0/4:2:2)
MPEG-2/4 in Transport Stream, (4:2:0/4:2:2)
MPEG-2/4 in MPTS (4:2:0, 4:2:2), MPEG-4 (*.m4v)
MPEG-4 AVC Elementary Stream 4:2:0/4:2:2, (*.h264)
MPEG-H HEVC/H.265 4:2:0 Main Profile (*.h265)
MXF Format (DCP, DV, DVCPro50, MPEG, IMX, OP1a)
Newtek Video Toaster (*.rtv)
Phantom Support (*.cine), PhotoShop FilmStrip (*.flm)
Photo CD PCD, Photoshop PSD, Portable anymap PNM
Portable Bitmap Format PBM DPS
Portable graymap PGM
Portable pixmap PPM
QuickTime Movies (*.mov)
QuickTime formats w/proper codec, ProRes, etc...
RealVideo (*.ra, *.rm, *.ram), Red Camera Stream (*.r3d)
Run-Length encoding (rle)
Sony XDCam, SGI Movie Format (*.mv), SGI RGB
Silicon Image Bayer (*.siv), Sun Raster (*.ras)
Targa TGA, ICB, VDA, VST, Targa 3000, TIFF, TIF
v210 Y'CbCr 10 Bit, VC-1 Pro, VP8, VP9, Viewstore (*.vsr)
vcap, vcap10, Windows Media (*.asf, *.wmf, *.wmv)
Y'CbCr 8/10, Y'CbCr, RGB, YCrCb 8/RGBA

Audio Import Formats:
Dolby® Digital Plus Professional Input Decoder
MPEG-2 Layer 1 (*.mp1)
MPEG-2 Layer 3 (*.mp3)
Waveform Audio (*.wav)
Adaptive Multi-rate (*.amr)
Audio Interchange File Format (*.aiff)
Windows Media Audio (*.wma)
Advanced Audio Coding (*.aac)

Exported File Formats:
BMP, Headerless/Raw (*.yuv, *.rgb, *.raw)
Microsoft AVI (*.avi), MXF (v210)
QuickTime with up to 16 audio channels

ClearView Software provides several options for recording via IP networks as outlined below. The solution also provides the very useful ability to record a side by side comparison from the system's output to a separate sequence for export into standard file format.

IP Input - For Compressed Stream Decoding and Recording

Compressed IP streams are automatically decoded with single or dual input modes that record a video sequence as sensed at the IP multicast address and port specified within the IP configuration menu. *IP Input may decode up to 4K video with the latest multicore processor computer systems .*

Each input selection is provided with individual menus to set up each IP stream input parameters. Each IP menu contains transformation settings for scale, crop, de-interlace, rate change and position for matching of source content to the IP network delivered sequence format for testing.
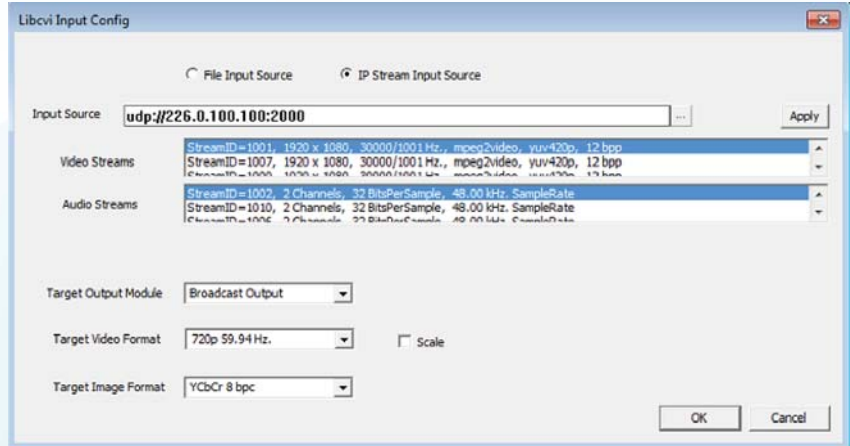
SMPTE ST 2110 Network UHD Input & Output Support

Recording, playback, and record-while-play modes in ClearView may be applied with certain minimum computing platform requirements. Recommended is a minimum I7 processor, 32 GB of RAM, minimum 25 Gb/s throughput to storage, and Mellanox ConnectX®-5 or higher network adapters. A sequence loaded into Viewport A may be output for processing by the IP network encoder or device under test with IP output. The ClearView can simultaneously record as ST 2110 or decode a compressed IP stream as test input.

From ClearView

The ClearView Output tab provides the unique ability to record any sequence or combination of two sequences that are set into any View Mode. As an example a side by side view of two synchronized sequences, each with an identifying overlay window, is created as a single file in a ClearView library. This sequence can then be exported in YUV, AVI or QuickTime format for delivery and playback review by most of today's computer desktop graphics outputs. This mode also allows a snapshot recording so that representative stills can be inserted as reference material to presentations.

Note: ClearView system products have functions for HDSDI, HDMI or analog source recording. ClearView Software only supports the ability to record from IP networks.
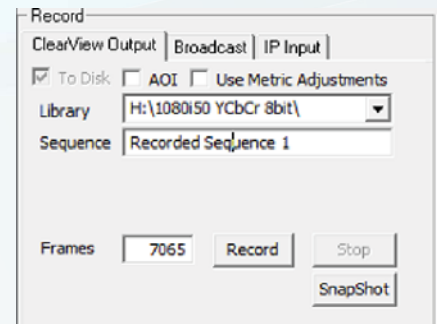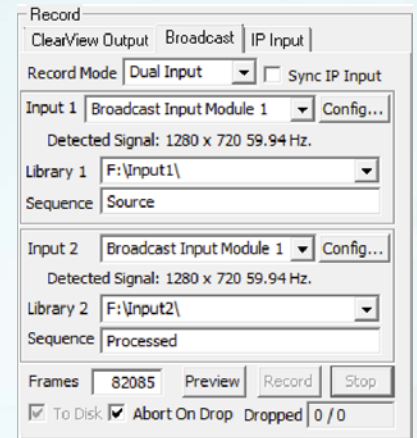
ClearView Software Models and Specifications

CV-1L - Permanent on-premise software **CV-1L-Year** - One year SaaS subscription **CV-1L-6Mon** - 6 months SaaS subscription - SaaS may be on-premise or cloud-based - On-premise requires USB key shipment	**On-Premise Software** - Minimum Required System Specification: Intel I7 or equivalent, 16 GB memory, 3 Gb/s minimum disk throughput **On-Premise Software for ST 2110 Environment** - Minimum Required Specification: Intel I7 or equivalent, 32 GB memory, 25 Gb/s throughput to storage, Mellanox ConnectX®-5 or higher network adapters	**SaaS on AWS** - Minimum Required Specification: T2.xlarge with 16 GB memory **SaaS on Azure** - Minimum Required Specification: Standard E2s v3 - 2 vCPU(s) with 16 GB memory