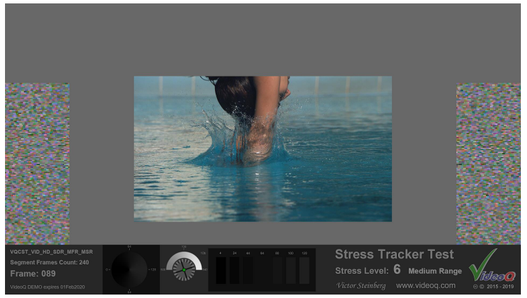

VQCST

VideoQ Compression Stress Tracker ™

Dynamic Test Pattern
for video compression quality analysis

Training Presentation

December 2024

videoq.com/vql.html

videoq.com

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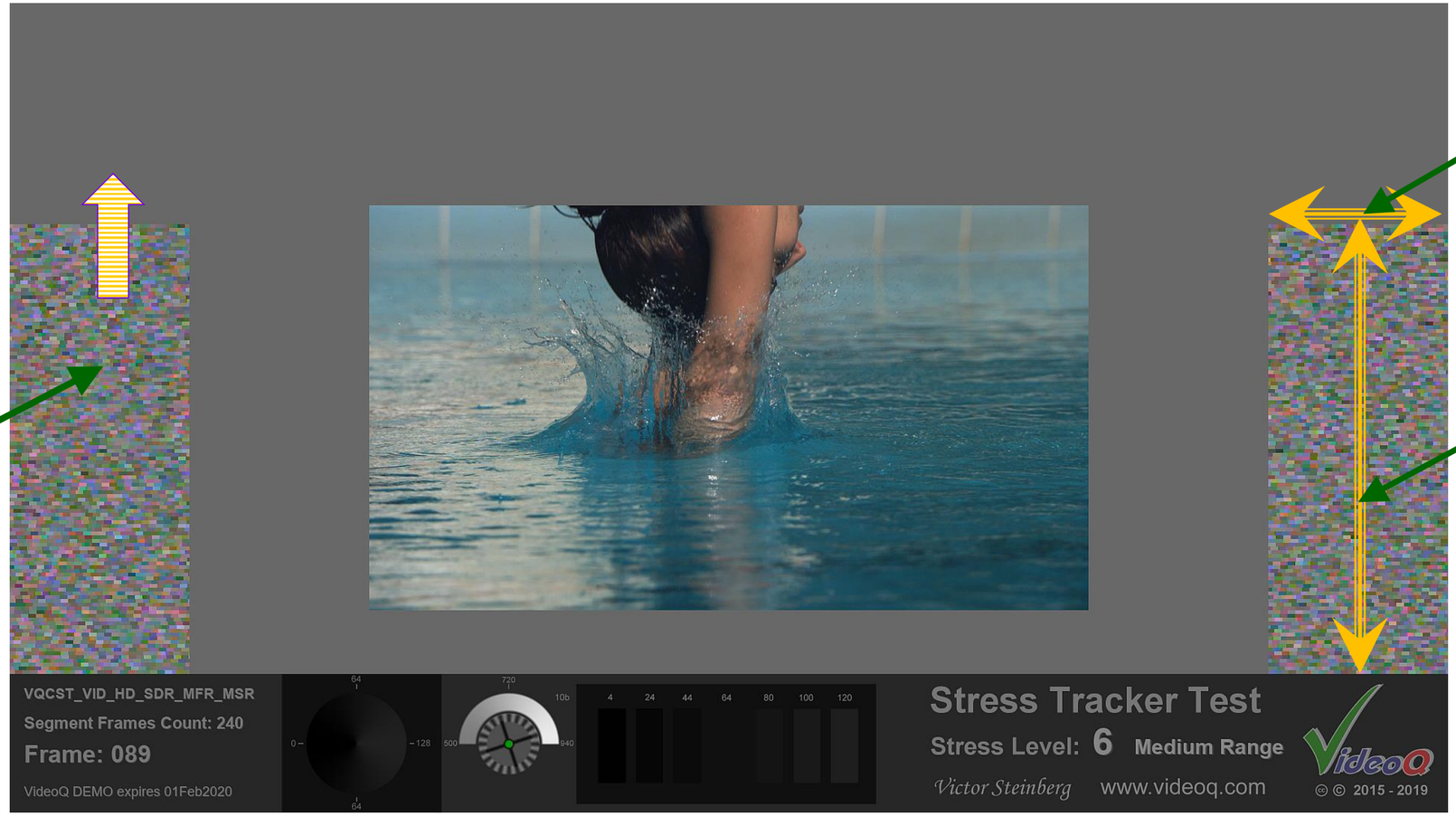
*Click on **VQL Logo** in the upper-right corner of any slide for this **Table Of Contents***

1. Dynamic Test Pattern for Compression Codecs

Stress Level
rising

Pseudo-random color shapes: ***calibrated*** stress source



Switchable **Stress Ranges**: Low, Medium, High

Variable **Stress Level**: from 0 to 9

VQCST is a sequence of **10 Segments** (**10 Stress Levels**), each segment duration: 4.0, 4.8 or 5.0 seconds.
Total sequence duration is 40, 48 or 50 seconds, depending on the selected frame rate.
Stress Tracker ™ test is suitable for **subjective image quality estimation** in real time and for **automated** measurement of **Stress Response Profile**.
It is possible to play infinite loop of each segment or infinite loop of the full sequence.

2. Features

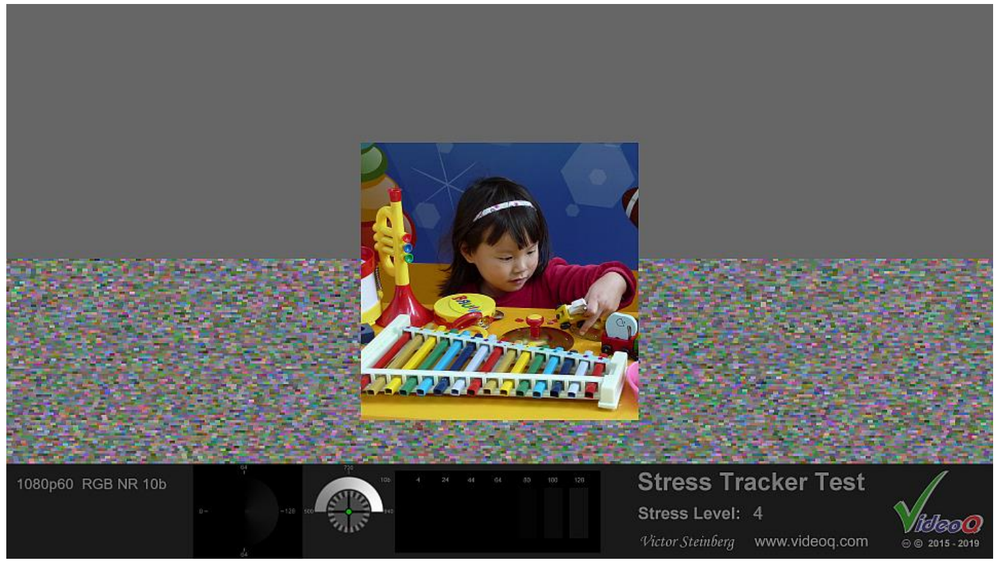
Sophisticated dynamic test pattern for **HDR** and **SDR** video compression quality analysis by **direct viewing**, **instrumental analysis** (e.g. by VideoQ **VQV** viewer-analyzer), and/or **calculation of quality scores** – VMAF, SSIM, etc. (e.g. by VideoQ **VQCSA** analyzer).

Video compression QA/QC tool:

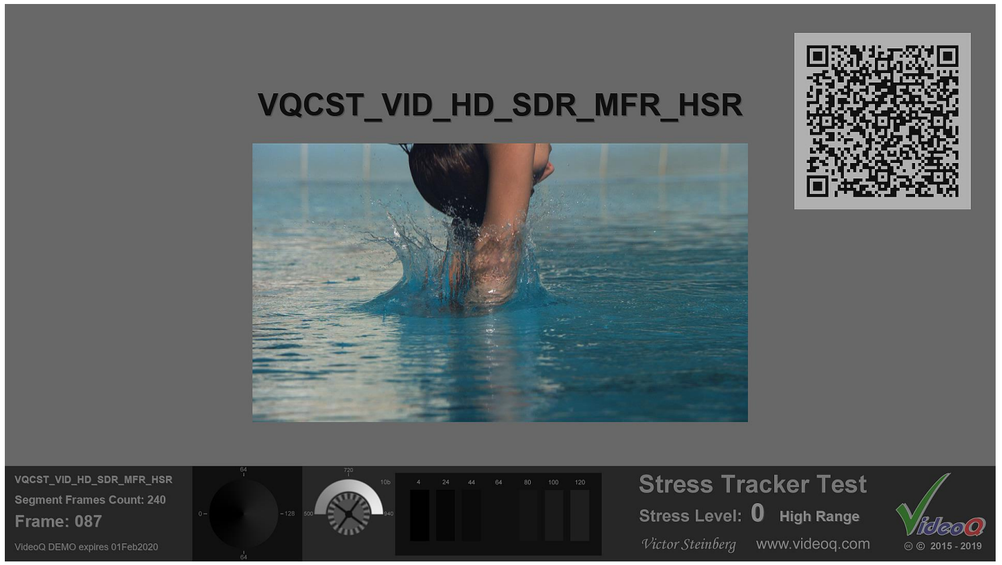
- Easy-to-use tool, instantly revealing performance of your video codec or complete system
- Analysis of systems with any bitrate, frame size, frame rate, interlace, or aspect ratio
- Suitable for analysis of all codecs, types of video materials and encoding profiles
- Unique test pattern composition
- Unique Stress Response Profile measurement methodology
- Full Reference (**A** vs. **B**) and Self-Reference (**AStress_Level** vs. **A0**) modes
- Ideal tool for development labs, software developers and high volume manufacturers

3. Test Pattern Variants

Static picture variant



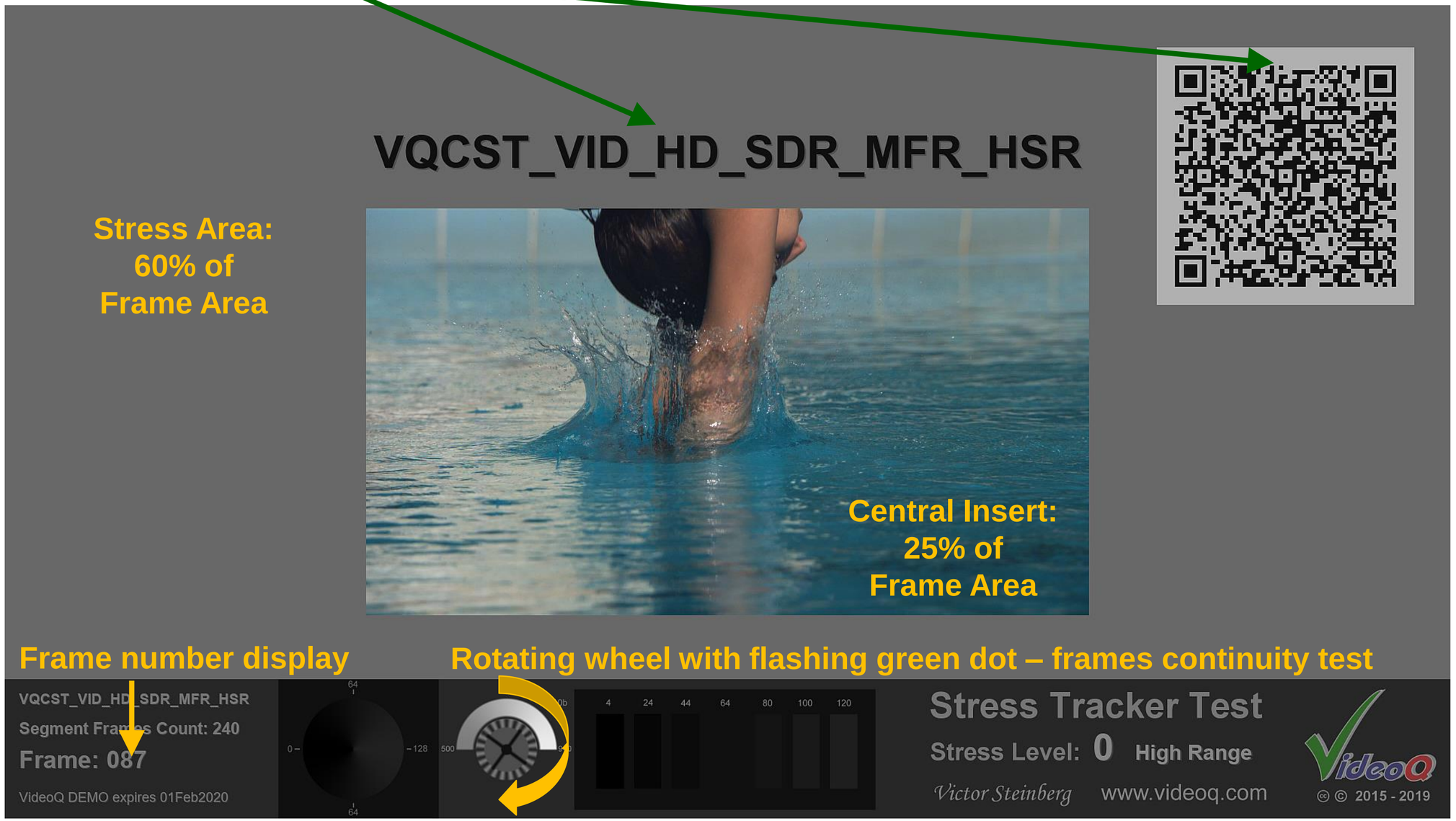
Dynamic video variant



- 3 **Central Insert Types**: **static picture** (photo), **video clip** or artificial **test pattern**
- 3 **Frame Sizes**: **HD**, **UHD** (4K) and **8K**; other frame sizes available on request
- 3 **Dynamic Range** formats: **SDR**, **HDR-PQ**, **HDR-HLG**
- 3 **Frame Rate Ranges**: **Low** (24 to 30 fps), **Medium** (50 to 60 fps), **High** (above 60fps, e.g. 120fps)
- 3 **Stress Ranges**: **Low**, **Medium** and **High**, suitable for various codecs and bitrates
- VMAF, SSIM, etc. **scores** can be measured for the **whole frame** or for **specified zones**

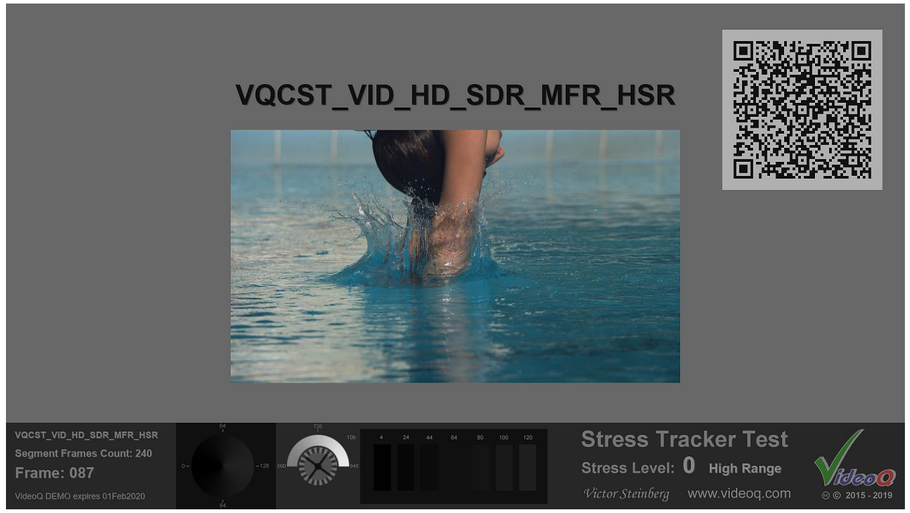
4. Test Pattern Composition

Large font **Code Name** and **QR Code** overlays are present only in **Stress Level 0** segment

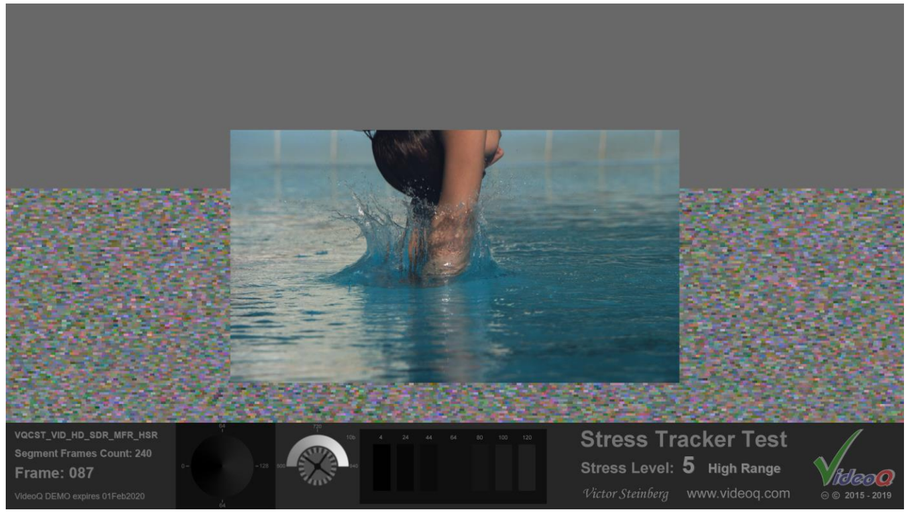


5. Stress Range Subsets – High, Medium, Low

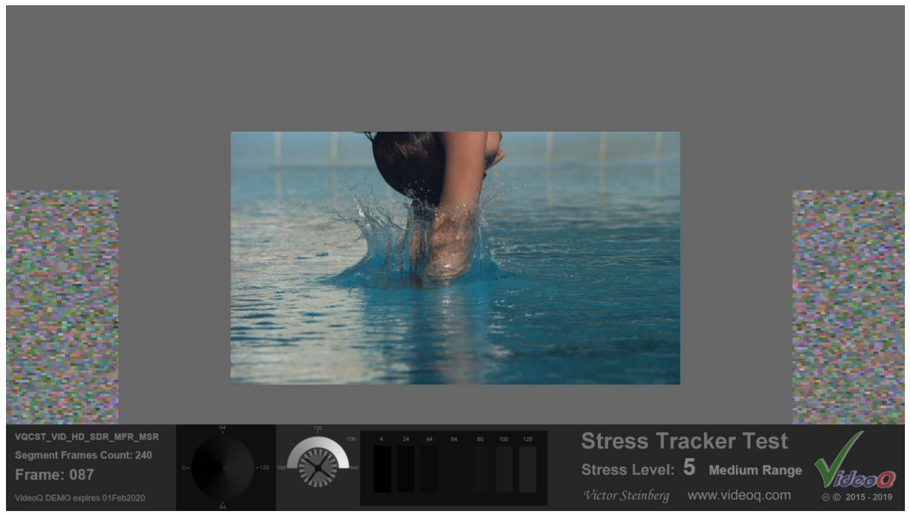
HSR, MSR or **LSR**, Stress Level 0



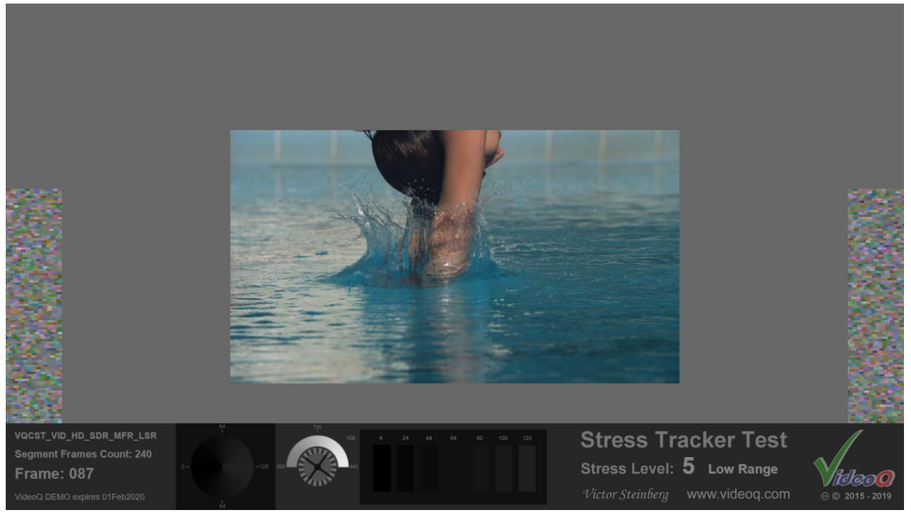
High **S**tress **R**ange, Stress Level 5



Medium **S**tress **R**ange, Stress Level 5



Low **S**tress **R**ange, Stress Level 5



6. Code Name Conventions

VQCST_VID_HD_SDR_MFR_LSR

Central Insert Type:
- VID = Video
- PIC = Picture
- ZPT = Zone Plates Pattern

Frame Size:
- HD (2K)
- UHD (4K)
- 8K

Dynamic Range:
- SDR
- HDR-PQ
- HDR-HLG

Frame Rate Range:
- LFR = Low
- MFR = Medium
- HFR = High

Stress Range:
- LSR = Low
- MSR = Medium
- HSR = High

Stress range variants differ in the area that is occupied by pseudo-random shapes

Frame rate range variants differ in the number of frames per segment: 120, 240 or 480 frames

7. Lossless Source File Formats

VQCST test patterns are available as separate sets of media files in the following formats:

- Frame size: 7680x4320 (8K UHD), 3840x2160 (4K UHD), 1920x1080 (2K HD)
- Frame rate: from 23.976 fps to 60 fps, *other frame rates available on request*
- Media file parameters:
  - AVI container: r210 and v210 lossless uncompressed 10 bit codecs
  - MP4 container: HEVC and AVC lossless 10 bit codecs
  - SDR, HDR-PQ or HDR-HLG metadata embedded – as appropriate

Other video data formats and codecs are available on request

8. Lossless Bitrates

Tables below contain the bitrates required by two different lossless codecs (AVC and HEVC) for each segment of 10 stress levels sequence. **VQCST_VID_HD_SDR_MFR** test patterns suite used.

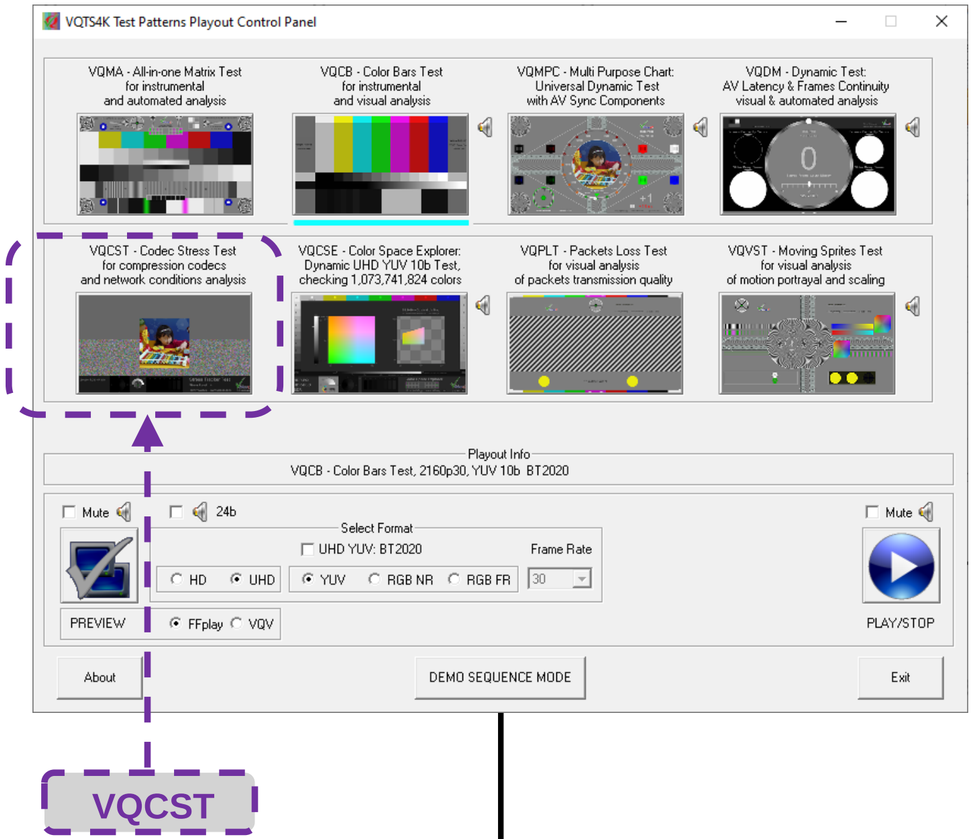
	HSR	MSR	LSR
AVC_Mbps ≡	114.0	114.0	114.0
	160.0	127.0	121.0
	184.0	139.0	127.0
	208.0	151.0	133.0
	232.0	163.0	139.0
	256.0	175.0	145.0
	280.0	187.0	151.0
	321.0	199.0	157.0
	370.0	211.0	164.0
	414.0	222.0	169.0

	HSR	MSR	LSR	Stress Level:
HEVC_Mbps ≡	133.0	133.0	133.0	0
	179.0	148.0	142.0	1
	202.0	160.0	149.0	2
	224.0	172.0	154.0	3
	248.0	184.0	160.0	4
	269.0	195.0	166.0	5
	292.0	207.0	172.0	6
	329.0	219.0	178.0	7
	374.0	230.0	184.0	8
	415.0	241.0	190.0	9

Note the significantly higher bitrates required for lossless encoding of the high Stress Levels segments, especially for High Stress Range (HSR) variants

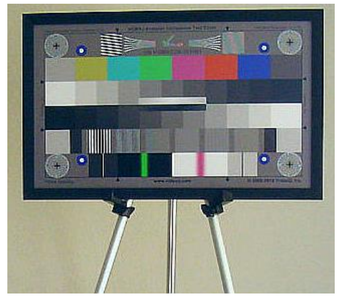
9. VQCST Integration within VQTS4K Test System

Test Pattern Generator



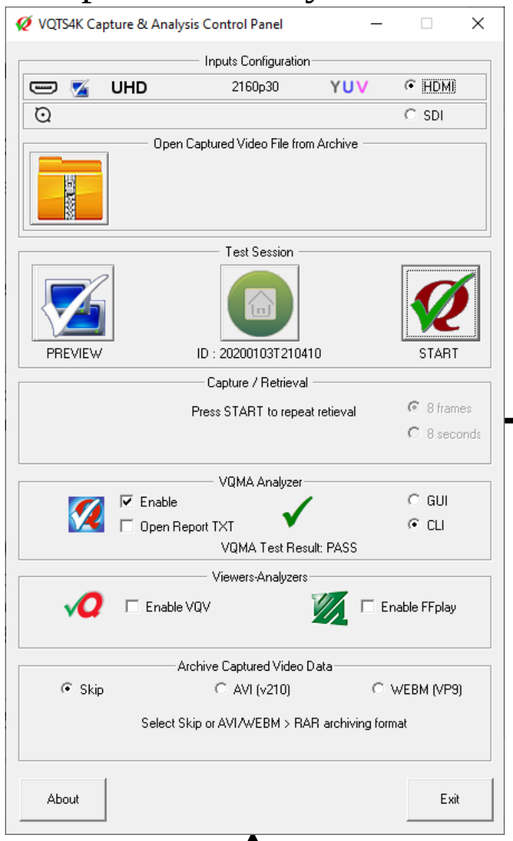
VQCST

Camera
Test Chart Option

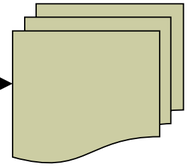


Network
Connectivity
Options

Capture & Analysis Tools



Test Samples
&
Test Reports



BMD Playout Card

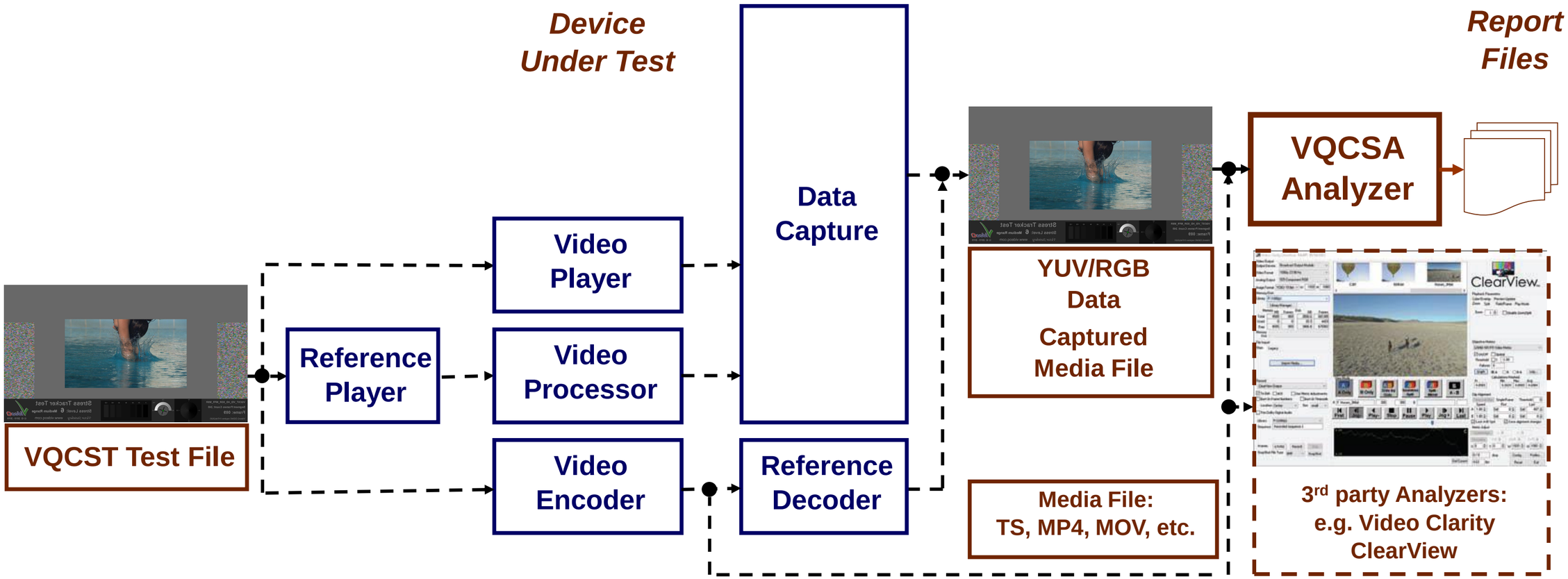
HDMI or SDI

System Under Test

HDMI or SDI

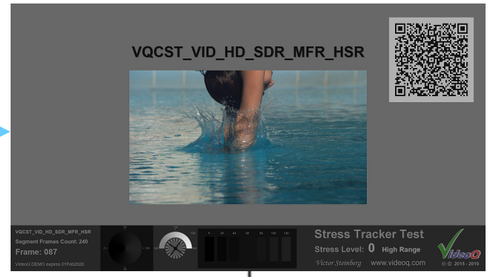
BMD Capture Card

10. Workflow Overview



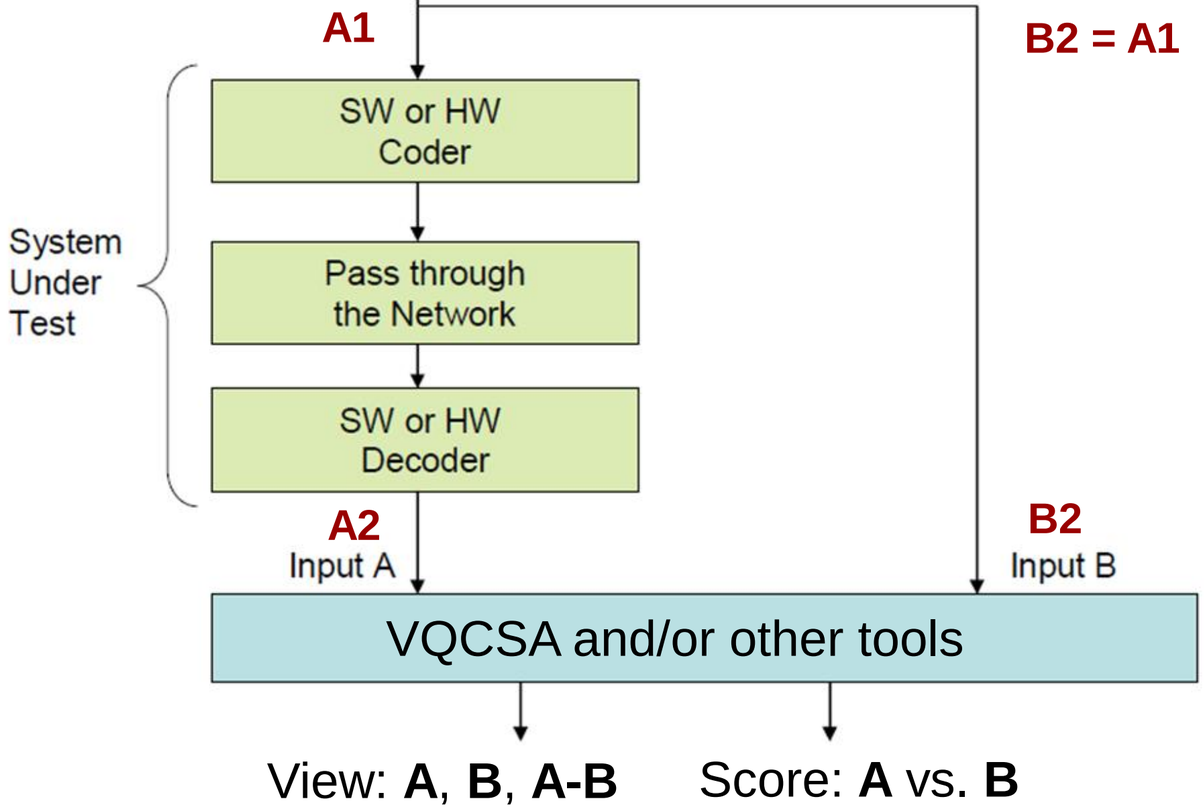
11. Traditional Full Reference Mode

Central Insert:
Live Clip, Photo,
or Test Pattern



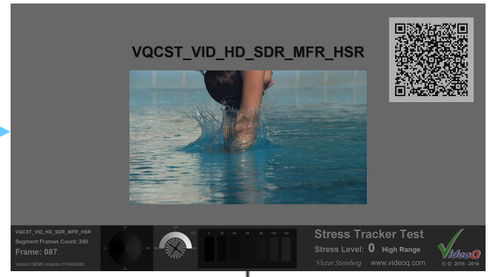
VQCST
suite of media files

Select the desired variant



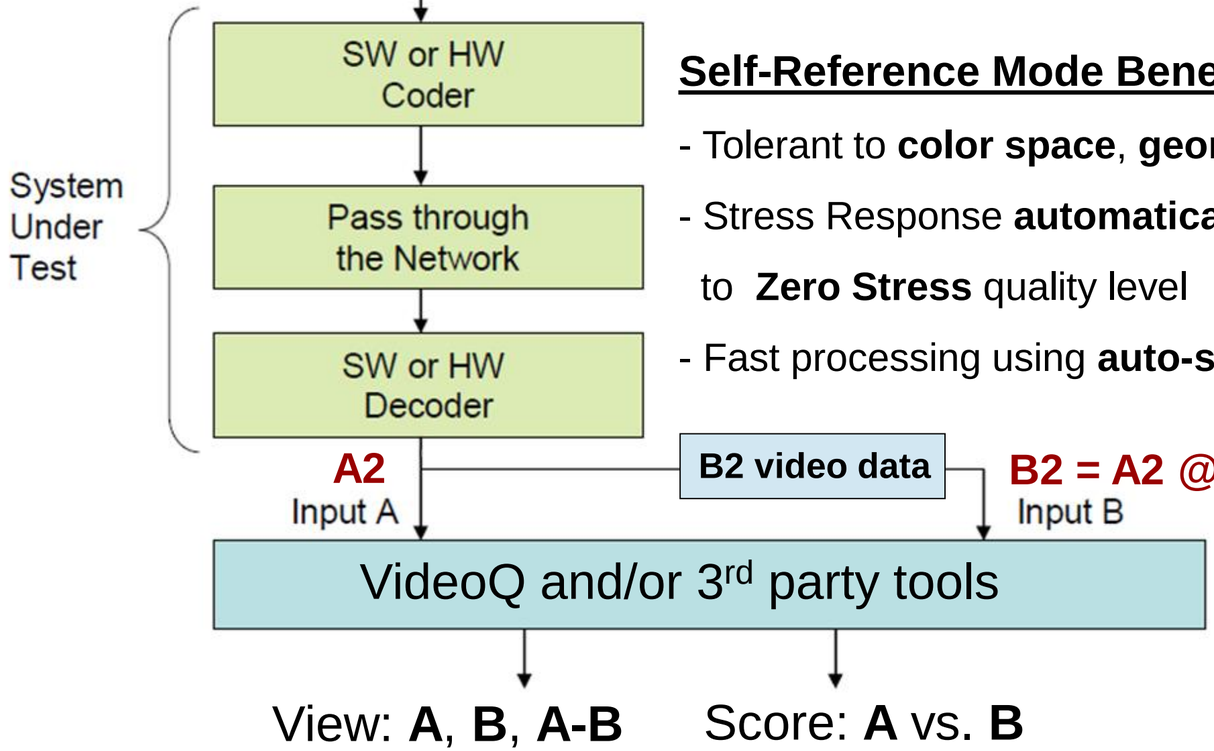
12. Self-Reference Mode

Central Insert:
Live Clip, Photo,
or Test Pattern



VQCST
suite of media files

← Select the desired variant



Self-Reference Mode Benefits:

- Tolerant to **color space**, **geometry** and **frame size** conversions
- Stress Response **automatically** offset (clamped)
  to **Zero Stress** quality level
- Fast processing using **auto-synchronized** input B data

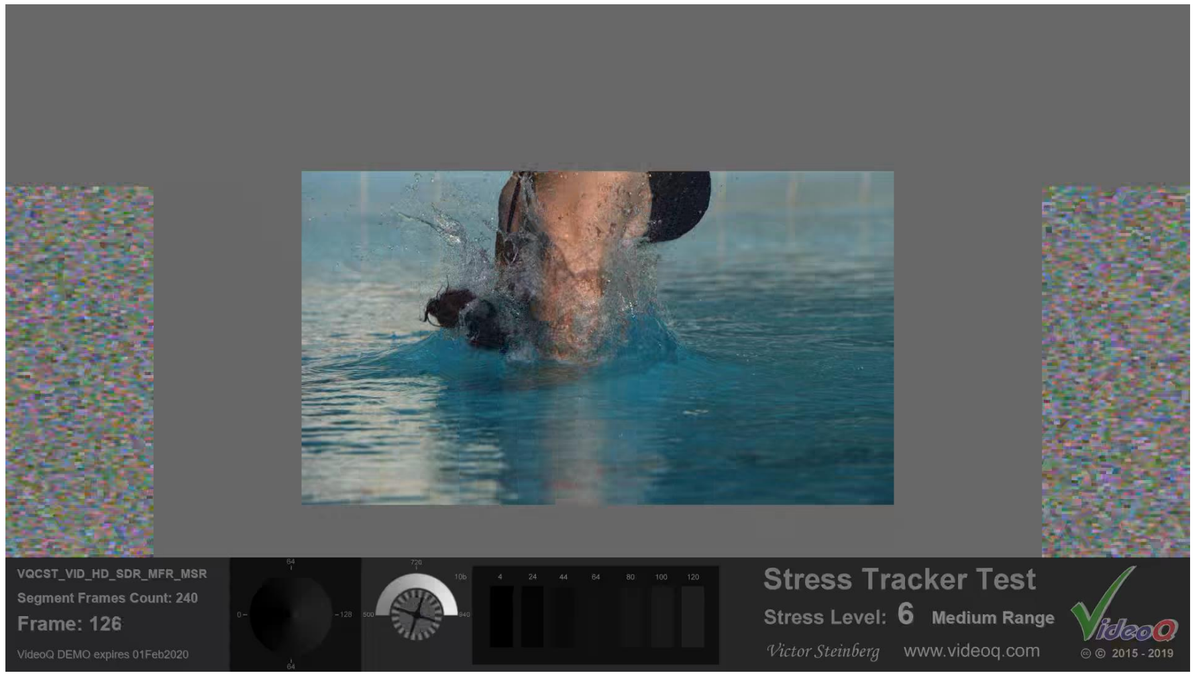
13. About Self-Reference Mode

- Pro: In Self-Reference Mode access to reference **source video** at **meter location** is ***not required***
- Pro: In Self Reference Mode the test procedures are ***tolerant*** to **color space**, **geometry** and **frame size conversions** within the system under test
- Pro: Self-Reference Mode means **fast test procedures**:
  *In this mode there is only one **A** input, thus no need to select and/or prepare input **B** data.*
  *No need for spatial position or video level range **alignment**.*
  *If there is no freeze/skip events, then even **time-line auto-alignment** stage can be omitted.*
- Pro: Self-Reference Mode means **easy setup and benchmarking process**, e.g. for nearly real time Compression Profile optimization
- Pro: Self-Reference Mode results are close enough to **Full Reference Mode** results, though only for the ***video insert area***
- Con: It is not possible to get the distortion scores for **full frame area**, including the ***stress shapes***

14. Compression Quality Test Examples

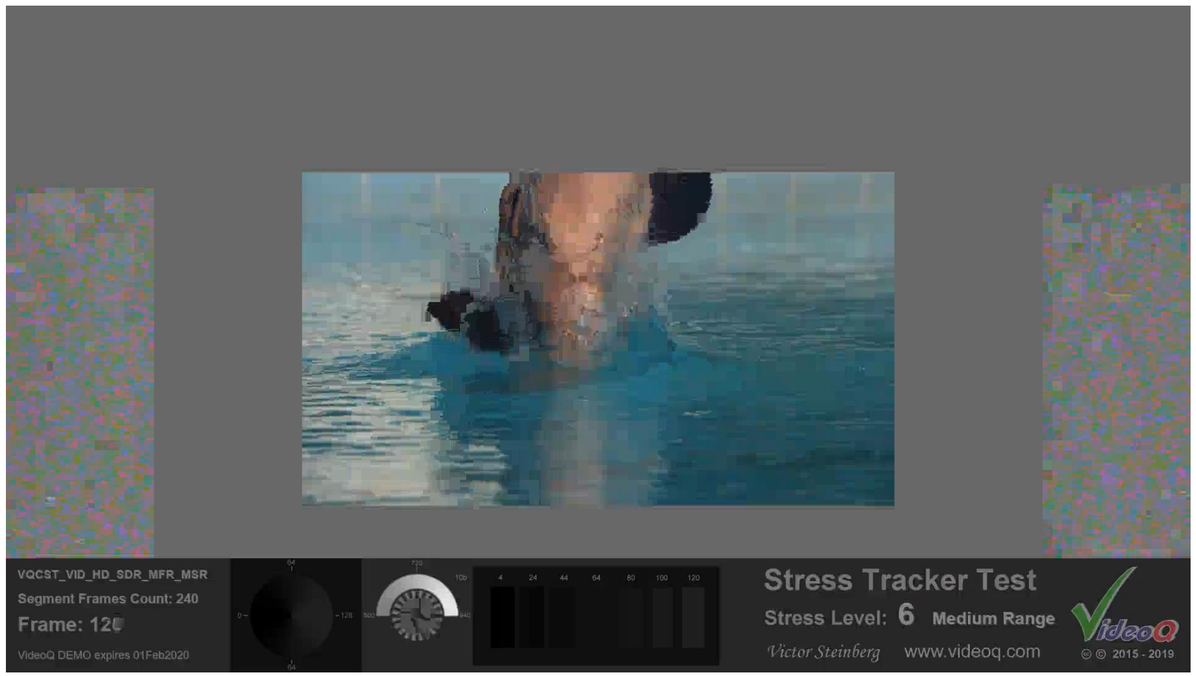
HD, 60fps (MFR), **HEVC 8Mbps**,
Medium Stress Range (MSR), Stress Level **6**

<u>Noticeable compression artifacts</u>



HD, 60fps (MFR), **AVC 2Mbps**,
Medium Stress Range (MSR), Stress Level **6**

<u>Strong (annoying) compression artifacts</u>



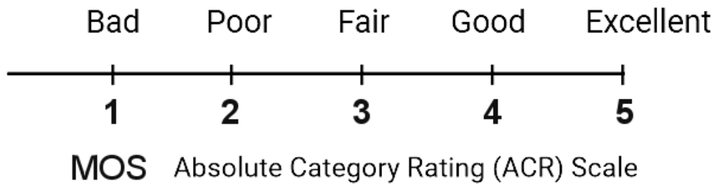
15. HD, 60fps, LSR, Stress Level 6, AVC 2Mbps

16. Stress Response Profile Measurement Example

Test conditions:

HD 60fps HEVC – 2, 4, 8 Mbps encoding;

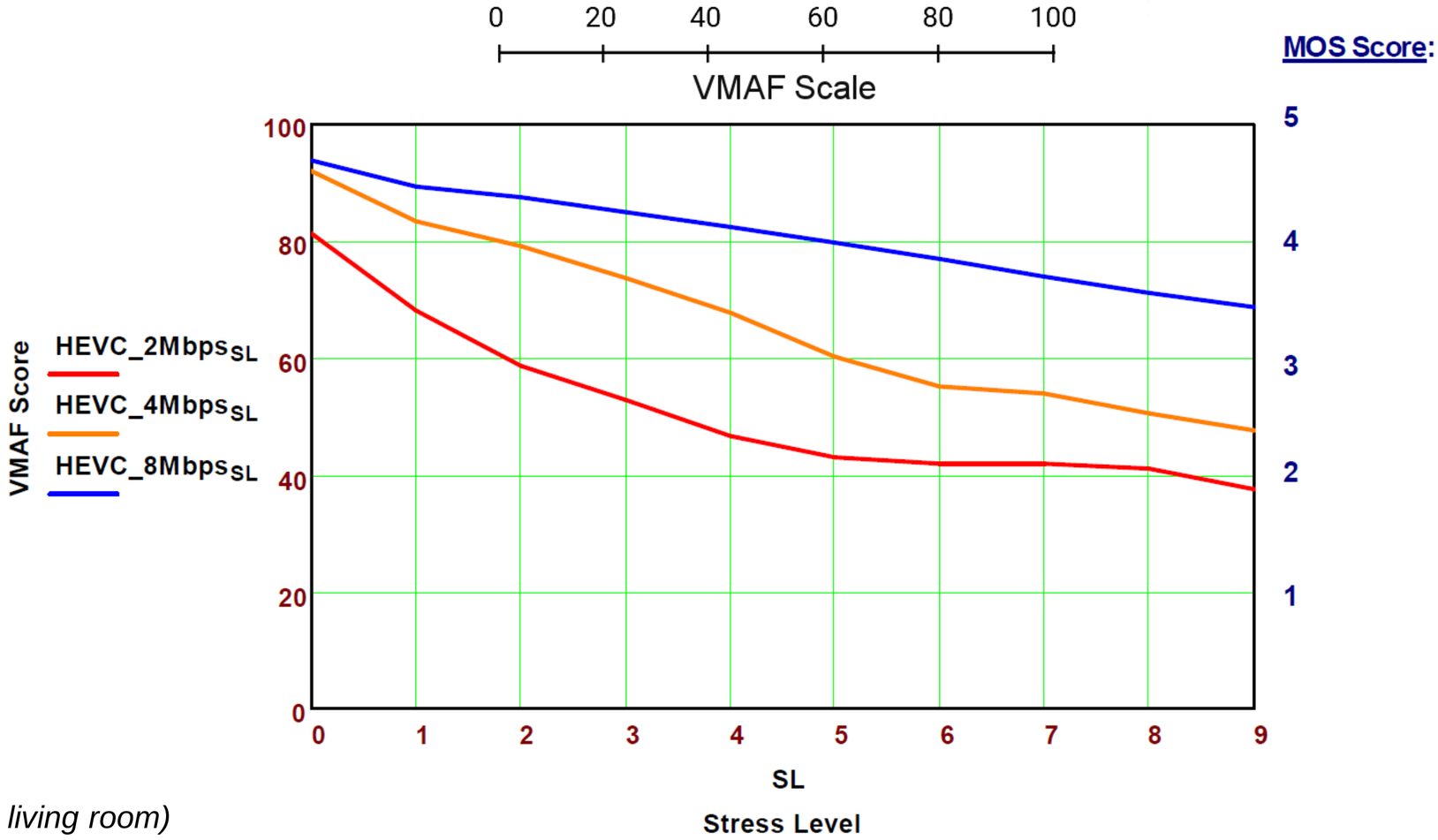
Medium **S**tress **R**ange (MSR) **VQCST_VID** test



Bitrate, Mbps:

Stress Level:	2	4	8
0	81.3	92.0	93.8
1	68.1	83.4	89.3
2	58.7	79.1	87.5
3	52.8	73.7	85.0
4	46.7	67.7	82.4
5	43.0	60.2	79.7
6	42.0	55.1	77.0
7	41.9	54.0	73.9
8	41.1	50.5	71.1
9	37.6	47.6	68.7

$\mathbf{VMAF} \equiv$



VMAF model used: Netflix vmaf_v0.6.1.pkl (HD, living room)

17. 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