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| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  39th Meeting: by teleconference, 18–24 April 2020 | Document: JCTVC-AM0025 |

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| *Title:* | **Cross-check of JCTVC-AM0024 shutter interval SEI message software** | | |
| *Status:* | Input document to JCT-VC | | |
| *Purpose:* | Information | | |
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# Abstract

This document reports that the crosschecker verified that software source code provided by proponents of JCTVC-AM0024 compiles, runs and illustrates the end-to-end system use of the shutter interval SEI message in a a temporal sub-layer high frame application. This document contains example crops of a pair of decoded images before and after the post-processing performed by the software.

# Introduction

The recently adopted shutter interval info SEI included in the draft HEVC amendment [1] conveys metadata that can guide post-processing, such as that described in ATSC 3.0 A/341 [2] Annex D (Multiple Frame Rate Temporal Filtering). In the example ATSC 3.0 temporal sub-layer scenario described in JCTVC-AM0024 [3], the base temporal sub-layer conveys a backward-compatible Standard Frame Rate (SFR) video sequence (e.g. 60 fps, 1/60 sec. shutter interval), while the second temporal sub-layer conveys the HFR enhancement (e.g. the remaining 60 fps with a 1/120 sec. shutter interval). The bitstream contains alternating SFR and HFR coded frames in output order, totalling 120 fps (frames per sec). The modified reference HM encoder includes a pre-processor that can filter a video sequence, representing a single shutter HFR source, into dual SFR, HFR interleaved source feed. The modified reference HEVC encoder then generates a dual temporal sub-layer bitstream with embedded shutter interval SEI messages. The modified reference HEVC decoder then applies temporal post-processing using the SEI message information to filter the decoded SFR sub-layer frames to produce an HFR output.

# Results

The BasketBallDrill sequence in described in the common test conditions [4] is used for this example. Though that source sequence is 50 frames/sec, it can be used to demonstrate HFR by being presented at 2x speed. In the table below, BasketBallDrill frame 3 (in output order counting from 0) is already HFR and is therefore not processed, while the SFR frame 4 is temporally filtered to deblur the frame to appear according to an HFR shutter period.

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|  | frame 3 of BasketBallDrive (HFR) | frame 4 of BasketBallDrive (SFR) |
| decoded | A blurry image of a person  Description automatically generated | A blurry image of a person  Description automatically generated |
| post-processed | A blurry image of a person  Description automatically generated | A blurry image of a person  Description automatically generated |
|  | HFR (unmodified) | HFR (recovered) |

# References

1. JCTVC-[AL1005](http://phenix.int-evry.fr/jct/doc_end_user/current_document.php?id=10997): “Shutter interval information SEI message for HEVC (Draft 2)"
2. [ATSC 3.0](https://www.atsc.org/atsc-documents/type/3-0-standards/) A/341: "Video - HEVC".
3. JCTVC-[AM0024](http://phenix.int-evry.fr/jct/doc_end_user/current_document.php?id=11003): "Illustration of the shutter interval info SEI message in HEVC Draft"
4. JCTVC-[AF1100](http://phenix.int-evry.fr/jct/doc_end_user/current_document.php?id=10878): "Common test conditions for HM video coding experiments"

# Patent rights declaration(s)

**MovieLabs does not have any current or pending patent rights relating to the technology described in this contribution.**