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| **Joint Collaborative Team on 3D Video Coding Extension**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  11th Meeting: Geneva, CH, 12–18 Feb. 2015 | Document: JCT3V-K0004 |

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| *Title:* | **JCT-3V AHG Report: MV-HEVC and 3D-HEVC Software Integration (AHG4)** | | |
| *Status:* | AHG report input to JCT-3V | | |
| *Purpose:* | AHG report | | |
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| *Source:* | AHG | | |

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# Abstract

This report summarizes the activities of the AhG on MV-HEVC and 3D-HEVC Software Integration that have taken place between the 10th JCT-3V meeting in Strasbourg and the 11th JCT-3V meeting in Geneva. Activities focused on the integration of proposals adopted at the 10th meeting into a common code base and the release of the MV-HEVC Software draft 2.

# Mandates

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| **Title** | **Chairs** | **Mtg** |
| **MV-HEVC / 3D-HEVC Software Integration (AHG4)**  ([jct-3v@lists.rwth-aachen.de](mailto:jct-3v@lists.rwth-aachen.de))   * Coordinate development of the HTM software and its distribution to JCT-3V members. * Produce documentation of software usage for distribution with the software. * Prepare and deliver HTM-13.0 software version and the reference configuration encodings according to JCT3V-G1100 based on common conditions suitable for in the core experiment (expected within four weeks after the meeting). * Prepare and deliver HTM-13.1 software that include additional items not integrated into the 13.0 version. * Prepare and deliver the Draft 2 of MV-HEVC software JCT3V-J1009. * Perform analysis and reconfirmation checks of the behaviour of technical changes adopted into the draft design, and report the results of such analysis. * Suggest configuration files for additional testing of tools. * Study the alignment of HTM software with HM16. * Coordinate with 3D-HEVC Draft and MV-HEVC / 3D-HEVC Test Model editing to identify any mismatches between software and text. | G. Tech  H. Liu (co-chairs)  Y. W. Chen  K. Wegner (vice chairs) | N |

# HTM tool integration

Development of the software was coordinated with the parties needing to integrate changes.

The distribution of the software was announced on the JCT-3V e-mail reflector and the software was made available through the SVN server:

[https://hevc.hhi.fraunhofer.de/svn/svn\_3DVCSoftware/tags/](https://hevc.hhi.fraunhofer.de/svn/svn_3DVCSoftware/tags/HTM-4.0)

Anchor bitstreams have been created and uploaded to:

[ftp.hhi.fraunhofer.de](ftp://ftp.hhi.fraunhofer.de); login: mpeg3dv\_guest; path: /MPEG-3DV/HTM-Anchors/

One version of the HTM software were produced and announced on the JCT-3V email reflector. The following sections give a brief summary of the integrated tools and achieved coding gains.

## Versions HTM-13.0

Starting point for development of HTM-13.0 was HTM-12.2. Development of HTM-13.0 was conducted in two parallel tracks each performing sequential integration. Development of each branch has been supervised by one software coordinator. Software of all two tracks was merged by the software coordinators.

### Integrated items

*Track 1: DLT, DMM, SDM*

Coordinator: Hongbin Liu

* [JCT3V-J0060](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2349) 3D-HEVC HLS: Single depth flag signaling
* [JCT3V-J0059](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2348) A cleanup of the size derivation for 3D-HEVC merge candidate list
* [JCT3V-J0033](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2322) A cleanup of DMM index coding in 3D-HEVC
* [JCT3V-J0035](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2324) On Lookup Table Size Reduction for DMM1
* [JCT3V-J0029](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2318) Cleanup3: DLT table derivation
* [JCT3V-J0115](http://phenix.int-evry.fr/jct2/doc_end_user/current_document.php?id=2414) Single depth intra mode
* [JCT3V-J0066](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2355) Simplification and improvement of sub-PU

*Track 2: Merge, HLS Disparity derivation, others*

Coordinator: Yi-Wen Chen

* [JCT3V-J0042](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2331) Simplification of depth merge candidate list
* [JCT3V-J0046](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2335) Modification of reference index for depth disparity derivation
* [JCT3V-J0050](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2339) Simplification of chroma IC
* [JCT3V-J0041](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2330) Simplification of an NBDV availability check
* [JCT3V-J0039](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2328) Removal of redundant VSP candidates in Merge mode
* [JCT3V-J0037](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2326) ARP, IC and DBBP Flags Signaling for 3D-HEVC
* [JCT3V-J0107](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2403) On 3D-HEVC HLS and its alignment with MV-HEVC HLS

### Coding performance

***MV-HEVC:*** The coding results for MV-HEVC are identical to results obtained from version HTM-12.2.

***3D-HEVC: HTM-13.0 vs. HTM-12.2 (CTC, three view configuration)***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | video  video rate | video  total rate | synth  total rate | enc time | dec time | ren time |
| Balloons | 0,0% | -0,1% | 0,0% | 100,7% | 94,4% | 99,4% |
| Kendo | 0,0% | -0,1% | 0,0% | 101,4% | 105,1% | 102,1% |
| Newspaper\_CC | 0,0% | -0,1% | -0,1% | 102,9% | 101,7% | 101,4% |
| GT\_Fly | -0,1% | -0,2% | 0,0% | 100,3% | 94,0% | 99,4% |
| Poznan\_Hall2 | 0,0% | -0,1% | 0,0% | 100,5% | 97,1% | 99,3% |
| Poznan\_Street | 0,0% | -0,1% | 0,0% | 100,5% | 93,4% | 97,0% |
| Undo\_Dancer | -0,1% | -0,2% | -0,1% | 99,7% | 98,2% | 99,0% |
| Shark | -0,1% | -0,1% | 0,1% | 101,1% | 104,7% | 99,3% |
| 1024x768 | 0,0% | -0,1% | 0,0% | 101,6% | 100,4% | 101,0% |
| 1920x1088 | -0,1% | -0,1% | 0,0% | 100,4% | 97,5% | 98,8% |
| **average** | **-0,1%** | **-0,1%** | **0,0%** | **100,9%** | **98,6%** | **99,6%** |

## Version HTM-13.1

HTM-13.1 with further bug fixes and clean ups will be released during the meeting.

# MV-HEVC Software draft 2

The MV-HEVC software draft 2 (JCT3V-J1009) has been released. The software has been generated by removing 3D-HEVC related source code and configuration files from HTM-13.0. The software can also be accessed using the svn:

https://hevc.hhi.fraunhofer.de/svn/svn\_3DVCSoftware/branches/HTM-13.0-MV-draft-2

The related document has been submitted to the MPEG secretariat for PDAM ballot.

For MV-HEVC non-CTC configuration parameters files have been included e.g. for generation of bitstreams using INBL decoding, auxiliary pictures, layer-wise startup, and IBP prediction.

# Open issues

* Some minor mismatches related to 3D-HEVC HLS.
* Most of MV-and 3D-HEVC SEI messages are not supported yet.
* Some items related to MV-HEVC decoding processes (e.g. hybrid scalability, correct bumping, POC reset) have not been integrated yet.
* Especially MV-HEVC related decoding processes and syntax need to be reviewed and tested.
* Update to HM-16.3 is required
* Other minor issues are listed in the bug tracking system.

# Recommendations

The recommendations of the MV-HEVC and 3D-HEVC Software Integration AHG are:

* Develop HTM-14 based on HTM-13 and improve its quality.
* Continue to identify bugs and discrepancies with text, and address them.
* Fix open issues.
* Discuss alignment of HTM with HM-16.0 including range extension.
* Discuss on how to address open issues.