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| **Joint Collaborative Team on 3D Video Coding Extension Development**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  3rd Meeting: Geneva, CH, 17–23 Jan. 2013 | Document: JCT3V-C0007 |

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| *Title:* | **JCT-3V AHG Report: 3D High level syntax (AHG7)** | | |
| *Status:* | Input Document | | |
| *Purpose:* | Report | | |
| *Author(s) or Contact(s):* | Ying Chen  5775 Morehouse Drive San Diego, CA 92121 USA  Thomas Rusert  Ericsson Research 164 80 Stockholm Sweden | Tel: Email: | +1-858-845-6589 [cheny@qti.qualcomm.com](mailto:cheny@qti.qualcomm.com)  [thomas.rusert@ericsson.com](mailto:thomas.rusert@ericsson.com) |
| *Source:* | AHG | | |

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# Abstract

This document reports on the work of the JCT-3V ad hoc group (AhG) on 3D High level syntax (AHG7) between the 2nd JCT-3V meeting in Shanghai (13 – 19 October, 2012) and the 3rd JCT-3V meeting in Geneva (17 – 24 January, 2013).

# Mandates

* Study the MV-HEVC/3D-HEVC design based on the latest HEVC draft.
* Study high level syntax design extensions of AVC for 3DV functionalities.
* Study the relations of AVC multiview/3D extensions and HEVC multiview/3D extensions on high-level syntax concepts, e.g., related to SEI messages.
* Identify commonality of multi-view and scalable high-level extensions of HEVC.

# Work Status and Comments

Mandate 1: Study the MV-HEVC/3D-HEVC design based on the latest HEVC w.r.t. NAL unit header, parameter sets, reference picture buffering, and HRD.

A preliminary version of text for HRD has been provided in MV-HEVC working draft 2.

It is needed to further align the MV-HEVC with the latest HEVC specification.

There are 14 input contributions for MV-HEVC to the 3rd JCT-3V meeting in Geneva.

A joint meeting between JCT-3V and JCT-VC meeting is being planned.

Mandate 2: Study high level syntax design extensions of AVC for 3DV functionalities.

There are 6 input contributions related to MVC+D.

Mandate 3: Study the relations of AVC multiview/3D extensions and HEVC multiview/3D extensions on high-level syntax concepts, e.g., related to SEI messages.

Several proposals in the 2nd JCT-3V meeting related to extending MVC or 3D-AVC SEI messages to MV-HEVC and 3D-HEVC have been adopted.

In this meeting, there is and SEI input document proposing extending an SEI message in MVC to MV-HEVC.

Mandate 4: Identify commonality of multi-view and scalable high-level extensions of HEVC.

An input contribution (JCT3V-C0146 from Nokia) related to utilizing and extending MV-HEVC for scalable coding based on HEVC has been received.

It is reported that the targeted scalable codec may be high level syntax only SHVC (Scalable extension of HEVC).

# List of the input contributions related to this AhG

Input documents may be categorized to five standard tracks:

* MVC+D
* 3D-AVC
* MFC (MVC based)
* MV-HEVC, and
* 3D-HEVC

Input documents applicable to both MVC+D and 3D-AVC are listed in the MVC+D category. Input documents applicable to both MV-HEVC and 3D-HEVC are listed in the MV-HEVC category. Since no 3D-HEVC only or 3D-AVC only proposals are identified, relevant proposals are only listed for MVC+D and MV-HEVC respectively. Note we haven’t received any high level syntax proposals for MFC.

## MVC+D

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| JCT3V number | Title | Authors |
| [JCT3V-C0031](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=464) | MVC+D: on target output views | [M. M. Hannuksela](mailto:miska.hannuksela@nokia.com), D. Rusanovskyy (Nokia) |
| [JCT3V-C0057](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=495) | AHG7: Bitstream extraction for MVC+D | [Y. Chen](mailto:cheny@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |
| [JCT3V-C0121](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=560) | MVC+D: Clarification on Depth acquisition information SEI message | [Xiaofeng Yang](mailto:yx.yangxiaofeng@huawei.com), [Carol Zhang](mailto:yuanyuanzhang@huawei.com), [Roy YUE](mailto:yuepeiyu@huawei.com) |
| [JCT3V-C0156](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=598) | MVC+D HLS: On unpaired MVD and field coding | [M. M. Hannuksela](mailto:miska.hannuksela@nokia.com), D. Rusanovskyy (Nokia) |
| [JCT3V-C0158](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=600) | MVC+D HLS: depth sampling characteristics | [M. M. Hannuksela](mailto:miska.hannuksela@nokia.com), D. Rusanovskyy (Nokia) |
| [JCT3V-C0162](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=606) | MVC+D HLS: on depth acquisition information and depth representation information SEI messages | [M. M. Hannuksela (Nokia)](mailto:miska.hannuksela@nokia.com) |

## MV-HEVC

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| JCT3V number | Title | Authors |
| [JCT3V-C0041](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=476) | Proposed VPS extension semantics and editorial cleanups to syntax | [J. Boyce](mailto:jill@vidyo.com) [Y.-K. Wang](mailto:yekuiw@qti.qualcomm.com), [S. Deshpande](mailto:sdeshpande@sharplabs.com) |
| [JCT3V-C0059](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=497) | AHG7: Target output views for MV-HEVC | [Y. Chen](mailto:cheny@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |
| [JCT3V-C0060](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=498) | AHG7: Reference picture list initialization for MV-HEVC | [A.K. Ramasubramonian](mailto:aramasub@qti.qualcomm.com%20), [L.Zhang](mailto:lizhang@qti.qualcomm.com), [Y. Chen](mailto:cheny@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |
| [JCT3V-C0061](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=499) | AHG7: Slice header prediction for MV-HEVC | [A.K. Ramasubramonian](mailto:aramasub@qti.qualcomm.com%20), [Y. Chen](mailto:cheny@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |
| [JCT3V-C0062](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=500) | AHG7: Parallel decoding SEI for MV-HEVC | [Y. Chen](mailto:cheny@qti.qualcomm.com), [V. Seregin](mailto:vseregin@qti.qualcomm.com), [A. K.Ramasubramonian](mailto:vseregin@qti.qualcomm.com), [L. Zhang](mailto:lizhang@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |
| [JCT3V-C0079](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=518) | AHG7: On initialization process for reference picture lists | [O. Nakagami](mailto:ohji.nakagami@jp.sony.com), [Y. Takahashi](mailto:yoshitomo.takahashi@jp.sony.com), [T. Suzuki (Sony)](mailto:teruhikos@jp.sony.com) |
| [JCT3V-C0081](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=520) | AHG7: On Random access point pictures and picture order counts for MV-HEVC | [B. Choi](mailto:b.d.choi@samsung.com), [M.W. Park](mailto:m.w.park@samsung.com), [J. Yoon](mailto:jw0413.yoon@samsung.com), [C. Kim](mailto:dionism@samsung.com), [J. Park (Samsung)](mailto:jeonghoon@samsung.com) |
| [JCT3V-C0082](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=521) | AHG7: Reference picture marking process for MV-HEVC | [B. Choi](mailto:b.d.choi@samsung.com), [M.W. Park](mailto:m.w.park@samsung.com), [J. Yoon](mailto:jw0413.yoon@samsung.com), [C. Kim](mailto:dionism@samsung.com), [J. Park (Samsung)](mailto:jeonghoon@samsung.com) |
| [JCT3V-C0084](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=523) | AHG7: POC alignment between layers | [T. Ikai](mailto:ikai.tomohiro@sharp.co.jp), Y. Yoshiya, T. Uchiumi (Sharp) |
| [JCT3V-C0085](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=524) | AHG7: RAP picture alignment and slice definition | [T. Ikai](mailto:ikai.tomohiro@sharp.co.jp), Y. Yoshiya, T. Uchiumi (Sharp) |
| [JCT3V-C0086](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=525) | AHG7: On VPS extension | [T. Ikai](mailto:ikai.tomohiro@sharp.co.jp), Y. Yoshiya, T. Uchiumi (Sharp) |
| [JCT3V-C0106](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=545) | AHG7: Video parameter set extension design for MV-HEVC and 3D-HEVC | [B. Choi](mailto:b.d.choi@samsung.com), [M.W. Park](mailto:m.w.park@samsung.com), [J. Yoon](mailto:jw0413.yoon@samsung.com), [C. Kim](mailto:dionism@samsung.com), [J. Park (Samsung)](mailto:jeonghoon@samsung.com) |
| [JCT3V-C0146](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=587) | Unification of scalable and multi-view extensions with HLS only changes | K. Ugur, Miska M. Hannuksela, J. Lainema, D. Rusanovskyy (Nokia) |
| [JCT3V-C0165](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=610) | MV-HEVC: on RAP pictures | [M. M. Hannuksela (Nokia)](mailto:miska.hannuksela@nokia.com) |

The MV-HEVC proposals are further categorized as follows. JCT3V-C0146 may be related to multiple technical areas.

### Video parameter set

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| JCT3V number | Title | Authors |
| [JCT3V-C0041](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=476) | Proposed VPS extension semantics and editorial cleanups to syntax | [J. Boyce](mailto:jill@vidyo.com) [Y.-K. Wang](mailto:yekuiw@qti.qualcomm.com), [S. Deshpande](mailto:sdeshpande@sharplabs.com) |
| [JCT3V-C0059](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=497) | AHG7: Target output views for MV-HEVC | [Y. Chen](mailto:cheny@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |
| [JCT3V-C0086](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=525) | AHG7: On VPS extension | [T. Ikai](mailto:ikai.tomohiro@sharp.co.jp), Y. Yoshiya, T. Uchiumi (Sharp) |
| [JCT3V-C0106](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=545) | AHG7: Video parameter set extension design for MV-HEVC and 3D-HEVC | [B. Choi](mailto:b.d.choi@samsung.com), [M.W. Park](mailto:m.w.park@samsung.com), [J. Yoon](mailto:jw0413.yoon@samsung.com), [C. Kim](mailto:dionism@samsung.com), [J. Park (Samsung)](mailto:jeonghoon@samsung.com) |

### Random access

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| JCT3V number | Title | Authors |
| [JCT3V-C0081](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=520) | AHG7: On Random access point pictures and picture order counts for MV-HEVC | [B. Choi](mailto:b.d.choi@samsung.com), [M.W. Park](mailto:m.w.park@samsung.com), [J. Yoon](mailto:jw0413.yoon@samsung.com), [C. Kim](mailto:dionism@samsung.com), [J. Park (Samsung)](mailto:jeonghoon@samsung.com) |
| [JCT3V-C0085](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=524) | AHG7: RAP picture alignment and slice definition | [T. Ikai](mailto:ikai.tomohiro@sharp.co.jp), Y. Yoshiya, T. Uchiumi (Sharp) |
| [JCT3V-C0165](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=610) | MV-HEVC: on RAP pictures | [M. M. Hannuksela (Nokia)](mailto:miska.hannuksela@nokia.com) |

### Reference picture marking and RPS

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| JCT3V number | Title | Authors |
| [JCT3V-C0082](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=521) | AHG7: Reference picture marking process for MV-HEVC | [B. Choi](mailto:b.d.choi@samsung.com), [M.W. Park](mailto:m.w.park@samsung.com), [J. Yoon](mailto:jw0413.yoon@samsung.com), [C. Kim](mailto:dionism@samsung.com), [J. Park (Samsung)](mailto:jeonghoon@samsung.com) |
| [JCT3V-C0146](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=587) | Unification of scalable and multi-view extensions with HLS only changes | K. Ugur, Miska M. Hannuksela, J. Lainema, D. Rusanovskyy (Nokia) |

### Reference picture list construction and slice header

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| JCT3V number | Title | Authors |
| [JCT3V-C0060](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=498) | AHG7: Reference picture list initialization for MV-HEVC | [A.K. Ramasubramonian](mailto:aramasub@qti.qualcomm.com%20), [L.Zhang](mailto:lizhang@qti.qualcomm.com), [Y. Chen](mailto:cheny@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |
| [JCT3V-C0079](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=518) | AHG7: On initialization process for reference picture lists | [O. Nakagami](mailto:ohji.nakagami@jp.sony.com), [Y. Takahashi](mailto:yoshitomo.takahashi@jp.sony.com), [T. Suzuki (Sony)](mailto:teruhikos@jp.sony.com) |
| [JCT3V-C0061](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=499) | AHG7: Slice header prediction for MV-HEVC | [A.K. Ramasubramonian](mailto:aramasub@qti.qualcomm.com%20), [Y. Chen](mailto:cheny@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |

### Others

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| --- | --- | --- |
| JCT3V number | Title | Authors |
| [JCT3V-C0062](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=500) | AHG7: Parallel decoding SEI for MV-HEVC | [Y. Chen](mailto:cheny@qti.qualcomm.com), [V. Seregin](mailto:vseregin@qti.qualcomm.com), [A. K.Ramasubramonian](mailto:vseregin@qti.qualcomm.com), [L. Zhang](mailto:lizhang@qti.qualcomm.com), [Y.-K. Wang(Qualcomm)](mailto:yekuiw@qti.qualcomm.com) |
| [JCT3V-C0084](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=523) | AHG7: POC alignment between layers | [T. Ikai](mailto:ikai.tomohiro@sharp.co.jp), Y. Yoshiya, T. Uchiumi (Sharp) |