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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**  10th Meeting: Strasbourg, FR, 18–24 Oct. 2014 | Document: JCT3V-J0002 |

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| *Title:* | **JCT-3V AHG Report: MV-HEVC / 3D-HEVC Draft and Test Model editing (AHG2)** | | |
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| *Source:* | AHG | | |

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# Abstract

This document reports on the work of the JCT-3V ad hoc group on MV-HEVC / 3D-HEVC Draft and Test Model editing (AHG2) between the 9th meeting in Sapporo and the 10th JCT-3V meeting in Strasbourg.

# Mandates

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| **Title and Email Reflector** | **Chairs** | **Mtg** |
| **MV-HEVC / 3D-HEVC Draft and Test Model editing (AHG2)**   * Produce and finalize JCT3V-I1001 3D-HEVC Draft Text 5. * Produce and finalize JCT3V-I1002 MV-HEVC Draft Text 9. * Produce and finalize JCT3V-I1003 3D-HEVC and MV-HEVC Test Model 9. * Gather and address comments for refinement of these documents. * Coordinate with the 3D-HEVC Software Integration AhG to address issues relating to mismatches between software and text. * Coordinate with AHG4 w.r.t. text improvements in 3D-HEVC specific HLS. | G. Tech, K. Wegner (co-chairs),  J. Boyce,  Y. Chen,  M. Hannuksela,  T. Suzuki,  S. Yea,  J.-R. Ohm,  G. Sullivan (vice chairs) | N |

# Introduction

The fifth 3D-HEVC draft, the seventh Test Model of 3D-HEVC and MV-HEVC and the ninth MV-HEVC draft were developed from the fourth 3D-HEVC draft, the sixth 3D-HEVC Test Model and the eighth MV-HEVC draft, respectively, following the decisions taken at the 9th JCT-3V meeting in Sapporo.

Three editorial teams were formed to work on the three documents that were to be produced:

* I1001 3D-HEVC Draft Text 4
* G. Tech, Y. Chen
* I1002 MV-HEVC Draft Text 8
* G. Tech, M. Hannuksela, Y. Chen, J. Boyce
* Y.-K. Wang, A. Ramasubramonian, J. Chen, G. J. Sullivan, Y. Ye
* I1003 Test Model 9 of 3D-HEVC and MV-HEVC
* Y. Chen, G. Tech

# Status

## 3D-HEVC Draft 5

Three versions of JCT3V-I1001 have been published by the AHG following the 9th JCT-3V meeting in Sapporo. The last version has been submitted as DAM text to the MPEG secretariat.

### Incorporated changes

All, but one, adoptions of the last meeting have been incorporated. Most of the changes have been minor modifications. Existing text has been revised and improved. One major change was the alignment with range extension related specifications of the 2nd HEVC edition.

Changes (26) of I1001 relative to H1001 are:

Editorial updates (1)

* (Update HEVC V2 ) Range extension parts.

Editorial adjustments (4)

* (3DE−05) Restructuring of DBBP output.
* (3DE−04) Adjusted page breaks
* (3DE−04) Adjusted heading indentation and size to match ISO basic template version 3.
* (3DN−10/[JCT3V−I0069](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2152)) Complexity Assessment on Depth Intra Modes with Simplified Data Flows. Decision (Ed): Integrate suggested editorial changes and further SDC fixes.

Fixes (2)

* (3DC−03) Fix ticket 72
* (3DC−02) Fix additional scalability dimensions.

Single Depth intra mode (1)

* (3DN−20/[JCT3V−I0095](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2178)) Single depth intra mode for 3D−HEVC Decision: Adopt I0095 Test 1 (method with 2 candidates)

Residual Prediction (3)

* (3DN−19/[JCT3V−I0051](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2133)) Simplification of advanced residual prediction Decision: Adopt JCT3V−I0051#1
* (3DN−14/[JCT3V−I0072](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2155)) Problem fix for MV scaling in inter−view ARP Decision(BF/ED/SW): Adopt
* (3DN−12/[JCT3V−I0104](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2187)) CE1: Results of ARP simplification Decision: Adopt JCT3V−I0104.

DBBP (4)

* (3DN−18/[JCT3V−I0077](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2160)) Partition Derivation for DBBP adoption of a simplification by the removal of decoder−side partition derivation (e.g. Test1 in I0097 with the proposed WD change) and adoption of syntax condition of the partition mode as per Test2 (the corresponding WD text is also provided in I0097).The software and text provided in a revision (−v3) of I0077, which includes harmonization with I0125, will be used.
* (3DN−17/[JCT3V−I0109](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2192)) One dimensional DBBP boundary filtering the filter simplification in option 2 of I0109 (which is a harmonization of three proposals including I0088, I0094, and a prior version of I0109), reducing of the number of filter conditions to be tested and applying a 1D rather than 2D filtering.
* (3DN−16/[JCT3V−I0078](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2161)) Memory Complexity for DBBP and VSP, adoption of the memory reduction method 2 (disallow DBBP for 8x8 CU)
* (3DN−15/[JCT3V−I0076](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2159)) Simplification of Threshold Derivation for DBBP and DMM4 JCT−3V confirmed, adoption of the simplification proposal to use four corner samples rather than all samples to form an average.

DMM/SDC (2)

* (3DN−02/[JCT3V−I0120](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2203)) CE2 : Remove “depth\_dc\_flag” signalling in DMM cases
* (3DN−01/[JCT3V−I0110](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2193)) Lookup table size reduction in DMM1

HLS (4)

* (3DN−06/[JCT3V−I0100](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2183)) HLS: General comments. Decision: Adopt the first and the fourth aspect (the latter without condition)
* (3DN−05/[JCT3V−I0099](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2182)) On the video parameter set extension 2 in 3D−HEVC. Decision: Adopt the version I0099WDr1
* (3DN−04/[JCT3V−I0090](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2173)) HLS Cleanup. Decision(ed.): Adopt the second aspect case a) Decision: Adopt the second aspect case b)
* (3DN−03/[JCT3V−I0085](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2168)) CE2: Separate enabling flag for intra coding tools. Decision: Retain inter\_sdc flag as is; Introduce new dmm4 flag; Change semantics of depth\_modes flag such that it controls dmm1 and intra sdc

Others (5)

* (3DN−13/[JCT3V−I0191](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2284)) Removal of the 2Nx2N restriction for sub−PU IVMP Decision: Adopt (new version 2 with additional modification to be delivered)
* (3DN−11/[JCT3V−I0093](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2176)) Depth coding compatible with arbitrary bit−depth Decision(Ed): Adopt
* (3DN−08/[JCT3V−I0086](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2169)) Simplification of shift DV candidate, Decision: Adopt removal of DMV search for shifted DV candidate derivation (in I0086\_WD\_r1)
* (3DN−09/[JCT3V−I0057](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2140)) Clipping Operation for DLT Indexes Decision: Adopt the text of I0057r1, with additional editorial improvement that Idx2DepthValue[ i ] shall be set to zero.
* (3DN−07/[JCT3V−I0080](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2163)) Parameter Derivation for Illumination Compensation Decision: Adopt this aspect (clipping of coordinate)

### Open issues

* A list of other minor issues is listed in the bug tracking system.
* One adoption, (JCT3V-I0129 (ARP)), which has been indicated as an adopted editorial change in the meeting notes has accidently not been incorporated.
* Further editorial alignments with the 2nd edition of HEVC are required.
* The specification of profiles, tiers, and levels needs to be discussed.

## Test Model 9 of 3D-HEVC and MV-HEVC

One version of JCT3V-I1003 has been published by the editing AHG following the 9th JCT-3V meeting in Sapporo. The last version corresponds to the text submitted to MPEG secretariat.

### Incorporated changes

All adoptions of the last meeting have been incorporated. Moreover existing text has been revised and improved and missing text from previous meeting has been added.

Changes (7) of I1003 relative to H1003 are:

* (3DN-01/[JCT3V-I0086](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2169)) Simplification of shift DV candidate, Decision: Adopt removal of DMV search for shifted DV candidate derivation.
* (3DN-02/[JCT3V-I0078](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2161)) Memory Complexity for DBBP and VSP, adoption of the memory reduction method 2 (disallow DBBP for 8x8 CU).
* (3DN-04/[JCT3V-I0051](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2133)) Simplification of advanced residual prediction Decision: Adopt JCT3V-I0051#1.
* (3DN-05/[JCT3V-I0104](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2187)) CE1: Results of ARP simplification Decision: Adopt JCT3V-I0104.
* (3DN-03/[JCT3V-I0109](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2192)) One dimensional DBBP boundary filtering the filter simplification in option 2 of I0109 (which is a harmonization of three proposals including I0088, I0094, and a prior version of I0109), reducing of the number of filter conditions to be tested and applying a 1D rather than 2D filtering.
* (3DN-06/[JCT3V-I0095](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2178)) Single depth intra mode for 3D-HEVC Decision: Adopt I0095 Test 1 (method with 2 candidates).
* (3DN-07/[JCT3V-I0123](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=2206)) Fast Intra SDC coding for 3D-HEVC Intra Coding.

## MV-HEVC Draft Text 9

Seven versions of I1002 were published by the AHG following the 9th JCT-3V meeting in Sapporo. Editing has been taken place in an editing meeting following the Sapporo meeting. The text was developed together with the editors of the 2nd edition of HEVC. The last version corresponds to the text integrated to 2nd edition of the HEVC specification.

### Incorporated changes

All adoptions of the last meeting have been incorporated. Moreover existing text has been revised and improved.

Changes (~100) of I1002 relative to JCT3V-H1002 are: (the list might be incomplete)

* Conformance point specifications, multiview and scalability 5-deep (total number of direct and indirect reference layers and the current layer) – agreed
* Conformance point specifications, Requiring decoding of auxiliary pictures if indicated in OLS – confirmed
* Definition in terms of enhancement capability (and external base layer), Q6 supporting per-layer PTL spec. – confirmed.
* Stereo Main profile Multiview Main profile – confirmed, Remove constraint on vertical displacement? If the view order index = 1 the constraint applies; the remaining ones are not. – agreed
* HEVC version 1 compatibility, Presence of layer 0 – agreed to remove requirement.
* HEVC version 1 compatibility, Independent non-base layer decoding – agree to define.
* HEVC version 1 compatibility, Access unit boundary (definition of "picture"), active parameter sets SEI compatibility (R0274), RawMinCuBits – agree to corrective actions
* R0274 On active parameter sets SEI message Bug fix of active parameter sets SEI message It was pointed out that the "if payload\_extension\_present()" condition test, and an associated presence constraint were not necessary and agreed that they should be removed (only an editorial change). Decision: Adopt (as modified).
* R0257 Language indication for Overlay information SEI message Editor action item: Connect "UTF-8" to its meaning. Decision: Null-terminated st(v) string of characters encoded according to RFC 5646. Decision: Adopted, RFC 5646, variant 2, byte aligned, 0..255 range. Editors to double-check reference for UTF-8 and improve the reference (or reference a better definition) as necessary.
* SEI maturity in current draft/ Overlay information SEI message Decision: The persistence should end within each identified layer when the CLVS of that layer ends. Regarding language identification, see R0257. Parsing depends on the SPS of each associated layer ID Decision: Outside the outer-most loop, just prior to num\_overlays\_minus1, signal the number of bits minus 8 that is used within the loop for signalling overlay\_element\_label\_min(max). Editor action item: In the definition of st(v), a parenthetical reference to the specification in which this is defined should be added, and further editorial improvement of that description seems desirable.
* R0355 TMCTS-SEI Decision: Adopt as modified. (Further editorial improvement may still be desirable during finalization.)
* R0255 Persistence of SEI messages Decision: Adopt (clarified as noted, notes regarding overlay information).
* R0221 Extensibility of nesting SEI messages Editor action item: Editors are suggested to consider adding the proposed note. Decision (BF): For bitstream partition nesting (BSP) SEI message, add an explicit counter to indicate the number of SEI messages in the BSP SEI message, with up to 64 allowed to be nested.
* R0231 Signalling and use of HRD parameters for bitstream partitions Decision (BF/Cleanup): Adopt.
* R0235 AHG10: Processing of bitstreams without an available base layer Decision: Adopt (conditioned on the relevance of the basis text).
* R0153 External Base Proposal 1: When the base layer is externally specified, signalling modifications and constraints for the max\_vps\_dec\_pic\_buffering\_minus1[ i ][ 0 ][ j ] syntax elements are proposed. Two options for handling this were described. Decision: Adopt "option 1" (not signalling syntax element and inferring its value as 0).
* R0153 Proposal 2: Modifications are proposed to the semantics of poc\_reset\_idc syntax element for handling the case of an externally specified base layer. Decision: Adopt.
* R0125 Non-base layer subtree and auxiliary pictures 1. In order to keep the compatibility of slice headers with nuh\_layer\_id equal to 0 after non-base layer subtree extraction, poc\_lsb\_not\_present\_flag[ i ] shall be equal to 1, when layer\_id\_in\_nuh[ i ] is equal to AssignedBaseLayerId[ j ]. It was remarked that this constraint is effectively already present by the requirement that a rewritten bitstream conforms. Editor action item: The issue is purely editorial and the editors can consider whether some editorial action is desirable to make the constraint impact more clear or explicit.
* R0125 Non-base layer subtree and auxiliary pictures 3. An asserted bug fix in highest\_layer\_idx\_plus1 derivation is reported. Decision: Bug confirmed – adopt fix.
* R0124 On hybrid codec scalability 3a. Making it a requirement of bitstream conformance that, when vps\_base\_layer\_internal\_flag is equal to 0, vps\_max\_layers\_minus1 shall be greater than 0. Decision: Adopt.
* R0124 On hybrid codec scalability 3d. Making it a requirement of bitstream conformance that, when vps\_base\_layer\_internal\_flag is equal to 0, single\_layer\_for\_non\_irap\_flag and higher\_layer\_irap\_skip\_flag shall be equal to 0. It was agreed that the current text does not handle this issue, but a different solution was desired. Decision (Ed.): Define semantics of these flags in an equivalent way as they would be used with an internal base layer. Editor action item: Check other places in the specification to ensure that they are also well defined to work for an external base layer.
* R0223 On POC handle missing pictures and discardable pictures in the same manner as different picture types across layers in requiring POC resetting, Decision: consider adding informative text to address item 1.
* R0223 On POC 2.) allow mixing of CRA and BLA pictures without requiring POC resetting (changing language about "different NAL unit type" to IRAP versus non-IRAP); and Decision: Adopt 2
* R0223 On POC explicitly spell out a restriction on the value of full\_poc\_reset\_flag based on the value of poc\_reset\_idc of pictures in the first access unit in the same POC resetting period. Decision: Adopt 3 .
* R0280 Bitstream conformance restrictions in subclause C.4Decision (Ed.): Adopted (as modified).
* R0053 On invocation of a correct decoding process for the current picture It is proposed that the decoding process of the current picture (subclause 8.1, subclause F.8.1, subclause G.8.1 or subclause H.8.1) is selected on the basis of nuh\_layer\_id of the current picture and the profile to which the bitstream partition containing the current picture conforms. Decision (Ed.): Adopt items 1 and 3a.
* R0053 On invocation of a correct decoding process for the current picture It is proposed that the general decoding process in subclause 8.1 selects TargetPartitioningScheme based on external means or HRD, and if no other means is available TargetPartitioningScheme is set to 0. The BitstreamToDecode derived in subclause 8.1 is proposed to consist of the partitions containing target output layers, the partitions containing the direct and indirect reference layers of the layers in the partitions containing the target output layers and the partition containing the base layer. Decision (Ed.): Regarding Item 2, the intent is for the decoding process to be invoked only for output layers and layer on which they depend.
* R0053 AHG10 and On invocation of a correct decoding process for the current picture 3a It is clearly indicated that the processing for the external base-layer pictures is invoked at the beginning of an access unit, and the processing is separated into its own subclause (F.8.1.6).Decision (Ed.): Adopt items 1 and 3a.
* R0053 AHG10 and On invocation of a correct decoding process for the current picture It was discussed whether any well-specified constraints are established for a layer that is not indicated to be decoded by any OLS and does not have an associated profile\_idc. Decision (BF/Ed.): Prohibit such layers from being present.
* R0276 On sub-bitstream extraction Item 4 of the proposal had been withdrawn. Decision: Adopt (as modified).
* R0238 Editorial cleanups Decision (BF/Ed.): Adopt.
* R0071 On cross-layer impacts of IRAP and EOS It is proposed that if the current picture is the first picture that follows an end of sequence NAL unit (with nuh\_layer\_id equal to 0) in decoding order, NoClrasOutputFlag is set equal to 1. (This causes marking of all pictures in the DPB as "unused for reference" as well as setting LayerInitializedFlag and FirstPicInLayerDecodedFlag equal to 0 for all layers, which initializes the layer-wise start-up process.) Decision: Adopt this aspect.
* R0071 On cross-layer impacts of IRAP and EOS It is proposed that when nuh\_layer\_id is greater than 0, BLA pictures, CRA pictures with HandleCraAsBlaFlag equal to 1 and IDR pictures with cross\_layer\_bla\_flag equal to 1 cause the following: LayerInitializedFlag and FirstPicInLayerDecodedFlag is set equal to 0 for the current layer and all layers directly or indirectly predicted from the current layer. (Consequently, layer-wise start-up is enforced for these layers.) Each picture in the DPB for the current layer and all layers directly or indirectly predicted from the current layer are marked as "unused for reference". Decision: Adopt this aspect.
* R0071 On cross-layer impacts of IRAP and EOS It is proposed to allow EOS NAL unit with nuh\_layer\_id greater than 0. It is proposed that the decoding of the EOS NAL unit with nuh\_layer\_id greater than 0 causes the same impacts as those above (2a and 2b). Furthermore, for the semantics of SEI messages applying for nuh\_layer\_id greater than 0, it is proposed that EOS NAL unit with nuh\_layer\_id greater than 0 is treated similarly to an end of sequence for the persistence of the SEI message. When present, an EOS NAL unit with a particular nuh\_layer\_id value shall be the last NAL unit with that particular nuh\_layer\_id value within an access unit, except an end of bitstream NAL unit with that nuh\_layer\_id value (when present). Refined text was reviewed, as provided in a revision of the document. Item 3 was clarified. Decision: Adopt these aspects (items 3 as modified).
* R0071 On cross-layer impacts of IRAP and EOS A new item 4 was added, regarding the derivation of NoOutputOfPriorPicsFlag for a INBL and its dependent layers. Decision: Adopt these aspects (item 4).
* R0272 HEVCv1/ Conformance cleanups The proposal would be to add PTL information for the base layer sub-bitstream. The PTL seen by a version 1 decoder contains the entire bitstream. The PTL for the 0-th OLS is placed at the beginning of the VPS extension (when the base layer is not provided by external means and there is some enhancement layer). Decision: Adopted (item 1).
* R0272 HEVCv1/ Conformance cleanups Clarify that directly nested BP, PT, and DUI SEI messages only apply to the operation points that correspond to base-layer-output-only OLSs. Decision: Adopted (items 3 and 4), with key elements of the text provided in -v2.
* R0156 Move conformance cropping window parameters to rep\_format( ) syntax structure of VPS extension It is proposed to move the signaling of the conformance cropping window parameters of enhancement layers from the SPS to the VPS extension, as part of the rep\_format( ) syntax structure. It is asserted that this movement will enable more frequent parameter set sharing.Decision: Adopt.
* R0230 Unavailable and useless stuff Decision (Ed.): However, it was agreed, as an editorial matter, to only discuss the conformance requirements of OLSs that contain at least one VCL NAL unit.
* R0230 Unavailable and useless stuff Editor action item: Also add a note, to advise encoders to be careful about fixed frame rate and CBR indications in enhancement layers.
* R0230 Unavailable and useless stuff Decision (Ed.): Only require conformance of extracted sub-bitstreams corresponding to operation points for which all layers of the operation point (both the "necessary" and "unnecessary" layers for the decoding of the output layers) have VCL data in the bitstream and for which the highest TID of the operation point is a TD in that VCL data.
* R0279 More miscellaneous cleanups Clarification of the semantics of access unit delimiter RBSP to be applicable in multi-layer context (text in an attachment) The proposal is to specify that the pic\_type syntax element, which identifies the slice types allowed in the current picture, applies to all pictures in the AU.Decision (Ed.): Adopt.
* R0279 More miscellaneous cleanups Clarification of the specifications of order of NAL units and coded pictures and their association to access units in both subclauses 7.4.2.4.4 and F.7.4.2.4.4 (text in an attachment) Decision (Ed.): Append "with layer\_id equal to 0" to ordering constraints for AUD NAL unit in clause 7. Editor action item: Some other elements are clearly editorial and are delegated to the editors for consideration.+
* R0279 More miscellaneous cleanups To specify that for any independent non-base layer the used representation format is the one that is signalled in the active SPS for the layer. Decision (Ed.): Adopt. Editor action item: It was recommended for the editors to also add some note or expression of a requirement that the representation format must be signalled in the active SPS.
* R0279 More miscellaneous cleanups To clarify the use of parameters in parameter sets for interpretation of semantics of the frame-field information SEI message, including the following two parts, and it is also suggested to make a systematic check for other SEI messages for the need of similar clarifications. Decision (Ed.): Adopt (both identified aspects, and further similar clarifications if identified by the editors)
* R0279 More miscellaneous cleanups To clarify the semantics of the temporal sub-layer zero index SEI message for its use in multi-layer contexts, and to add a syntax element to indicate the number of previous consecutive temporal sub-layer zero pictures that have discardable\_flag equal to 1 (text in an attachment). The contribution proposed extending the syntax of the temporal sub-layer zero index SEI message. It was remarked that the proposal seems to change the spirit of what the prior interpretation of the SEI message would be. Editor action item: Add a note to advise encoders that, when using this SEI message, not to set discardable flag = 1 for TL0 pictures that are not RASL, RADL or sub-layer non-reference pictures. Decision (Ed.): Change semantics to clarify that it applies to the pictures of the associated layers.
* R0279 More miscellaneous cleanups 6. To change the recovery point SEI message to correct the POC derivation when random access is performed and to clarify/add the POC derivation when layer-switching is performed. Decision: Adopt constraint on presence of the SEI message as described in "Option 1" of the -v2 version of the contribution.
* R0236 On access unit boundary detection [Ed. Add clarification – note that the AVC definition of "picture" which is what we were assuming when we wrote version 1, was define a picture as containing all VCL NAL units of the AU. We later changed the definition of "picture" for scalability extension, and this caused the problem.]
* R0236 On access unit boundary detection Decision: Adopt the proposed clarification and issue a defect report document that highlights the issue.
* R0236 On access unit boundary detection The phrasing in in subclause 7.4.2.4.4 is not explicit whether nuh\_layer\_id equal to 0 or any nuh\_layer\_id value is considered in determining the first NAL unit of an access unit. This aspect is a clarification of the prior basis text. Decision (Ed.): Adopt this aspect.
* R0226 Modification to semantics of slice\_temporal\_mvp\_enabled\_flag.
* R0226 Modification to semantics in temporal motion vector prediction constraints SEI message.
* R0227 Signalling of bit rate and picture rate information for additional layer sets.
* R0227 Adding a restriction on update of representation format of the base layer.
* R0227 Bug fix and simplification for value ranges of num\_negative\_pics, num\_positive\_pics, and num\_long\_term\_pics.
* R0227 Add semantic constraint of vps\_vui\_bsp\_hrd\_present\_flag.
* R0227 Remove restriction on update of separate\_color\_plane\_flag in SPS.
* R0227 It was suggested that when the base layer is internal, we should send the VST also for the base layer along with the other layers (e.g., for session negotiation purposes). Decision: Agreed (send VST for base layer when internal).
* R0276 Generalize scalable nesting SEI message so that it can be applied to additional layer sets.
* R0276 Editorial cleanups to derivation of BitstreamToDecode in the HRD and semantics of scalable nesting SEI message and the sub-bitstream property SEI message to properly reference the subclauses of F.10.x. Decision: The BoG recommended actions are agreed (see also additional notes for R0276).
* R0154 Modify semantics of default\_output\_layer\_idc and output\_layer\_flag[ i ][ j ] to consistently handle auxiliary pictures.
* R0154 Add inference value to alt\_output\_layer\_flag[ i ].
* R0155 Modify the semantics of slice\_type for I slice\_type with respect to IRAP pictures and sps\_max\_dec\_pic\_buffering\_minus1[ TemporalId ] value to enable inter-layer prediction could be used for pictures with nuh\_layer\_id > 0.
* R0155 Constrain the allowed range for values of output\_layer\_set\_idx\_to\_vps[ i ].
* R0157 Constrain DependencyId and ViewOrderIdx to increase with increasing values of nuh\_layer\_id (text in v2 version). Decision: The BoG recommended actions are agreed (see also additional notes for R0276).
* R0010 JCT-VC AHG report: Layered coding constraint specifications and capability indications Scalable Main and Stereo Main decoders should be capable of decoding Main profile bitstreams (at least when the base layer is not provided by external means). Decision (Ed.): Confirmed (and Scalable Main 10 should decode Main 10).
* R0010 JCT-VC AHG report: Layered coding constraint specifications and capability indications When the target output layers of an output layer set do not include the auxiliary pictures (or any such non-target "unnecessary" layers), the bits of the auxiliary/non-target pictures in the extracted bitstream subset would be counted in the CPB buffer flow, but the decoding of the auxiliary pictures would not be part of the associated decoding process requirements. Decision (Ed.): Confirmed.
* R0010 JCT-VC AHG report: Layered coding constraint specifications and capability indications When the target output layers of an output layer set do include the auxiliary pictures, the profile specification for (partitions of) the output layer set would need to include decoding process requirements for decoding those pictures. Unless some way is found to specify the necessary decoding process capabilities (e.g., by a profile definition that includes such capabilities), the specification would need to disallow having target output layers of an output layer set that are auxiliary pictures Decision (Ed.): Confirmed.
* R0010 JCT-VC AHG report: Layered coding constraint specifications and capability indications It was suggested that the profile/tier/level information for such an output layer set should include all the layers in the output layer set in the CPB operation but not include the "unnecessary" layers in its decoding process requirements. In principle, it was suggested to be desirable to support this possibility (esp. for the future extensibility purpose), and suggested that we should conduct further study to ensure that the specification is consistent with this design intent. Decision (Ed.): Confirmed that this should be supported.
* R0010 Layered coding constraint specifications and capability indications Regarding DPB specification (incl. Q0103 / JCT3V-H0034) level limit constraints related to maximum DPB size, the VPS-level DPB needs to have constraints as well as the SPS level having such constraints (each layer in the TargetDecLayerIdList shall obey profile-specific level limit in A.4.1 d, which applies to sps\_max\_dec\_pic\_buffering\_minus1[ HighestTid ]). Decision (Ed.): Confirmed.
* R0010 Layered coding constraint specifications and capability indications The text should clearly specify the following: Values of general\_profile\_idc for indicating SHVC and MV-HEVC profiles. Decoding requirements specification needs to require decoding (an editorial oversight) If the capabilities of one profile are "nested" within the capabilities of another profile, decoders should be required to recognize that and decode the bitstream. Decision (Ed.): Confirmed. Editors are requested to share general\_profile\_idc for naturally-nested profiles (e.g., Scalable Main 10 and Scalable Main) as was done in RExt. Monochrome 8 should use the RExt general\_profile\_idc. Some details of Monochrome 8 are yet to be defined. Define these in a manner consistent with other RExt profiles unless some contribution indicates otherwise. Nesting relationships are to be specified for Main, and Main Still Picture for all three new profiles and for Main 10 for the Scalable Main 10 profile.
* R0010 Layered coding constraint specifications and capability indications Make the PPS syntax HEVCv1 compatible, and enable the syntax of SPS with nuh\_layer\_id > 0 to be either HEVCv1 compatible or not. Decision (Cleanup): Confirmed.
* R0010 Layered coding constraint specifications and capability indications Simplify the bitstream rewriting process for independent non-base layers (part of R0042). Decision (Cleanup): Confirmed.
* R0010 Layered coding constraint specifications and capability indications Specify independent non-base layer decoding for profiles specified in Annex A. For example, the following phrasing could be used "When expressing the capabilities of a decoder for a profile specified in Annex A, the capability of decoding an independent non-base layer should be expressed." Decision (Cleanup): Confirmed.
* R0010 Allow an SHVC/MV-HEVC bitstream to be considered conforming without containing a base layer (i.e., without containing pictures of layer 0), and indicate such a bitstream using the vps\_reserved\_one\_bit (with the syntax element name and semantics changed) Decision (Cleanup): Confirmed.
* R0010 Remove the bitstream partition HRD parameters SEI message. Decision (Cleanup): Confirmed.
* R0010 Wording improvement is needed for item b of the profile specific level limits, to correctly implement the intent to consider output times of pictures in different AUs. Editor action item: Editors to consider.
* R0010 It is noted that the drafted Scalable Main profile does not support monochrome decoding. Decision (Cleanup): Remove constraint prohibiting 4:2:0 for alpha and depth and specify the the semantics of associated SEI messages, if not already specified, to refer to the luma component only. True monochrome will not be required to be supported (parent).
* R0010 R0041 is on this topic. Text was requested for using the last of the "44 reserved bits" for this indicator. The text was provided in a revision of R0041 and reviewed Minor comments included harmonization with RExt, including the flag for sub-layers, requiring the flag to be equal to zero if the associated layer ID is zero and otherwise equal to 1, clarifying the scope of the flag to CLVS scope, having the rewriting process set the flag to 0, and making the value of the flag an exception to the requirement for the PTL in the SPS to match that of the VPS for an INBL. (The question of whether the rewriting process is removed or not is an editorial matter, and it seems that we may retain it for convenience while providing additional informative text.) Decision: Confirmed (modified as suggested above for 07-06 review).
* R0362/Parameter set repetition: R0010 Should some additional adjustment be made of the syntax of independent non-base layers in regard, e.g., to VPS repetition and handling of end of sequence and end of bitstream NAL units? Consider allowing VPS presence in independent non-base layer (text preparation requested). Check whether other PSs can be repeated in other layers. Decision (Cleanup): It was agreed to allow this for all PSs (observing that SPSs in layer 0 must use compatible syntax). Revisit for text review. Decision (Ed.): Regarding ordering of pictures within one AU, it is intended to require the VCL NAL units of the picture to be in the order of increasing layer ID value. Text in R0362 parameter sets repetition
* R0360 YKW Cleanup Editor action item: Most aspects were suggested to be clearly editorial and were delegated to the editors for consideration. Item 2 relates to ordering of pictures in an AU, which was found in Annex F. This seemed adequate, so the suggested change may be unnecessary.
* R0043 SHVC/MV-HEVC level definitions and related decoder capability requirements Decision: The intent is agreed as stated above; the editors are delegated the task of expressing that in the language of the text.
* R0361/VUI cleanups: R0361 Adarsh VUI cleanups
* JCT3V-I0103 MV-HEVC HLS: Clean-up of MV-HEVC SEI messages I0103 rev1
* JCT3V-I0134 aspects 1 and 3
* JCT3V-I0199 (BoG editors' notes), in addition to other items, view\_id\_len: remove the value range of the syntax element.
* Remaining items identified through BoG on editors' notes in SHVC/MV-HEVC specs in R0359/I0199
* R0357 Updates to chroma resampler hint SEI message
* Updates to knee function info SEI message Decision: Agreed to include the message with the modifications agreed above. Further editorial improvement during the editing period for finalization also seems desirable.
* Add constraint on SHVC specific syntax to be zero in MV-HEVC profile definition, including, single\_layer\_for\_non\_irap\_flag equal and colour\_mapping\_enabled\_flag.

# Recommendations

The recommendations of the MV-HEVC / 3D-HEVC Draft and Test Model editing AHG are to:

* Approve the edited documents I1001, I1002 and I1003 as JCT-3V outputs.
* Continue to edit documents I1001 and I1003 to ensure that all agreed elements of 3D-HEVC are fully described, in particular integrate I0129 (ARP).
* Compare the documents I1001, I1002 and I1003 with the HTM-software and resolve any discrepancies that may exist, in collaboration with the Software AHG.
* Continue to improve the overall editorial quality of the documents I1001, and I1003.
* Ensure that properly drafted candidate text is available prior to making any decision to change the specifications.
* Reviewing specification text of each adopted proposal, since 3D-HEVC is close to finalization.
* Discuss reported open issues.