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| **Joint Video Experts Team (JVET)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  13th Meeting: Marrakech, MA, 9–18 Jan. 2019 | Document: JVET-M\_Notes\_d1 |

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| *Title:* | **Meeting Report of the 13th meeting of the Joint Video Experts Team (JVET), Marrakech, MA, 9–18 January 2019** | | |
| *Status:* | Report document from the chairs of JVET | | |
| *Purpose:* | Report | | |
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| *Source:* | Chairs of JVET | | |

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# Summary

The Joint Video Experts Team (JVET) of ITU-T WP3/16 and ISO/IEC JTC 1/ SC 29/ WG 11 held its thirteenth meeting during 9–18 January 2019 at the Palais des Congrès Mogador (Tourist Zone Agdal, 40000, Marrakech, Morocco, Tel: + 212 530 530 530). The JVET meeting was held under the chairmanship of Dr Gary Sullivan (Microsoft/USA) and Dr Jens-Rainer Ohm (RWTH Aachen/Germany). For rapid access to particular topics in this report, a subject categorization is found (with hyperlinks) in section 2.13 of this document. It is further noted that the unabbreviated name of JVET was formerly known as “Joint Video *Exploration* Team”, but the parent bodies had modified it when entering the phase of formal development of a new standard by the previous meeting. The name Versatile Video Coding (VVC) was chosen as the informal nickname for the new standard.

The JVET meeting began at approximately 0910 hours on Wednesday 9 January 2019. Meeting sessions were held on all days (including weekend days) until the meeting was closed at approximately XXXX hours on Friday 18 October 2019. Approximately XXX people attended the JVET meeting, and approximately XXX input documents and 17 AHG reports were discussed. The meeting took place in a collocated fashion with a meeting of WG11 – one of the two parent bodies of the JVET. The subject matter of the JVET meeting activities consisted of developing video coding technology with a compression capability that significantly exceeds that of the current HEVC standard, or otherwise gives better support regarding the requirements of future application domains of video coding. As a primary goal, the JVET meeting reviewed the work that was performed in the interim period since the twelfth JVET meeting in producing a third draft of the VVC standard and the third version of the associated VVC test model (VTM). Further important goals were reviewing the results of 13 Core Experiments (CE), reviewing other technical input on novel aspects of video coding technology, and producing the next versions of the VVC draft text and VTM, and plan next steps for further investigation of candidate technology towards the formal standard development.

The JVET produced XX output documents from the meeting (update):

* JVET-L1001 Versatile Video Coding specification text (Draft 3)
* JVET-L1002 Algorithm description for Versatile Video Coding and Test Model 3 (VTM 3)
* JVET-L1004 Algorithm descriptions of projection format conversion and video quality metrics in 360Lib (Version 8)
* JVET-L1005 and JVET-L1006 Methodology and reporting template for coding tool testing and for neural network tool testing
* JVET-L1010, JVET-L1011, and JVET-L1012 JVET common test conditions and software reference configurations for SDR, HDR/WCG, and 360° video
* JVET-L1021 through JVET-L1033, Description of Core Experiments 1 through 13

For the organization and planning of its future work, the JVET established XX “ad hoc groups” (AHGs) to progress the work on particular subject areas. At this meeting, XX Core Experiments (CE) were defined. The next four JVET meetings were planned for 19–27 March 2019 under ITU-T SG16 auspices in Geneva, CH, during 3–12 July 2019 under WG 11 auspices in Gothenburg, SE, during 1–9 October 2019 under ITU-T SG16 auspices in Geneva, CH, and during 8–17 January 2020 under WG 11 auspices in Brussels, BE.

The document distribution site <http://phenix.it-sudparis.eu/jvet/> was used for distribution of all documents.

The reflector to be used for discussions by the JVET and all its AHGs is the JVET reflector:  
[jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de) hosted at RWTH Aachen University. For subscription to this list, see  
<https://mailman.rwth-aachen.de/mailman/listinfo/jvet>.

# Administrative topics

## Organization

The ITU-T/ISO/IEC Joint Video Experts Team (JVET) is a group of video coding experts from the ITU-T Study Group 16 Visual Coding Experts Group (VCEG) and the ISO/IEC JTC 1/SC 29/WG 11 Moving Picture Experts Group (MPEG). The parent bodies of the JVET are ITU-T WP3/16 and ISO/IEC JTC 1/SC 29/WG 11.

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It is further noted that the unabbreviated name of JVET was formerly known as “Joint Video *Exploration* Team”, but the parent bodies had modified it when entering the phase of formal development of a new standard by the previous meeting. The name Versatile Video Coding (VVC) was chosen as the informal nickname for the new standard.

## Meeting logistics

Information regarding logistics arrangements for the meeting had been provided via the email reflector [jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de) and at <http://wftp3.itu.int/av-arch/jvet-site/2019_01_M_Marrakech/>.

## Primary goals

As a primary goal, the JVET meeting reviewed the work that was performed in the interim period since the twelfth JVET meeting in producing a third draft of the VVC standard and the third version of the associated VVC test model (VTM). Further important goals were reviewing the results of 13 Core Experiments (CE), reviewing other technical input on novel aspects of video coding technology, and producing the next versions of draft text and VTM, and plan next steps for further investigation of candidate technology towards the formal standard development.

## Documents and document handling considerations

### General

The documents of the JVET meeting are listed in Annex A of this report. The documents can be found at <http://phenix.it-sudparis.eu/jvet/>.

Registration timestamps, initial upload timestamps, and final upload timestamps are listed in Annex A of this report.

The document registration and upload times and dates listed in Annex A and in headings for documents in this report are in Paris/Geneva time. Dates mentioned for purposes of describing events at the meeting (other than as contribution registration and upload times) follow the local time at the meeting facility.

Highlighting of recorded decisions in this report is practised as follows:

* Decisions made by the group that might affect the normative content of a future standard are identified in this report by prefixing the description of the decision with the string “Decision:”.
* Decisions that affect the VTM or BMS software but have no normative effect are marked by the string “Decision (SW):”.
* Decisions that fix a “bug” in the VTM description (an error, oversight, or messiness) or in the software are marked by the string “Decision (BF):”.

This meeting report is based primarily on notes taken by the JVET chairs. The preliminary notes were also circulated publicly by ftp and http during the meeting on a daily basis. It should be understood by the reader that 1) some notes may appear in abbreviated form, 2) summaries of the content of contributions are often based on abstracts provided by contributing proponents without an intent to imply endorsement of the views expressed therein, and 3) the depth of discussion of the content of the various contributions in this report is not uniform. Generally, the report is written to include as much information about the contributions and discussions as is feasible (in the interest of aiding study), although this approach may not result in the most polished output report.

### Late and incomplete document considerations

The formal deadline for registering and uploading non-administrative contributions had been announced as Wednesday, 2 January 2019. Any documents uploaded after 1159 hours Paris/Geneva time on Thursday 3 January were considered “officially late”, giving a grace period of 12 hours to accommodate those living in different time zones of the world. The deadline does not apply to AHG reports, CE summaries, and other such reports which can only be produced after the availability of other input documents.

All contribution documents with registration numbers JVET-M0535 and higher were registered after the “officially late” deadline (and therefore were also uploaded late). However, some documents in the “M0535+” range might include break-out activity reports that were generated during the meeting, and are therefore better considered as report documents rather than as late contributions. Also, many cross-check reports were uploaded late.

In many cases, contributions were also revised after the initial version was uploaded. The contribution document archive website retains publicly accessible prior versions in such cases. The timing of late document availability for contributions is generally noted in the section discussing each contribution in this report.

One suggestion to assist with the issue of late submissions was to require the submitters of late contributions and late revisions to describe the characteristics of the late or revised (or missing) material at the beginning of discussion of the contribution. This was agreed to be a helpful approach to be followed at the meeting.

The following technical design proposal contributions were registered and/or uploaded late:

* JVET-M0XXX (a proposal on …), uploaded 01-XX.
* ….

It may be observed that some of the above-listed contributions were submissions made in response to issues that arose in discussions during the meeting or from the study of other contributions, and thus could not have been submitted by the ordinary deadline. For example, some of them were proposing combinations or simplifications of other proposals.

The following other document not proposing normative technical content, but with some need for consideration, were registered and/or uploaded late:

* JVET-M0XXX (a document on …), uploaded 01-XX.
* ….

The following cross-verification reports were registered before the deadline and uploaded late: JVET-M0XXX [uploaded XX-XX], … . Cross-verification reports that were both registered late and uploaded late (those with numbers higher than JVET-L0XXX) are not specifically identified here, in the interest of brevity. Initial upload times for each document are recorded in Annex A of this report.

The following contribution registrations were later cancelled, withdrawn, never provided, were cross-checks of a withdrawn contribution, or were registered in error: JVET-M0XXX, ….

“Placeholder” contribution documents that were basically empty of content, or lacking any results proving benefit of the proposed technology, and obviously uploaded with an intent to provide a more complete submission as a revision, had been agreed to be considered unacceptable and to be rejected in the document management system until a more complete version was available (which would then typically be counted as a late contribution). At the current meeting, this situation applied to the initial uploads of documents JVET-M0245, JVET-M0325, JVET-M0351, JVET-M0396, JVET-M0424, JVET-M0526, and JVET-M0660.

Contributions that had significant problems with uploaded versions included the following:

* M0042 (improperly formatted filename)
* M0067 (proposal described as a report in header)
* M0080 (incorrect document number in a filename)
* M0084 (incomplete patent rights declaration)
* M0147 (no author or contact information in header)
* M0202 (incomplete patent rights declaration)
* M0204 (unreadable file uploaded)
* M0209 (unreadable file uploaded)
* M0244 (incorrect company identified in patent rights declaration)
* M0245 (proposal missing all clearly necessary experiment results)
* M0276 (incomplete patent rights declaration)
* M0325 (proposal missing all clearly necessary experiment results)
* M0351 (proposal missing all clearly necessary experiment results)
* M0352 (document number missing in header and most test results missing)
* M0374 (wrong meeting number in header)
* M0376 (wrong meeting start date in header)
* M0396 (proposal missing all clearly necessary experiment results)
* M0400 (wrong meeting start date and incorrect country abbreviation in header)
* M0416 (wrong meeting identified in header)
* M0424 (proposal missing all clearly necessary experiment results)
* M0481 (unreadable file uploaded)
* M0526 (proposal missing all clearly necessary experiment results)
* M0594 (zero-byte zip file uploaded in -v2)
* M0657 (bad title)
* M0660 (cross-check document with only a tiny fraction of the necessary experiment results)

As a general policy, missing documents were not to be presented, and late documents (and substantial revisions) could only be presented when there was a consensus to consider them and there was sufficient time available for their review. Again, an exception is applied for AHG reports, CE summaries, and other such reports which can only be produced after the availability of other input documents. There were no objections raised by the group regarding presentation of late contributions, although there was some expression of annoyance and remarks on the difficulty of dealing with late contributions and late revisions.

It was remarked that documents that are substantially revised after the initial upload can also be a problem, as this becomes confusing, interferes with study, and puts an extra burden on synchronization of the discussion. This can especially be a problem in cases where the initial upload is clearly incomplete, and in cases where it is difficult to figure out what parts were changed in a revision. For document contributions, revision marking is very helpful to indicate what has been changed. Also, the “comments” field on the web site can be used to indicate what is different in a revision although participants tend to seldom notice what is recorded there.

A few contributions may have had some problems relating to IPR declarations in the initial uploaded versions (missing declarations, declarations saying they were from the wrong companies, etc.). These issues were corrected by later uploaded versions in a reasonably timely fashion in all cases (to the extent of the awareness of the responsible coordinators).

Some other errors were noticed in other initial document uploads (wrong document numbers or meeting dates or meeting locations in headers, etc.) which were generally sorted out in a reasonably timely fashion. The document web site contains an archive of each upload.

### Outputs of the preceding meeting

All output documents of the previous meeting, particularly the meeting report JVET-L1000, the Versatile Video Coding specification text (Draft 3) JVET-L1001, the Algorithm description for Versatile Video Coding and Test Model 3 (VTM 3) JVET-L1002, the Algorithm descriptions of projection format conversion and video quality metrics in 360Lib Version 8 JVET-L1004, the Methodology and reporting template for tool testing JVET-L1005, the JVET common test conditions and software reference configurations for SDR, HDR/WCG, and 360° video (JVET-L1010, JVET-L1011, and JVET-L1012), and the Description of Core Experiments 1 through 13 (JVET-L1021 through JVET-L1033), had been completed and were approved. The software implementation of VTM (versions 3.0 and 3.1), and the 360Lib software implementation (version 8.0) were also approved.

The group had initially been asked to review the meeting report of the previous meeting for finalization. The meeting report was later approved … .

The available output documents of the previous meeting and the software had been made available in a reasonably timely fashion.

## Attendance

The list of participants in the JVET meeting can be found in Annex B of this report.

The meeting was open to those qualified to participate either in ITU-T WP3/16 or ISO/IEC JTC 1/‌SC 29/‌WG 11 (including experts who had been personally invited as permitted by ITU-T or ISO/IEC policies).

Participants had been reminded of the need to be properly qualified to attend. Those seeking further information regarding qualifications to attend future meetings may contact the responsible coordinators.

## Agenda

The agenda for the meeting was as follows:

* Opening remarks and review of meeting logistics and communication practices
* IPR policy reminder and declarations
* Contribution document allocation
* Review of results of the previous meeting
* Reports of *ad hoc* group (AHG) activities
* Reports of core experiments planned at the previous meeting
* Consideration of contributions and communications on project guidance
* Consideration of additional video coding technology contributions
* Consideration of information contributions
* Coordination activities
* Approval of output documents and associated editing periods
* Future planning: Determination of next steps, discussion of working methods, communication practices, establishment of coordinated experiments, establishment of AHGs, meeting planning, other planning issues
* Other business as appropriate for consideration

## IPR policy reminder

Participants were reminded of the IPR policy established by the parent organizations of the JVET and were referred to the parent body websites for further information. The IPR policy was summarized for the participants.

The ITU-T/ITU-R/ISO/IEC common patent policy shall apply. Participants were particularly reminded that contributions proposing normative technical content shall contain a non-binding informal notice of whether the submitter may have patent rights that would be necessary for implementation of the resulting standard. The notice shall indicate the category of anticipated licensing terms according to the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form.

This obligation is supplemental to, and does not replace, any existing obligations of parties to submit formal IPR declarations to ITU-T/ITU-R/ISO/IEC.

Participants were also reminded of the need to formally report patent rights to the top-level parent bodies (using the common reporting form found on the database listed below) and to make verbal and/or document IPR reports within the JVET necessary in the event that they are aware of unreported patents that are essential to implementation of a standard or of a draft standard under development.

Some relevant links for organizational and IPR policy information are provided below:

* <http://www.itu.int/ITU-T/ipr/index.html> (common patent policy for ITU-T, ITU-R, ISO, and IEC, and guidelines and forms for formal reporting to the parent bodies)
* <http://ftp3.itu.int/av-arch/jvet-site> (JVET contribution templates)
* <http://www.itu.int/ITU-T/dbase/patent/index.html> (ITU-T IPR database)
* <http://www.itscj.ipsj.or.jp/sc29/29w7proc.htm> (JTC 1/‌SC 29 Procedures)

It is noted that the ITU TSB director’s AHG on IPR had issued a clarification of the IPR reporting process for ITU-T standards, as follows, per SG 16 TD 327 (GEN/16):

“TSB has reported to the TSB Director’s IPR Ad Hoc Group that they are receiving Patent Statement and Licensing Declaration forms regarding technology submitted in Contributions that may not yet be incorporated in a draft new or revised Recommendation. The IPR Ad Hoc Group observes that, while disclosure of patent information is strongly encouraged as early as possible, the premature submission of Patent Statement and Licensing Declaration forms is not an appropriate tool for such purpose.

In cases where a contributor wishes to disclose patents related to technology in Contributions, this can be done in the Contributions themselves, or informed verbally or otherwise in written form to the technical group (e.g. a Rapporteur’s group), disclosure which should then be duly noted in the meeting report for future reference and record keeping.

It should be noted that the TSB may not be able to meaningfully classify Patent Statement and Licensing Declaration forms for technology in Contributions, since sometimes there are no means to identify the exact work item to which the disclosure applies, or there is no way to ascertain whether the proposal in a Contribution would be adopted into a draft Recommendation.

Therefore, patent holders should submit the Patent Statement and Licensing Declaration form at the time the patent holder believes that the patent is essential to the implementation of a draft or approved Recommendation.”

The responsible coordinators invited participants to make any necessary verbal reports of previously-unreported IPR in technology that might be considered as prospective candidate for inclusion in future standards, and opened the floor for such reports: No such verbal reports were made.

## Software copyright disclaimer header reminder

It was noted that the VTM software implementation package uses the same software copyright license header as the HEVC reference software, where the latter had been agreed at the 5th meeting of the JCT-VC and approved by both parent bodies at their collocated meetings at that time. This license header language is based on the BSD license with a preceding sentence declaring that other contributor or third party rights, including patent rights, are not granted by the license, as recorded in N10791 of the 89th meeting of ISO/IEC JTC 1/‌SC 29/‌WG 11. Both ITU and ISO/IEC will be identified in the <OWNER> and <ORGANIZATION> tags in the header. This software is used in the process of designing the VTM software, and for evaluating proposals for technology to be potentially included in the design. This software or parts thereof might be published by ITU-T and ISO/IEC as an example implementation of a future video coding standard and for use as the basis of products to promote adoption of such technology.

Different copyright statements shall not be committed to the committee software repository (in the absence of subsequent review and approval of any such actions). As noted previously, it must be further understood that any initially-adopted such copyright header statement language could further change in response to new information and guidance on the subject in the future.

These considerations apply to the 360Lib video conversion software and and HDRtools as well.

## Communication practices

The documents for the meeting can be found at <http://phenix.it-sudparis.eu/jvet/>.

It was reminded to send a notice to the chairs in cases of changes to document titles, authors etc.

JVET email lists are managed through the site <https://mailman.rwth-aachen.de/mailman/options/jvet>, and to send email to the reflector, the email address is [jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de). Only members of the reflector can send email to the list. However, membership of the reflector is not limited to qualified JVET participants.

It was emphasized that reflector subscriptions and email sent to the reflector must use real names when subscribing and sending messages and subscribers must respond to inquiries regarding the nature of their interest in the work. The current number of subscribers was 928.

For distribution of test sequences, a password-protected ftp site had been set up at RWTH Aachen University, with a mirror site at FhG-HHI. Accredited members of JVET may contact the responsible JVET coordinators to obtain the password information (but the site is not open for use by others).

## Terminology

Some terminology used in this report is explained below:

* **ACT**: Adaptive colour transform.
* **AI**: All-intra.
* **AIF**: Adaptive interpolation filtering.
* **ALF**: Adaptive loop filter.
* **AMP**: Asymmetric motion partitioning – a motion prediction partitioning for which the sub-regions of a region are not equal in size (in HEVC, being N/2x2N and 3N/2x2N or 2NxN/2 and 2Nx3N/2 with 2N equal to 16 or 32 for the luma component).
* **AMVP**: Adaptive motion vector prediction.
* **AMT or MTS**: Adaptive multi-core transform, or multiple transform set.
* **AMVR**: (Locally) adaptive motion vector resolution.
* **APS**: Active parameter sets.
* **ARC**: Adaptive resolution conversion (synonymous with DRC, and a form of RPR).
* **ARSS**: Adaptive reference sample smoothing.
* **ATMVP or “**subblock-based temporal merging candidates**”** : Alternative temporal motion vector prediction.
* **AU**: Access unit.
* **AUD**: Access unit delimiter.
* **AVC**: Advanced video coding – the video coding standard formally published as ITU-T Recommendation H.264 and ISO/IEC 14496-10.
* **BA**: Block adaptive.
* **BC**: See CPR or IBC.
* **BD**: Bjøntegaard-delta – a method for measuring percentage bit rate savings at equal PSNR or decibels of PSNR benefit at equal bit rate (e.g., as described in document VCEG-M33 of April 2001).
* **BDOF**: Bi-directional optical flow (formerly known as **BIO**)
* **BL**: Base layer.
* **BMS**: Bench-mark set, a compilation of coding tools on top of VTM, which provide somewhat better compression performance, but are not deemed mature for standardzation.
* **BoG**: Break-out group.
* **BR**: Bit rate.
* **BV**: Block vector (used for intra BC prediction).
* **CABAC**: Context-adaptive binary arithmetic coding.
* **CBF**: Coded block flag(s).
* **CC**: May refer to context-coded, common (test) conditions, or cross-component.
* **CCLM**: Cross-component linear model.
* **CCP**: Cross-component prediction.
* **CG**: Coefficient group.
* **CGS**: Colour gamut scalability (historically, coarse-grained scalability).
* **CIIP**: Combined Inter/Intra prediction
* **CL-RAS**: Cross-layer random-access skip.
* **CPMV: Control-point motion vector**
* **CPMVP**: Control-point motion vector prediction (used in affine motion model).
* **CPR**: Current-picture referencing, also known as IBC – a technique by which sample values are predicted from other samples in the same picture by means of a displacement vector called a block vector, in a manner conceptually similar to motion-compensated prediction.
* **CTC**: Common test conditions.
* **CVS**: Coded video sequence.
* **DCT**: Discrete cosine transform (sometimes used loosely to refer to other transforms with conceptually similar characteristics).
* **DCTIF**: DCT-derived interpolation filter.
* **DF**: Deblocking filter.
* **DMVR**: Decoder-side motion vector refinement.
* **DRC**: Dynamic resolution conversion (synonymous with ARC, and a form of RPR).
* **DT**: Decoding time.
* **ECS**: Entropy coding synchronization (typically synonymous with WPP).
* **EE**: Exploration Experiment – a coordinated experiment conducted toward assessment of coding technology.
* **EMT**: Explicit multiple-core transform.
* **EOTF**: Electro-optical transfer function – a function that converts a representation value to a quantity of output light (e.g., light emitted by a display.
* **EPB**: Emulation prevention byte (as in the emulation\_prevention\_byte syntax element).
* **ECV**: Extended Colour Volume (up to WCG).
* **EL**: Enhancement layer.
* **ET**: Encoding time.
* **FRUC**: Frame rate up conversion (pattern matched motion vector derivation).
* **HDR**: High dynamic range.
* **HEVC**: High Efficiency Video Coding – the video coding standard developed and extended by the JCT-VC, formalized by ITU-T as Rec. ITU-T H.265 and by ISO/IEC as ISO/IEC 23008-2.
* **HLS**: High-level syntax.
* **HM**: HEVC Test Model – a video coding design containing selected coding tools that constitutes our draft standard design – now also used especially in reference to the (non-normative) encoder algorithms (see WD and TM).
* **HMVP: History based motion vector prediction**
* **HyGT**: Hyper-cube Givens transform (a type of NSST).
* **IBC** (also **Intra BC**): Intra block copy, also known as CPR – a technique by which sample values are predicted from other samples in the same picture by means of a displacement vector called a block vector, in a manner conceptually similar to motion-compensated prediction.
* **IBDI**: Internal bit-depth increase – a technique by which lower bit-depth (8 bits per sample) source video is encoded using higher bit-depth signal processing, ordinarily including higher bit-depth reference picture storage (ordinarily 12 bits per sample).
* **IBF**: Intra boundary filtering.
* **ILP**: Inter-layer prediction (in scalable coding).
* **IPCM**: Intra pulse-code modulation (similar in spirit to IPCM in AVC and HEVC).
* **JEM**: Joint exploration model – the software codebase for future video coding exploration.
* **JM**: Joint model – the primary software codebase that has been developed for the AVC standard.
* **JSVM**: Joint scalable video model – another software codebase that has been developed for the AVC standard, which includes support for scalable video coding extensions.
* **KLT**: Karhunen-Loève transform.
* **LB** or **LDB**: Low-delay B – the variant of the LD conditions that uses B pictures.
* **LD**: Low delay – one of two sets of coding conditions designed to enable interactive real-time communication, with less emphasis on ease of random access (contrast with RA). Typically refers to LB, although also applies to LP.
* **LIC**: Local illumination compensation.
* **LM**: Linear model.
* **LP** or **LDP**: Low-delay P – the variant of the LD conditions that uses P frames.
* **LUT**: Look-up table.
* **LTRP**: Long-term reference pictures.
* **MC**: Motion compensation.
* **MCP**: Motion compensated prediction.
* **MDNSST**: Mode dependent non-separable secondary transform.
* **MMLM**: Multi-model (cross component) linear mode.
* **MPEG**: Moving picture experts group (WG 11, the parent body working group in ISO/IEC JTC 1/‌SC 29, one of the two parent bodies of the JVET).
* **MPM**: Most probable mode (in intra prediction).
* **MV**: Motion vector.
* **MVD**: Motion vector difference.
* **NAL**: Network abstraction layer (as in AVC and HEVC).
* **NSQT**: Non-square quadtree.
* **NSST**: Non-separable secondary transform.
* **NUH**: NAL unit header.
* **NUT**: NAL unit type (as in AVC and HEVC).
* **OBMC**: Overlapped block motion compensation (e.g., as in H.263 Annex F).
* **OETF**: Opto-electronic transfer function – a function that converts to input light (e.g., light input to a camera) to a representation value.
* **OOTF**: Optical-to-optical transfer function – a function that converts input light (e.g. l,ight input to a camera) to output light (e.g., light emitted by a display).
* **PDPC**: Position dependent (intra) prediction combination.
* **PMMVD**: Pattern-matched motion vector derivation.
* **POC**: Picture order count.
* **PoR**: Plan of record.
* **PPS**: Picture parameter set (as in AVC and HEVC).
* **QM**: Quantization matrix (as in AVC and HEVC).
* **QP**: Quantization parameter (as in AVC and HEVC, sometimes confused with quantization step size).
* **QT**: Quadtree.
* **BT**: Binary tree.
* **TT**: Ternary tree.
* **RA**: Random access – a set of coding conditions designed to enable relatively-frequent random access points in the coded video data, with less emphasis on minimization of delay (contrast with LD).
* **RADL**: Random-access decodable leading.
* **RASL**: Random-access skipped leading.
* **R-D**: Rate-distortion.
* **RDO**: Rate-distortion optimization.
* **RDOQ**: Rate-distortion optimized quantization.
* **ROT**: Rotation operation for low-frequency transform coefficients.
* **RPLM**: Reference picture list modification.
* **RPR**: Reference picture resampling (e.g., as in H.263 Annex P), a special case of which is also known as ARC or DRC.
* **RPS**: Reference picture set.
* **RQT**: Residual quadtree.
* **RRU**: Reduced-resolution update (e.g. as in H.263 Annex Q).
* **RVM**: Rate variation measure.
* **SAO**: Sample-adaptive offset.
* **SD**: Slice data; alternatively, standard-definition.
* **SDT**: Signal dependent transform.
* **SEI**: Supplemental enhancement information (as in AVC and HEVC).
* **SH**: Slice header.
* **SHM**: Scalable HM.
* **SHVC**: Scalable high efficiency video coding.
* **SIMD**: Single instruction, multiple data.
* **SPS**: Sequence parameter set (as in AVC and HEVC).
* **STMVP**: Spatial-temporal motion vector prediction.
* **TBA/TBD/TBP**: To be announced/determined/presented.
* **TGM**: Text and graphics with motion – a category of content that primarily contains rendered text and graphics with motion, mixed with a relatively small amount of camera-captured content.
* **UCBDS**: Unrestricted center-biased diamond search.
* **UWP**: Unequal weight prediction.
* **VCEG**: Visual coding experts group (ITU-T Q.6/16, the relevant rapporteur group in ITU-T WP3/16, which is one of the two parent bodies of the JVET).
* **VPS**: Video parameter set – a parameter set that describes the overall characteristics of a coded video sequence – conceptually sitting above the SPS in the syntax hierarchy.
* **VTM**: VVC Test Model.
* **VVC**: Versatile Video Coding, the standardization project developed by JVET.
* **WCG**: Wide colour gamut.
* **WG**: Working group, a group of technical experts (usually used to refer to WG 11, a.k.a. MPEG).
* **WPP**: Wavefront parallel processing (usually synonymous with ECS).
* Block and unit names in HEVC:
  + **CTB**: Coding tree block (luma or chroma) – unless the format is monochrome, there are three CTBs per CTU.
  + **CTU**: Coding tree unit (containing both luma and chroma, synonymous with LCU), with a size of 16x16, 32x32, or 64x64 for the luma component.
  + **CB**: Coding block (luma or chroma), a luma or chroma block in a CU.
  + **CU**: Coding unit (containing both luma and chroma), the level at which the prediction mode, such as intra versus inter, is determined in HEVC, with a size of 2Nx2N for 2N equal to 8, 16, 32, or 64 for luma.
  + **PB**: Prediction block (luma or chroma), a luma or chroma block of a PU, the level at which the prediction information is conveyed or the level at which the prediction process is performed in HEVC.
  + **PU**: Prediction unit (containing both luma and chroma), the level of the prediction control syntax within a CU, with eight shape possibilities in HEVC:
    - **2Nx2N**: Having the full width and height of the CU.
    - **2NxN (or Nx2N)**: Having two areas that each have the full width and half the height of the CU (or having two areas that each have half the width and the full height of the CU).
    - **NxN**: Having four areas that each have half the width and half the height of the CU, with N equal to 4, 8, 16, or 32 for intra-predicted luma and N equal to 8, 16, or 32 for inter-predicted luma – a case only used when 2N×2N is the minimum CU size.
    - **N/2x2N** paired with **3N/2x2N** or **2NxN/2** paired with **2Nx3N/2**: Having two areas that are different in size – cases referred to as AMP, with 2N equal to 16 or 32 for the luma component.
  + **TB**: Transform block (luma or chroma), a luma or chroma block of a TU, with a size of 4x4, 8x8, 16x16, or 32x32.
  + **TU**: Transform unit (containing both luma and chroma), the level of the residual transform (or transform skip or palette coding) segmentation within a CU (which, when using inter prediction in HEVC, may sometimes span across multiple PU regions).
* Block and unit names in JEM (Note: Need to put VVC terminology here):
  + **CTB**: Coding tree block (luma or chroma) – there are three CTBs per CTU in P/B slice, and one CTB per luma CTU and two CTBs per chroma CTU in I slice.
  + **CTU**: Coding tree unit (synonymous with LCU, containing both luma and chroma in P/B slice, containing only luma or chroma in I slice), with a size of 16x16, 32x32, 64x64, or 128x128 for the luma component.
  + **CB**: Coding block, a luma or chroma block in a CU.
  + **CU**: Coding unit (containing both luma and chroma in P/B slice, containing only luma or chroma in I slice), a leaf node of a QTBT. It’s the level at which the prediction process and residual transform are performed in JEM. A CU can be square or rectangle shape.
  + **PB**: Prediction block, a luma or chroma block of a PU.
  + **PU**: Prediction unit, has the same size to a CU.
  + **TB**: Transform block, a luma or chroma block of a TU.
  + **TU**: Transform unit, has the same size to a CU.

## Opening remarks

Remarks during the opening session of the meeting 0900 Wednesday 9 January (chaired by GJS and JRO) were as follows.

* The meeting logistics, agenda, working practices, policies, and document allocation were reviewed.
* The results of the previous meeting were reviewed.
  + On placeholders – there were a number of cases where there was some description of a concept but no test results.
    - …
* The primary goals of the meeting were to review the results of CEs, identify promising technology directions, and adopt proposed technology into the VVC draft text and VTM.
* Due to the high number of input contributions, parallelization and breakout work were expected to be needed.
* Principles of standards development were discussed.

## Scheduling of discussions

Scheduling: Generally meeting time was scheduled during 0900–2100+ hours, with coffee and lunch breaks as convenient. Ongoing scheduling refinements were announced on the group email reflector as needed. Some particular scheduling notes are shown below, although not necessarily 100% accurate or complete:

* Wed. 9 January, 1st day
  + 0900–1100, 1130-1400 Opening plenary (chaired by GJS & JRO)
  + 1530-1700 Track A CE1: Partitioning (3)
  + 1750-2030 Track A CE3.1: Intra prediction and mode coding (16)
  + 1530 Track B CE2: Subblock motion compensation (24)
* Thu. 10 January, 2nd day
  + 0900 Track A CE3.2 …
  + BoG on tiles & wavefront [YKW & Miska in Chellah]

## Contribution topic overview

The approximate subject categories and quantity of contributions per category for the meeting were summarized as follows (note that document count does not include crosschecks, and may not be up to date):

* AHG reports (17) (section 3) (Plenary)
* Project development (5) (section 4) (Plenary)
* Core Experiments (xx) (section 5) with subtopics
  + CE1: Partitioning (3) (section 5.1) (Track A)
  + CE2: Subblock motion compensation (24) (section 5.2) (Track B)
  + CE3: Intra prediction and mode coding (16) (section 5.3) (Track A)
  + CE4: Inter prediction and motion vector coding (18) (section 5.4) (Track B)
  + CE5: Arithmetic coding engine (10) (section 5.5) (Track A)
  + CE6: Transforms and transform signalling (21) (section 5.6) (Track A)
  + CE7: Quantization and coefficient coding (2) (section 5.7) (Track A)
  + CE8: Screen content coding tools (15) (section 5.8) (Track B)
  + CE9: Decoder side motion vector derivation (8) (section 5.9) (Track B)
  + CE10: Combined and multi-hypothesis prediction (15) (section 5.10) (Track B)
  + CE11: Deblocking (9) (section 5.11) (Track B)
  + CE12: Mapping functions (2) (section 5.12) (Track A)
  + CE13: Coding tools for 360° video (11) (section 5.13) (Track A)
* Non-CE technology proposals (xx) (section 6) with subtopics
  + CE1 related – Partitioning (3) (section 6.1) (Track A)
  + CE2 related – Subblock motion compensation (32) (section 6.2) (Track B)
  + CE3 related – Intra prediction and mode coding (47) (section 6.3) (Track A & BoG Geert)
  + CE4 related – Inter prediction and motion vector coding (48) (section 6.4) (Track B)
  + CE5 related – Arithmetic coding engine (4) (section 6.5) (Track A)
  + CE6 related – Transforms and transform signalling (25) (section 6.6) (Track A & BoG X. Zhao)
  + CE7 related – Quantization and coefficient coding (19) (section 6.7) (Track A & BoG)
  + CE8 related – Screen content coding tools (28) (section 6.8) (Track B)
  + CE9 related – Decoder side motion vector derivation (12) (section 6.9) (Track B)
  + CE10 related – Combined and multi-hypothesis prediction (40) (section 6.10) (Track B)
  + CE11 related – Deblocking (3) (section 6.11) (Track B)
  + CE12 related – Mapping functions (2) (section 6.12) (Track A)
  + CE13 related – Coding tools for 360° content (7) (section 6.13) (Track A & BoG Jill)
  + Loop filtering tools (12) (section 6.14) (Track B)
  + General prediction aspects (5) (section 6.15) (Track A)
  + Quantization (3) (section 6.16) (Track A)
  + Entropy coding (2) (section 6.17) (Track A)
  + Tools based on NN technology (7) (section 6.18) (Track B)
  + HL syntax (50) (section 6.19) (Track A & 2 BoG)
* Complexity analysis and reduction (3) (section 7) (Track A)
* Encoder optimization (3) (section 8) (Track A)
* Metrics and evaluation criteria (0) (section 9) (Track none)
* Withdrawn (7) (section 10) (Track none)
* Joint meetings, plenary discussions, BoG reports, Summary of actions (section 11)
* Project planning (section 12)
* Establishment of AHGs (section 13)
* Output documents (section 14)
* Future meeting plans and concluding remarks (section 15)

Track A (238) was generally chaired by GJS, and Track B (272) by JRO.

# AHG reports (17)

These reports were discussed Wednesday 9 January XXXX-XXXX (chaired by GJS and JRO).

[JVET-M0001](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4898) JVET AHG report: Project management (AHG1) [J.-R. Ohm, G. J. Sullivan]

This document reports on the work of the JVET ad hoc group on Project Management, including an overall status report on the VVC standardization project and the progress made during the interim period since the preceding meeting.

At the 12th meeting of the ITU-T/ISO/IEC Joint Video Experts Team (JVET), an *ad hoc* group on Project Management was established with the following mandates:

* Coordinate overall JVET interim efforts.
* Supervise CE and AHG studies.
* Report on project status to JVET reflector.
* Provide a report to next meeting on project coordination status.

The reflector used for discussions by the JVET and all of its AHGs is the JVET reflector:  
[jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de). For subscription to this list, see  
<http://mailman.rwth-aachen.de/mailman/listinfo/jvet>.

In the interim period since the 12th JVET meeting, work towards finalizing the following (21) documents had been performed:

* JVET-L1001 Versatile Video Coding specification text (Draft 3)
* JVET-L1002 Algorithm description for Versatile Video Coding and Test Model 3 (VTM 3)
* JVET-L1004 Algorithm descriptions of projection format conversion and video quality metrics in 360Lib (Version 8)
* JVET-L1005 and JVET-L1006 Methodology and reporting template for coding tool testing and for neural network tool testing
* JVET-L1010, JVET-L1011, and JVET-L1012 JVET common test conditions and software reference configurations for SDR, HDR/WCG, and 360° video
* JVET-L1021 through JVET-L1033, Description of Core Experiments 1 through 13

The work of the JVET overall had proceeded well in the interim period, and many input documents had been submitted for consideration at the current meeting. Intense discussion had been carried out on the group email reflector, and all output documents from the preceding meeting had been produced.

As noted below, all output documents from the preceding meeting had been made available at the "Phenix" site (<http://phenix.it-sudparis.eu/jvet/>) or the ITU-based JCT-VC site (<http://wftp3.itu.int/av-arch/jvet-site/2018_10_M_Macao/>), although some of these documents may need further refinement:

* The meeting report (JVET-L1000) [Posted 2019-01-08]
* Versatile Video Coding (Draft 3) (JVET-L1001) [Posted 2018-10-31, last update 2019-01-08]
* Algorithm description for Versatile Video Coding and Test Model 3 (VTM 3) (JVET-L1002) [Posted 2018-12-03, last update 2018-12-24]
* Algorithm descriptions of projection format conversion and video quality metrics in 360Lib Version 8 (JVET-L1004) [Posted 2018-11-10]
* Methodology and reporting template for coding tool testing (JVET-L1005) [Posted 2018-10-27]
* Methodology and reporting template for neural network coding tool testing (JVET-L1006) [Posted 2018-10-25]
* JVET common test conditions and software reference configurations (JVET-L1010) [Posted 2018-11-16]
* JVET common test conditions and evaluation procedures for HDR/WCG video (JVET-L1011) [Posted 2018-11-20]
* JVET common test conditions and evaluation procedures for 360° video (JVET-L1012) [Posted 2018-11-19]

Description of CE 1..13 (JVET-L1021..35) [all first posted 2018-10-11 or 2018-10-12, further updated during the CE definition period of 3 weeks after the meeting, i.e., until 2018-11-02]. The following CE description documents had substantially later updates (more than 4 weeks after the meeting):

* JVET-L1022 [last updated 2019-01-08] (for which some experiment plans had changed and the change had been announced on the JVET reflector)
* JVET-L1023 [last updated 2018-12-27]
* JVET-L1024 [last updated 2019-01-08] (for which some experiment plans had changed but the change had not been announced on the JVET reflector)
* JVET-L1025 [last updated 2019-01-04]
* JVET-L1026 [last updated 2019-01-04]
* JVET-L1027 [last updated 2018-11-13]
* JVET-L1033 [last updated 2018-11-27]

The seventeen *ad hoc* groups had made progress, and reports from those activities had been submitted.

Software integration of the VTM was finalized approximately according to the plan.

Various problem reports relating to asserted bugs in the software, draft specification text, and reference encoder description had been submitted to an informal "bug tracking" system. That system is not intended as a replacement of our ordinary contribution submission process. However, the bug tracking system was considered to have been helpful to the software coordinators and text editors. The bug tracker reports had been automatically forwarded to the group email reflector, where the issues were discussed – and this is reported to have been helpful.

The software distribution had been migrated to GitLab before the previous meeting, and the method for obtaining access to the software had been changed after the last meeting – using shared accounts for read access by members (with one account for MPEG members using its usual credentials and another for VCEG members with access managed through the TIES system). The bug tracking system for software aspects was not integrated yet with GitLab for the time being.

Roughly 700 input contributions to the current meeting (not counting the AHG reports) had been registered for consideration at the meeting. Though the topics of Core Experiments and related documents for the development of low-level coding tools reflect the bulk of these documents, around 50 documents were submitted on aspects of high-level syntax, including tile partitioning.

A preliminary basis for the document subject allocation and meeting notes for the 13th meeting had been made publicly available on the ITU-hosted ftp site.

[JVET-M0002](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4943) JVET AHG report: Draft text and test model algorithm description editing (AHG2) [B. Bross, J. Chen, J. Boyce, S. Kim, S. Liu, Y. Ye]

[incorporate from -v2]

Note three topics of resolving feature interactions and

three open tickets.

* No action needed on ticket #128.
* Software fix needed for #132.
* DCT2 downsampling of transform matrix should be separate horizontally and vertically (not assumed square) #135.

[JVET-M0003](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4944) JVET AHG report: Test model software development (AHG3) [F. Bossen, X. Li, K. Sühring]

[Add content from report]

Ticket #105 on mode combinations allowed.

v3.1 to be released during meeting.

To add software account access information in a revision.

Remarks on CTC:

* CPR is not enabled (perhaps should enable for SCC test sequences)
* MTS is not enabled for inter (perhaps should enable for low-res test sequences)

[JVET-M0004](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4876) JVET AHG report: Test material and visual assessment (AHG4) [T. Suzuki, V. Baroncini, R. Chernyak, P. Hanhart, A. Norkin, J. Ye]

The test sequences used for CfP/CTC are available on <ftp://jvet@ftp.ient.rwth-aachen.de> in directory “/jvet-cfp” (accredited members of JVET may contact the JVET chairs for login information).

Due to copyright restrictions, the JVET database of test sequences is only available to accredited members of JVET (i.e. members of ISO/IEC MPEG and ITU-T VCEG).

There was discussion that the current directory structure of test sequence ftp site is not good for the current activities. The ftp directory was created during the preparation of CfE/CfP and the same directory structure is still used. One possibility is to re-design the directory as follows, for example,

* ctc/ : Contains the active test set of the common testing conditions
* ahg/ : Contains subdirectories with sequences under consideration. The subfolder might be structured by meeting period (e.g. named by the doc-number of the corresponding meeting report?)
* ce/ : Contains subdirectories for data exchange for specific CE (already implemented, see ce/JVET-{K,L}1031\_Deblocking
* upload : stays as before

During the last meeting, there was a comment that all sequences, all classes should be at the same place. But there is still meaningful to separate SDR, HDR, 360. Further detail should be discussed in the meeting.

The AHG recommended:

* To discuss further ftp directory structure
* To continue to collect new test sequences available for JVET with licensing statement

It was noted that some test sequences had been submitted to the previous meeting, and that there was especially some interest in improving the SCC test set. Side activity was encouraged to study that.

[JVET-M0005](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5220) JVET AHG report: Memory bandwidth consumption of coding tools (AHG5) [R. Hashimoto, T. Ikai, X. Li, D. Luo, H. Yang, M. Zhou]

The document summarizes activities of AHG on memory bandwidth consumption of coding tools between the 12th and the 13th JVET meetings.

There is no related email discussion during this meeting cycle.

A patch on memory bandwidth measurement tools on VTM-3.0 has been provided by the AHG

<https://jvet.hhi.fraunhofer.de/trac/vvc/ticket/121>

Contributions to this meeting are as follows.

* CE2.4 (affine motion / block restriction) and related contributions
  + JVET-M0049 “CE2-related: A restriction on memory bandwidth consumption of affine mode”, M. Zhou (Broadcom)
  + JVET-M0150 “CE2.4.3: Affine restriction for worst-case memory bandwidth reduction”, L. Pham Van, W.-J. Chien, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)
  + JVET-M0226 “CE2: Reducing worst-case memory bandwidth of affine mode (test 2.4.1)”, Y.-W. Chen, X. Wang (Kwai Inc.)
  + JVET-M0309 “CE2: Memory bandwidth reduction for affine mode (test 2.4.2)”, J. Li, R.-L. Liao, C. S. Lim (Panasonic)
  + JVET-M0311 “CE2-related: Memory bandwidth reduction for affine mode with less dependency”, J. Li, R.-L. Liao, C. S. Lim (Panasonic)
  + JVET-M0400, “CE2-related: Worst-case memory bandwidth reduction for VVC”, W.-J. Chien, L. Pham Van, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)
  + JVET-M0472 “CE2: Affine sub-block size restrictions (Test 2.4.4)”, H. Chen, T. Solovyev, H. Yang, J. Chen (Huawei)
  + JVET-M0488 “CE2: Sub-block MV clip in affine prediction (test 2.4.5)”, M Gao, X Li, M Xu, S Liu(Tencent)
  + JVET-M0702 “CE2-related: Adaptive sub-block MV clip for affine blocks”, X. Li, M. Gao, S. Liu (Tencent)
* CE4.5 (block size restriction) and related contributions
  + JVET-M0313 “CE4: Motion compensation constraints for complexity reduction (test 4.5.1 and test 4.5.2)”, R.-L. Liao, J. Li, C. S. Lim (Panasonic)
  + JVET-M0348 “CE4-related: Further reducing VVC memory bandwidth worst case by combining 4x4/4x8/8x4 bi-prediction with AMVR”, X.W. Meng (Peking University), X. Zheng (DJI), S.S. Wang, S.W. Ma
* Others
  + JVET-M0357 “CE10-related: Reduction of the worst-case memory bandwidth and operation number of OBMC”, Y. Kidani, K. Kawamura, K. Unno, S. Naito (KDDI)

The AHG recommended to review the related contributions.

[JVET-M0006](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5276) JVET AHG Report: 360 video conversion software development (AHG6) [Y. He, K. Choi]

The document summarizes activities on 360-degree video content conversion software development between the 12th (3 – 12 Oct. 2018) and the 13th (9 – 18 Jan. 2019) JVET meetings.

Brief summary for the activities:

The 360Lib-8.0 software package included following changes:

* Projection format conversion:
  + Chroma sample location type support (JVET-L0238).
* Configurations:
  + Added chroma sample location type for the output in the encoding parameter settings.

Software:

* Fixed the compilation error reported by ticket #118 to support GCC 8.2.1.

360Lib-8.0 related release:

* 360Lib-8.0rc1 with support of VTM-3.0rc1 was released on Nov. 16, 2018;
* 360Lib-8.0 with support of VTM-3.0 was released on Nov. 22, 2018;

The 360Lib software is developed using a Subversion repository located at:

https://jvet.hhi.fraunhofer.de/svn/svn\_360Lib/

The released version of 360Lib-8.0 can be found at:

https://jvet.hhi.fraunhofer.de/svn/svn\_360Lib/tags/360Lib-8.0/

360Lib-8.0 testing results can be found at:

ftp.ient.rwth-aachen.de/testresults/360Lib-8.0

360Lib bug tracker

https://hevc.hhi.fraunhofer.de/trac/jem/newticket?component=360Lib

The first table below is for the projection formats comparison using VTM-3.0 according to 360o video CTC (JVET-L1012). It compares padded hybrid equi-angular cubemap (PHEC) coding and padded equi-rectangular projection (PERP) coding using VTM-3.0.

**Table 1. VTM-3.0 PHEC vs PERP (VTM-3.0 PERP as anchor)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **PHEC over PERP (VTM-3.0)** | | | | | |
|  | **End-to-end WS-PSNR** | | | **End-to-end S-PSNR-NN** | | |
|  | Y | U | V | Y | U | V |
| Class S1 | -11.14% | -8.48% | -8.95% | -11.06% | -8.40% | -8.90% |
| Class S2 | -4.99% | -5.50% | -5.75% | -4.97% | -5.40% | -5.67% |
| **Overall** | -8.68% | -7.29% | -7.67% | -8.62% | -7.20% | -7.61% |

The second table below is for PERP comparison between these two codecs. Table 3 is to compare VTM-3.0 with PHEC coding and HM-16.16 with CMP coding.

**Table 2. VTM-3.0 PERP vs HM-16.16 PERP (HM-16.16 PERP as anchor)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VTM-3.0 PERP - Over HM-16.16 PERP** | | | | | |
|  | **End-to-end WS-PSNR** | | | **End-to-end S-PSNR-NN** | | |
|  | Y | U | V | Y | U | V |
| Class S1 | -21.25% | -40.15% | -40.88% | -21.24% | -40.15% | -40.82% |
| Class S2 | -29.62% | -44.01% | -44.94% | -29.61% | -44.03% | -44.97% |
| **Overall** | -24.60% | -41.69% | -42.50% | -24.59% | -41.70% | -42.48% |

The following table is to compare VTM-3.0 with PHEC coding and HM-16.16 with CMP coding.

**Table 3. VTM-3.0 PHEC vs HM-16.16 CMP (HM-16.16 CMP as anchor)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **VTM-3.0 PHEC - Over HM-16.16 CMP** | | | | | |
|  | **End-to-end WS-PSNR** | | | **End-to-end S-PSNR-NN** | | |
|  | Y | U | V | Y | U | V |
| Class S1 | -25.82% | -41.35% | -41.88% | -25.71% | -41.32% | -41.84% |
| Class S2 | -32.70% | -47.14% | -48.10% | -32.69% | -47.13% | -48.11% |
| **Overall** | -28.57% | -43.66% | -44.37% | -28.50% | -43.65% | -44.35% |

The AHG recommended to continue software development of the 360Lib software package, to generate CTC VTM anchors according to the 360° video CTC, and to finalize the reporting template for the common test conditions.

[JVET-M0007](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5553) JVET AHG report: Coding of HDR/WCG material (AHG7) [A. Segall, E. François, D. Rusanovskyy]

This document summarizes the activity of AHG7: Coding of HDR/WCG Material between the 12th meeting in Macao, CN (3–12 October 2018) and the 13th meeting in Marrakech, MA (9–18 January 2019).

The AHG used the main JVET reflector, jvet@lists.rwth-aachen.de, with an [AHG7] indication on message headers. The primary activity of the AhG was related to the mandates of arranging for a demonstration event for viewing JVET-L0205 and JVET-L0245 and maintaining test content. This work is described in the following subsection.

Demonstration Event

In the previous AHG study (as well as the previous JVET meeting), it was determined that it was unlikely that HDR viewing equipment would be present at the Marrakech meeting due to meeting logistics. In response to that, some HDR proponents proposed to have a demonstration event during the recent AHG period. The goal of the demonstration event was to facilitate the viewing of JVET-L-0205 and JVET-L0245.

During the AHG study period, several companies and locations were contacted to schedule such an event. However, all contacts reported scheduling issues due to year-end HDR movie title releases as well as industry preparation for the Consumer Electronics Show (CES). Because of these scheduling issues, no event was held.

It was observed that the situation continues to enforce the importance of HDR content in current, consumer entertainment and consumer electronic industries.

Maintaining Test Content

During the recent meetings, it has been determined that there are some inconsistencies in how the copyright statements are managed within the HDR test sequences. For example, some sequences contain the copyright statement as a text file, while other sequences include the copyright sequences in the last frame of the sequence. During the AHG period, there was an effort to clean up and unify the copyright handling, with emphasis on the HLG content. While this did not affect the content of any sequence, it did result in changing the md5sums for the sequences (in cases that had copyright frames). These changes were also reflected in the CTCs.

There were 6 contributions identified as related to HDR video coding:

* JVET-M0032 CE12: Summary report on mapping functions [E. Francois, P. Yin]
* JVET-M0109 CE12-related: block-based in-loop reshaping [E. Francois, C. Chevance, F. Hiron (Technicolor)]
* JVET-M0427 CE12: Mapping functions (test CE12-1 and CE12-2) [T. Lu, F. Pu, P. Yin, W. Husak, S. McCarthy, T. Chen (Dolby)]
* JVET-M0580 Crosscheck of JVET-M0109 (CE12-related: block-based in-loop luma reshaping) [T. Lu, P. Yin (Dolby)]
* JVET-M0640 CE12-related: in-loop reshaping with approximate inverse mapping function [E. Francois (Technicolor)]
* JVET-M0703 Crosscheck of JVET-M0640 (CE12-related: in-loop luma reshaping with approximate inverse mapping function) [T. Lu, P. Yin]

The AHG recommended to review the related input contributions and discuss whether a demonstration and/or viewing event should be performed prior to (or at the) 14th JVET meeting.

[JVET-M0008](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5543) JVET AHG report: 360° video coding tools and test conditions (AHG8) [J. Boyce, K. Choi, P. Hanhart, J.-L. Lin]

This document summarizes the activity of AHG8: 360º video coding tools and test conditions between the between the 12th meeting in Macao, CN (3–12 October 2018) and the 13th meeting in Marrakesh, MA (9–18 January 2019).

There was no AHG email activity on the main jvet reflector, jvet@lists.rwth-aachen.de, with an [AHG8] indication on message headers.

There were five non-CE related input documents identified (three contributions and one cross-check) related to 360º video coding, which are listed below. In addition, CE13 on projection formats is related to 360º video coding, and has ten input documents, which will be described in the CE report in JVET-M0033. There are four additional CE13-related input documents (three contributions and one cross-check) listed below.

360 video contributions not related to CE13

JVET-M0225

AHG8: On wrap around motion compensation [B. Choi, W. Feng, S. Liu (Tencent)

JVET-M0368

AHG8: 360Lib support for chroma sample location in PHEC blending process [C.-H. Shih, Y.-H. Lee, J.-L. Lin, Y.-C. Chang, C.-C. Ju (MediaTek)

JVET-M0452

AHG8: Hemisphere cubemap projection format [J. Boyce, M. Dmytrychenko (Intel)

Crosschecks of 360 video contributions not related to CE13

JVET-M0644

Crosscheck of JVET-M0368 (AHG8: 360Lib support for chroma sample location in PHEC blending process) [P. Hanhart (InterDigital)

CE13-related contributions

JVET-M0322

CE13-related: In-loop filters disabled across face discontinuities on PHEC with 2-pixel padding [Yule Sun, Xuchang Huangfu, Lu Yu (Zhejiang Univ.)

JVET-M0323

CE13-related: Adaptive QP to improve subjective quality for PHEC [Yule Sun, Xuchang Huangfu, Lu Yu (Zhejiang Univ.)

JVET-M0534

CE13-related: HEC with Pre-rotation + Adaptive Frame Packing(Test 4.2.a+4.1) [C. Pujara, A. Konda, A. Singh, R. Gadde, W. Choi, K. Choi, K.P. Choi(Samsung)

JVET-M0547

360° coding tools using uncoded areas [J. Sauer, M. Bläser

Crosschecks of 360 video contributions not related to CE13

JVET-M0645

Crosscheck of JVET-M0534 (CE13-related: HEC with Pre-rotation + Adaptive Frame Packing(Test 4.2.a+4.1)) [P. Hanhart (InterDigital)

Recommendations

The AHG recommends the following:

Review input contributions

Conduct informal subjective viewing of contributions

Review common test conditions for 360° video, including objective metrics and viewports

Review 360° video test material, and consider adding or replacing test sequences for common test conditions

[JVET-M0009](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5526) JVET AHG report: Neural Networks in Video Coding (AHG9) [S. Liu, B. Choi, K. Kawamura, Y. Li, L. Wang, P. Wu, H. Yang]

[add notes]

[JVET-M0010](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5567) JVET AHG report: Encoding algorithm optimizations (AHG10) [A.M. Tourapis, A. Duenas, C. Helmrich, S. Ikonin, A. Norkin, R. Sjöberg]

[add abstract]

[JVET-M0011](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5423) JVET AHG report: Screen Content Coding (AHG11) [S. Liu, J. Boyce, A. Filippov, Y.-C. Sun, J. Xu, M. Zhou]

This document summarizes the activity of AHG11: Screen Content Coding between the 12th meeting in Macao, CN (3 – 12 Oct 2018) and the 13th meeting in Marrakech, MA (9–18 Jan. 2019).

The AHG used the main JVET reflector, jvet@lists.rwth-aachen.de, with [AHG11] in message headers. There were about a dozen emails exchanged on the JVET reflector with some discussions about testing sequences. There were also some email discussions about the interaction between CPR and inter coding tools adopted in Macao. Through the discussions, some mismatches between software VTM3 and spec VVC Draft 3 were identified. Some possible solutions are suggested in JVET-M0409. More in-depth technical discussions were carried in CE8 mailing list.

In total there are 26 CPR related technical contributions, 8 Palette related technical contributions and 7 other SCC related technical contributions identified for this meeting.

* CPR related:
  + JVET-M0151, CE8-related: Virtual search area for current picture referencing (CPR), L. Pham Van, T. Hsieh, W.-J. Chien, V. Seregin, H. Wang, M. Karczewicz (Qualcomm)
  + JVET-M0174, CE8-related: Removal of subblock-based chroma MC in CPR, C.-Y. Lai, T.-D. Chuang, Y.-L. Hsiao, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)
  + JVET-M0175, CE8-related: Clarification on interaction between CPR and other inter coding tools, C.-Y. Lai, T.-D. Chuang, Y.-L. Hsiao, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)
  + JVET-M0254, Non-CE8: Subblock Operation Removal for Chroma CPR, J. Xu, K. Zhang, L. Zhang, H. Liu, Y. Wang, P. Zhao, D. Hong (Bytedance)
  + JVET-M0325, CE8-related: CPR with previous CTU availability at frame and tile edge, C. Rosewarne, A. Dorrell (Canon)
  + JVET-M0326, CE8-related: Remove the redundancy of CPR-related syntax coding, S. Ye, F. Chen, L. Wang (Hikvision)
  + JVET-M0327, CE8-related: A new CPR syntax scheme, S. Ye, F. Chen, L. Wang (Hikvision)
  + JVET-M0332, CE8: Block vector prediction for CPR (test 8.1.1a and test 8.1.1b), J. Nam, J. Lim, S. Kim (LGE)
  + JVET-M0333, Non-CE8: Coding on block vector difference, J. Nam, J. Lim, S. Kim (LGE)
  + JVET-M0334, Non-CE8: Removal of redundant syntax between CPR and other inter coding tools, J. Nam, J. Lim, S. Kim (LGE)
  + JVET-M0335, Non-CE8: modification on SbTMVP process regarding with CPR, H.Jang, J.Nam, S.Kim, J.Lim(LGE)
  + JVET-M0336, Non-CE11: Considering boundary strength on CPR coded block boundary, H.Jang, J.Nam, S.Kim, J.Lim(LGE)
  + JVET-M0341, Non-CE8: MMVD harmonization with CPR, H.Jang, J.Nam, S.Kim, J.Lim(LGE)
  + JVET-M0393, Non-CE8: chroma block vector initialization for CPR in dual tree, T. Poirier, F. Le Léannec, F. Galpin (Technicolor)
  + JVET-M0402, Non-CE8: Proposed Cleanup for Current Picture Referencing, B. Heng, M. Zhou, W. Wan (Broadcom)
  + JVET-M0407, CE8: CPR reference memory reuse without increasing memory requirement (CE8.1.2a and CE8.1.2d), X. Xu, X. Li, S. Liu (Tencent), E. Chai (Ubilinx)
  + JVET-M0408, CE8: CPR reference memory reuse with reduced memory requirement (CE8.1.2b and CE8.1.2c), X. Xu, X. Li, S. Liu (Tencent), E. Chai (Ubilinx)
  + JVET-M0409, Non-CE8: Mismatch between text specification and reference software on ATMVP candidate derivation when CPR is enabled, X. Xu, X. Li, S. Liu (Tencent), W.-J. Chien, M. Karczewicz (Qualcomm)
  + JVET-M0410, Non-CE8: CPR flag signaling at slice level, X. Xu, X. Li, S. Liu (Tencent)
  + JVET-M0411, Non-CE8: Inter mode related flag signaling when current picture is the only reference picture, X. Xu, X. Li, S. Liu (Tencent)
  + JVET-M0418, CE8-related: Context modeling on pred\_mode\_flag when current picture is the only reference picture (CPR), Yu-Chen Sun, Jian Lou (Alibaba)
  + JVET-M0474, CE8.1.3: Extended CPR reference with 1 buffer line, L. Pham Van, V. Seregin, W.-J. Chien, T. Hsieh, M. Karczewicz (Qualcomm)
  + JVET-M0483, CE8-related: CPR mode signaling and interaction with inter coding tools, W.-J. Chien, V. Seregin, M. Karczewicz (Qualcomm)
  + JVET-M0541, Non-CE8: Combination of MMVD and CPR mode, Y. Li, Z. Chen (Wuhan Univ.), X. Xu, S. Liu (Tencent)
  + JVET-M0542, Non-CE8: Combination of Multi Hypothesis Intra and CPR mode, Y. Li, Z. Chen (Wuhan Univ.), X. Xu, S. Liu (Tencent)
  + JVET-M0544, Non-CE8: CPR with chroma 4x4 sub-block size when dual-tree is on, X. Xu, X. Li, S. Liu (Tencent)
* Palette related:
  + JVET-M0050, Palette Mode in HEVC (test 8.2.1), Yu-Chen Sun, Jian Lou (Alibaba), Yung-Hsuan Chao, Hongtao Wang, Vadim Seregin, Marta Karczewicz (Qualcomm)
  + JVET-M0051, CE8: Palette Mode and Intra Mode Combination (test 8.2.2), Yu-Chen Sun, Jian Lou (Alibaba)
  + JVET-M0052, CE8: Separate Palette Coding for Luma and Chroma (test 8.2.5), Yu-Chen Sun, Jian Lou (Alibaba), Yung-Hsuan Chao, Hongtao Wang, Vadim Seregin, Marta Karczewicz (Qualcomm), Roman Chernyak, Sergey Ikonin, Jianle Chen (Huawei)
  + JVET-M0417, CE8-related: Combination test of CE8.2.2 and CE8.2.5, Yu-Chen Sun, Jian Lou (Alibaba)
  + JVET-M0419, CE8-related: Context modeling on palette mode flag, Yu-Chen Sun, Jian Lou (Alibaba)
  + JVET-M0455, CE8: Palette index map scan order constraints (Test 8.2.3), J. Ye, X. Xu, M. Xu, X. Li, S. Liu (Tencent)
  + JVET-M0456, CE8: palette mode when dual-tree is enabled (Test 8.2.4), J. Ye, X. Xu, X. Li, S. Liu (Tencent)
  + JVET-M0457, CE8: Palette predictor list enhancement (Test 8.2.6), J. Ye, X. Xu, M. Xu, X. Li, S. Liu (Tencent)
* Other:
  + JVET-M0056, CE8: BDPCM with LOCO-I and independently decodable areas (test 8.3.1a), F. Henry, A. Mohsen (Orange), P. Philippe, G. Clare (bcom)
  + JVET-M0057, CE8: BDPCM with horizontal/vertical predictor and independently decodable areas (test 8.3.1b), F. Henry, M. Abdoli (Orange), P. Philippe, G. Clare (bcom)
  + JVET-M0058, CE8: BDPCM with modified binarization (test 8.3.2), F. Henry, M. Abdoli (Orange), G. Clare, P. Philippe (bcom)
  + JVET-M0253, Non-CE8: Hash-based Motion Search, J. Xu, J. Li, K. Zhang, L. Zhang (Bytedance), R. Xiong (Peking University)
  + JVET-M0365, Non-CE3: modified PDPC for horizontal and vertical modes, A. Filippov, V. Rufitskiy, J. Chen (Huawei)
  + JVET-M0449, CE8-related: BDPCM entropy coding with reduced number of context coded bins, M. Xu, X. Li, X. Xu, M. Gao, S. Liu (Tencent)
  + JVET-M0464, Non-CE8: Unified Transform Type Signalling and Residual Coding for Transform Skip, B. Bross, T. Nguyen, P. Keydel, H. Schwarz, D. Marpe, T. Wiegand (HHI)

The AHG recommended to review all related contributions, to continue investigating SCC coding tool performance, complexity and interactions between themselves and with other coding tools, and to continue evaluating new and modified test materials and consider including some of them in class F

See the notes for AHG3 relating to a desire to improve the SCC test sequences.

[JVET-M0012](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5405) JVET AHG report: High-level parallelism and coded picture regions (AHG12) [T. Ikai, M. M. Hannuksela, R. Sjöberg, R. Skupin, W. Wan, Y.-K. Wang, S. Wenger]

The document summarizes activities of AHG on High-level parallelism and coded picture regions between the 12th and the 13th JVET meetings.

Related contributions to this meeting were categorized as follows:

* Flexible size tiles
  + JVET-M0066 AHG12: Flexible Tile Partitioning, Y. Yasugi, T. Ikai (Sharp)
  + JVET-M0423 Cross-check of JVET-M0066: AHG12: Flexible Tile Partitioning, A. Wieckowski (HHI)
  + JVET-M0376 AHG12: On signalling of flexible tiles, M. Damghanian, R.Sjöberg, M. Pettersson (Ericsson)
  + JVET-M0459 AHG12: On tiles with partial CTUs, R. Skupin, K. Suehring, Y. Sanchez, T. Schierl (HHI)
  + JVET-M0527 AHG12: Comments on Tiles and Flexible Tile Partitioning, W. Wan, M. Zhou, T. Hellman, B. Heng, P. Chen (Broadcom)
  + JVET-M0530 is also related to the flexible tile size.
* Tile partitioning and signaling (extraction also related)
  + JVET-M0121 AHG12: On Rectangular Tile Group, Y. He, A. Hamza (InterDigital)
  + JVET-M0123 AHG12: On hierarchical tile design, Y. He, A. Hamza (InterDigital)
  + JVET-M0129 AHG12: On flexible tiling, Y.-K. Wang, Hendry, M. Sychev (Huawei)
  + JVET-M0130 AHG12: On tile grouping, Y.-K. Wang, Hendry, J. Chen, M. Sychev (Huawei)
  + JVET-M0134 AHG12: On explicit signalling of tile IDs, Hendry, Y.-K. Wang, J. Chen, M. Sychev (Huawei)
  + JVET-M0137 AHG12: On tile configuration signaling, M. Sychev, Hendry, Y.-K. Wang (Huawei)
  + JVET-M0160 AHG17: Flexible tile grouping for VVC, L. Chen, T.-D. Chuang, Y.-W. Huang, S.-M. Lei (MediaTek)
  + JVET-M0261 AHG12: On grouping of tiles, M. M. Hannuksela, A. Aminlou (Nokia)
  + JVET-M0373 AHG12: Merge friendly tile group address signaling, R.Sjöberg, M. Damghanian, M. Pettersson (Ericsson)
  + JVET-M0374 AHG12: Flexible tiles to support MCTS use cases, R.Sjöberg, M. Damghanian, M. Pettersson (Ericsson)
  + JVET-M0375 AHG12: On uniform tile spacing, M. Damghanian, R.Sjöberg, M. Pettersson (Ericsson)
  + JVET-M0388 AHG12/AHG17: On merging of MCTSs for viewport-dependent streaming. M. M. Hannuksela (Nokia)
  + JVET-M0416 AHG12: On Tile Information Signalling, S. Deshpande (Sharp)
  + JVET-M0430 AHG12: On Tiles and Tile Groups for VVC, R. Skupin, K. Suehring, Y. Sanchez, T. Schierl (HHI)
  + JVET-M0530 AHG12: On signalling of tiles, M. Coban, M. Karczewicz (Qualcomm)
* Motion constraint tile (inter) and high level signalling
  + // MCTS
    - JVET-M0136 AHG12: Treating tile and tile group boundaries as picture boundaries, J. Chen, Y.-K. Wang, Hendry, M. Sychev (Huawei)
    - JVET-M0445 AHG12: On motion constrained tiles for VVC, R. Skupin, V. George, K. Suehring, Y. Sanchez, T. Schierl (HHI)
  + // Nal unit level signalling
    - JVET-M0155 AHG12: On tile group identification for VVC, B. Choi, S. Wenger, S. Liu (Tencent)
    - JVET-M0536 AHG12: On picture-level tiles and sequence-level tiles for VVC, E. Thomas, A. Gabriel (TNO)
* Wrap around tile (intra)
  + JVET-M0209 AHG12: On tile group configuration, W. Choi, K. Choi, K. Choi (Samsung)
* Specific tool changes for tile
  + JVET-M0300 CE4-related: HMVP and parallel processing with tiles and tile groups, A. M. Kotra, J. Chen, B. Wang, S. Esenlik, H. Gao (Huawei)
  + JVET-M0325 CE8-related: CPR with previous CTU availability at frame and tile edge, C. Rosewarne, A. Dorrell (Canon)
* WPP related
  + JVET-M0070 AHG12: Wavefront processing in a tile group, T. Ikai, S. Deshpande, T. Chujoh, E. Sasaki, T. Aono (Sharp)
  + JVET-M0071 AHG12: Improved parallel processing capability with WPP, Y. Fujimoto, M. Ikeda, T. Suzuki (Sony)
  + JVET-M0593 Crosscheck of JVET-M0071 (AHG12: Improved parallel processing capability with WPP), Y. Yasugi, T. Ikai (Sharp)

The AHG recommended to review the related contributions.

[JVET-M0013](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5554) JVET AHG report: Tool reporting procedure (AHG13) [W.-J. Chien, J. Boyce, R. Chernyak, R. Hashimoto, Y.-W. Huang, S. Liu, D. Luo]

This document summarizes the activity of AHG13: “Tool reporting procedure” between the 12th Meeting in Macao, CN (3–12 Oct. 2018) and the 13th meeting in Marrakech, MA (9–18 Jan. 2019). Tool on/off experimental results vs. VTM anchor are provided for the tools specified in JVET-L1005.

The initial version of JVET-L1005 “Methodology and reporting template for tool testing” was provided on Oct 27th. The document contained a reporting template.

All tests described in JVET-L1005 were conducted, except 67IPM and PDPC. VTM tool tests were conducted on VTM-3.0 software with VTM configuration by switching off specific tool either in configuration files or macros. Tool tests of 67IPM and PDPC were not conducted because there was no associated configuration setting nor associated macros in VTM-3.0 in order to disable the coding tools.

The tested tools, testers, and cross-checkers are listed in the tables below.

[add notes]

For two topics, testing was not performed because this part of the design could not be disabled in the software:

* 67 intra prediction mode +6 MPM intra mode coding + Wide angle intra prediction
* Position dependent prediction combination

It was remarked that decisions need to be made regarding which features can be disabled, and it is difficult to measure the benefit for a feature if it cannot be turned off. See also the AHG15 report on this topic.

[Integrate glossary terms]

[JVET-M0014](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5545) JVET AHG report: Progressive intra refresh (AHG14) [J.-M. Thiesse, A. Duenas, K. Kazui, A. Tourapis]

This document summarizes activities of AhG on progressive intra refresh between the 12th and 13th JVET meetings.

An AHG14 kick-off email was sent on 17 December 2018.

A Gitlab repository had been setup for the AHG participants (https://vcgit.hhi.fraunhofer.de/jvet-l-ahg-14/VVCSoftware\_VTM). The software based on VTM 3.0 with changes proposed in contributions JVET-M0197 and JVET-M0387 was shared in respective branches for review by participants.

Relevant contributions to this meeting were as follows:

* JVET-M0197 “AHG14: Software for ultra low-latency encoding“, K. Kazui (Fujitsu).
* JVET-M0387 “AHG14: Updates on Intra Refresh Proposal”, J.-M. Thiesse, D. Gommelet, D. Nicholson (Vitec).
* JVET-M0529 “AHG14: Normative Recovery Point Indication”, M. Pettersson, R. Sjöberg, M. Damghanian (Ericsson).

The AhG recommended:

* To review all related contributions.
* To combine all proposed software modifications in an AHG software (Gitlab branch).
* To agree on common test conditions for progressive intra refresh.
* To integrate the encoder-only modifications on next VTM.

[JVET-M0015](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5544) JVET AHG report: Bitstream decoding properties signalling (AHG15) [J. Boyce, J. Chen, S. Deshpande, M. Karczewicz, A. Tourapis, Y.-K. Wang, S. Wenger]

[deferred]

[JVET-M0016](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5209) JVET AHG report: Implementation studies (AHG16) [M. Zhou, J. An, E. Chai, K. Choi, S. Sethuraman, T. Hsieh, X. Xiu]

This document summarizes the activity of AHG16: implementation studies, between the 12th JVET meeting in Macao, CN (3-12 October 2018) and the 13th JVET meeting in Marrakesh, MA (9–18 January 2019).

There were not many email exchanges on the main JVET email reflector (jvet@lists.rwth-aachen.de) with an [AHG16] indication on message headers. A summary of the AHG activities is provided as follows:

Feedback provided during the finalization of CE descriptions:

* Multiple hypothesis inter prediction (MHIP): It was suggested to test coding efficiency impact after the line buffer for motion vectors of the additional hypotheses is removed and the total number of distinct reference frames is constrained to 2 for the hypotheses. This is captured in the CE10 description.
* Decoder-side motion vector refinement (DMVR): It was suggested to take the following elements as the baseline DMVR algorithm, i.e.
  + Block sizes for DMVR W\*H=64 && H>=8 && W\*H<=1024
  + Reference block size (w+7)\*(h+7) (for luma)
  + Integer DMVR
  + MV mirroring between list0 and list1 to allow bilateral matching
  + 25 points SAD-based integer-pel search (i.e. (+-) 2 refinement search range)
  + “Parametric error surface equation” based sub-pel refinement
  + Refined MVs used for MC only
  + Luma/chroma MC w/ reference block padding (if needed)

Additional tests were recommended to quantify the benefits of the following DMVR elements in the context of VTM3.0:

* + Mean removed SAD (MRSAD)
  + Bilateral interpolation
  + Use of the refined MVs from the top neighboring CTUs for merging/AMVP/TMVPs/de blocking
  + and splitting a large block to multiple of 16x16 sub-blocks for the DMVR
  + The suggestion above is integrated into in the CE9 description.
* Bi-directional optical flow (BDOF aka. BIO): It was commented that it is desirable to avoid the processing irregularity in the extended area during the prediction block generation for the BIO. In the current design the bilinear filters are used in the extended area. If the 8-tap MC filters are consistently used for the prediction block generation including the extended area, the reference block padding should be used to avoid memory bandwidth increase. Such a test is already planned in CE9.
* Overlapped motion compensation (OBMC): It was suggested to test OBMC when current block is uni-prediction and the neighboring blocks only use uni-prediction to generate OBMC region. When testing sub-block OBMC combined with affine mode, it is suggested to only do blending for top one line and left one column without doing blending for right column and bottom line. Such tests are planned in CE10.
* Current picture referencing (CPR, aka. IBC): It was commented that sharing the line buffer in the de-blocking filter for IBC will likely lead to the local memory increase (to avoid memory access conflicts between the de-blocking and the IBC). This is generally agreed and reflected in the final CE8 description.
* Planar motion vector prediction (PMVP): It was commented that using 8x8 sub-block size (or 8x8 for bi-pred and 8x4/4x8 for uni-pred) is most relevant for the CE tests. It is also desirable to avoid further stressing the merging list derivation process and signal the PMVP mode separately (as opposed to signaling it as an additional merging candidate. This comment might be valid for the regression based motion vector field (RMVF) too). Such tests are planned in CE2.

Other general comments

* Flexible tiling has a profound impact on block-level decoder implementation and should be carefully studied. Potential implications include the increased VDPU processing rate, the increased memory bandwidth if tiling is not VDPU aligned vertically, the increased buffering for frame compression, for in-loop filters and for TMVP storage, and the increased VDPU memory addressing overhead.
* (Affine) merging/AMVP list derivation is a block by block sequential operation within a CTU. Throughput study is needed to make sure that the current VTM3.0 design meets the throughput requirement (e.g. cycle budget of ~50 cycles per 8x8 block for 4K@60 at ~400 MHz clock rate).
* Separate luma/chroma partitioning tree introduces a long latency for chroma intra prediction when the CCLM is on. In the worst case, the chroma intra prediction cannot be kicked off until the whole 64x64 luma block is reconstructed (e.g. when a 64x64 luma block is split horizontally while the chroma blocks are split vertically, and vice versa). Suggest quantifying the gain of separate tree on the top of CCLM to see whether the CCLM and the separate tree can be made mutually exclusive.
* 2x2 Chroma intra-prediction itself is a serious concern from the throughput and processing overhead point of view, given the fact that the CCLM made the luma/chroma intra-prediction sequential, the luma intra prediction has been made more complicated (e.g. 4-tap interpolation filters, PDPC), and the combined intra/inter prediction was already adopted into the intra prediction/reconstruction critical path. It is helpful to test whether the CCLM can be disabled for 4x4 PUs.
* New tools such as diffusion filters, local illumination compensation (LIC), Hadamard transform domain/bilateral filtering of reconstructed blocks, and combined intra/inter prediction are all in the critical path of the intra prediction/reconstruction loop. Given the CCLM, PDPC and combined intra/inter prediction that are already adopted, the additional tools that could be absorbed into this loop is likely very limited from the throughput point of view. Therefore, the benefits of those tools should be carefully studied against each other.
* Line buffer removal from the Adaptive Loop Filter (ALF) is a significant cost reduction which should be pursued.
* The current design of the Bi-directional optical flow (BDOF aka. BIO) prohibits the 64x64 based decoder pipeline due to the early termination which requires a SAD computation up to 128x128 block size.
* 32x32/32x16/16x32 DST7/DCT8 based transform units are the bottleneck for the implementation of primary transforms.
* Transform coefficients “Zero out” of large TUs (e.g. 64x64/32x64/64x32) should be enforced at the syntax-level to avoid unnecessary CABAC context storage on the decoder side.
* Combination of Current Picture Referencing (CPR, aka. IBC) with other tools requires careful thinking. CPR combinations with triangle prediction, bi-prediction, weighted prediction, GBI prediction, BDOF and OBMC will require replication of those motion compensation logics into the intra prediction/reconstruction block. Moreover, using other tools (e.g. MMVD) to signal a CPR vector or using the CPR vectors as neighboring spatial and/or temporal candidates may further complicate the logic of the (affine) merging/AMVP list derivations due to additional CPR-related checks.

Broadcom conducted a memory bandwidth study on multiple hypothesis inter prediction by running both the CE software provided by HHI and the VTM3.0 with a commercial motion compensation cache model integrated. The summary results of the random access configuration are provided in the Table 1 and Table 2 (for informational purposes).

The following contributions were identified for the AHG.

* JVET-M0527, “AHG12: Comments on Tiles and Flexible Tile Partitioning”, W. Wan, M. Zhou, T. Hellman, B. Heng, P. Chen (Broadcom)
  + Elaborated the potential implications of the flexible tiling on decoder designs.
* Contributions aiming for addressing the 64x64 decoder pipeline issue of the BDOF (aka. BIO)
  + JVET-M0284, “CE9-related: BDOF Modifications to Enable 64x64 VPDU”, H. Chen, X. Ma, S. Esenlik, H. Yang, J. Chen (Huawei)
  + JVET-M0073, “Non-CE9: On early termination for BIO”, K. Kondo, M. Ikeda, T. Suzuki (Sony)
  + JVET-M0249”, Non-CE9: Modifications on Bi-Directional Optical Flow”, H. Liu, L. Zhang, K. Zhang, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)
* Contributions relating to ALF line buffer reduction
  + JVET-M0164, “Adaptive loop filter with virtual boundary processing”, C.-Y. Chen, T.-D. Chuang, Z.-Y. Lin, C.-Y. Lai, Y.-W. Huang, S.-M. Lei (MediaTek)
  + JVET-M0301, “Non-CE: Loop filter line buffer reduction”, A.M. Kotra, S. Esenlik, B. Wang, H. Gao, J. Chen (Huawei)
* Contributions aiming to prohibit the transform coefficients from being transmitted in the “zero-out” regions of 64x64/64x32/32x64 transform units at syntax level
  + JVET-M0250, “Non-CE7: Simplified CSBF coding for large block-size transforms”, J. Choi, J. Heo, S. Yoo, J. Choi, L. Li, J. Lim, S. Kim (LGE)
  + JVET-M0257, “CE7-related: coefficient scanning and last position coding for TUs of greater than 32 width or height”, M. Coban, M. Karczewicz (Qualcomm)
* Contributions relating to CPR vector usage and CPR combination with other tools
  + JVET-M0402, “Non-CE8: Comments on Current Picture Referencing”, B. Heng, M.Zhou, W.Wan (Broadcom)
  + JVET-M0175, “CE8-related: Clarification on interaction between CPR and other inter coding tools”, C.-Y. Lai, T.-D. Chuang, Y.-L. Hsiao, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)
  + JVET-M0483, “CE8-related: CPR mode signaling and interaction with inter coding tools”, W.-J. Chien, V. Seregin, M. Karczewicz (Qualcomm)
* JVET-M0046, “CE6-related: A study of primary transforms”, M. Zhou, Y. Hu (Broadcom)
  + Identified the 32-point DST7/DCT8 as the bottleneck for the implementation of primary transforms and recommended a “zero-out” solution.
* JVET-M0245 , “AHG16-related: Chroma block coding and size restriction”, C. Rosewarne, A. Dorrell (Canon)
  + JVET-M0065 Non-CE: Intra chroma partitioning and prediction restriction [Add authors]
  + Removal of 2x2/2x4/4x2 block sizes from the chroma intra prediction (for the separate tree case only)
* JVET-M0248, “AHG16: Motion compensation with padded samples for small coding units”, H. Liu, J. Chon, H.-C. Chuang, L. Zhang, K. Zhang, J. Xu (Bytedance)
  + Memory bandwidth reduction for motion compensation of small size PUs.
  + There are many other contributions in this category.
* JVET-M0265, “AHG16: Clean-up on MV Rounding”, K. Zhang, L. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong(Bytedance)
  + Improves design consistency of the MV rounding.

The AHG recommended reviewing the input contributions.

[JVET-M0017](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5394) JVET AHG report: High-level syntax (AHG17) [R. Sjöberg, S. Deshpande, M. M. Hannuksela, R. Skupin, Y.-K. Wang, S. Wenger]

This document summarizes the activities of the AHG on High-level syntax (HLS) between the 12th JVET meeting in Macao, CN (3-12 Oct. 2018) and the 13th meeting in Marrakesh, MA (9-18 Jan. 2019).

No e-mail related to AHG17 was sent to the JVET reflector during the AHG period except a kick-off message.

It was reported that the amount of input contributions related to the mandates of this AHG has increased from 8 in Macau to 22 for this meeting. For the wider category of high-level syntax contributions including AHG12, AHG14, AHG15 and AHG17, the number of input contributions is reported to have increased from 28 in Macau to 50 for this meeting. Note that the count differs from the JVET-M\_Notes\_d0.docx categorization in which 49 documents are allocated to section 6.19 “High-level syntax”.

It is reported that of the 12 JCT-VC meetings where the first version of HEVC was developed, the first 6 meetings had fewer high-level syntax contributions than this JVET meeting and the last 6 had a higher number with a peak of 96 of high-level syntax contributions at the 11th meeting in Stockholm 2012.

The number of documents in the high-level syntax category has increased from 8 to 50 in two meeting cycles.

22 of the input documents registered by January 7 were identified as related to the mandates of this AHG.

* JVET-M0101 AHG17: On VVC HLS [R. Skupin, K. Suehring, Y. Sanchez (HHI),M. M. Hannuksela, K. Kammachi-Sreedhar (Nokia), Y.-K. Wang,Hendry (Huawei), S. Wenger, B. Choi (Tencent),S. Deshpande (Sharp)
* JVET-M0120 AHG17: Proposed NAL Unit Header Design Principles [S. Wenger,B. Choi,S. Liu (Tencent)
* JVET-M0128 AHG17: On reference picture management for VVC [Y.-K. Wang,Hendry (Huawei),S. Deshpande (Sharp),M. M. Hannusela (Nokia),G. Ryu,W. Choi (Samsung),X. Wang,Y.-W. Chen (Kawi),L. Zhang (Bytedance),P. Wu,M. Li (ZTE),S.-H. Kim (LG),J. Boyce (Intel),A. M. Tourapis,D. Singer (Apple),F. Edouard,P. Andrivon (Technicolor),Y.-W. Huang,C.-W. Hsu,C.-Y. Chen,T.-D. Chuang,L. Chen (MediaTek),K. Kawamura (KDDI),Y.-C. Sun,J. Lou (Alibaba)
* JVET-M0131 AHG17: On NAL unit types for IRAP pictures and leading pictures [Y.-K. Wang, Hendry (Huawei)
* JVET-M0132 AHG17: On header parameter set (HPS) [Y.-K. Wang, Hendry, J. Chen (Huawei)
* JVET-M0133 AHG17: On parsing dependency between parameter sets [Y.-K. Wang (Huawei), J. Boyce (Intel)
* JVET-M0152 AHG17: On random access point for VVC [B. Choi, S. Wenger, S. Liu (Tencent)
* JVET-M0153 AHG17: On leading picture for VVC [B. Choi, S. Wenger, S. Liu (Tencent)
* JVET-M0154 AHG17: On decoded picture buffer management for VVC [B. Choi, S. Wenger, S. Liu (Tencent)
* JVET-M0156 AHG17: On component type indication for VVC B. Choi, S. Wenger, S. Liu (Tencent)
* JVET-M0157 AHG17: On picture order count for VVC B. Choi, S. Wenger, S. Liu (Tencent)
* JVET-M0160 AHG17: Flexible tile grouping for VVC L. Chen, T.-D. Chuang, Y.-W. Huang,S.-M. Lei (MediaTek)
* JVET-M0161 AHG17: Signalling random access properties in the NAL unit header L. Chen, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)
* JVET-M0260 AHG17: Carriage of tile group header parameters in higher level structures M. M. Hannuksela (Nokia)
* JVET-M0377 AHG17: Picture header NAL unit type R. SjÃ¶berg, M. Damghanian, M. Pettersson (Ericsson)
* JVET-M0378 AHG17: RPS for VVC R. SjÃ¶berg, M. Damghanian, M. Pettersson (Ericsson)
* JVET-M0386 AHG17: On slice\_type (tile\_group\_type) K. Suehring, Y. Sanchez, R. Skupin (HHI)
* JVET-M0388 AHG12/AHG17: On merging of MCTSs for viewport-dependent streaming M. M. Hannuksela (Nokia)
* JVET-M0415 AHG17: Comments on High-Level Syntax of VVC S. Deshpande (Sharp)
* JVET-M0520 AHG17: On NAL unit header design for VVC S. Wenger, B. Choi, S. Liu
* JVET-M0537 AHG17: On signaling of tile group set with MCTS properties (NAL unit header and new parameter set) E. Thomas, A. Gabriel(TNO)
* JVET-M0579 On Frame Rate Support and Extraction in VVC A. Segall,S. Deshpande (Sharp Labs of America),M. Hannuksela (Noka)

It was noted that at some point in the HEVC development, we started having AHG pre-meetings for HLS work.

The AHG recommended reviewing the related input contributions and to continue to study VVC high-level syntax aspects.

# Project development (5)

Contributions in this category were discussed XXday XX July XXXX–XXXX (chaired by XXX).

## Text and general standard development (0)

## Software development (1)

[JVET-M0055](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4857) AHG3: VTM transcoding capabilities for bitrate matching and debugging [T. Hinz, A. Wieckowski (HHI)]

## Common test conditions (1)

[JVET-M0090](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4893) On the use of chroma QP offsets in the VVC common test conditions [C. Helmrich, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

## Coding studies on specific use cases (3)

[JVET-M0197](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5004) AHG14: Software for ultra low-latency encoding [K.Kazui (Fujitsu)]

[JVET-M0387](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5194) AHG14: Updates on Intra Refresh Proposal [J.-M. Thiesse, D. Gommelet, D. Nicholson (VITEC)] [late] [miss]

[JVET-M0466](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5275) Adaptive Streaming Test Conditions for VTM [M. Afonso, A. Norkin, A. Aaron, J. Sole, K. Swanson (Netflix), Y. Ye, W. Jiang (Alibaba), J. Kim, K. Kolarov, D. Singer, A. Tourapis (Apple)]

## Test material (0)

# Core Experiments

## CE1: Partitioning (3)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0021](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5395) CE1: Summary report on partitioning [J. Ma, F. Le Léannec, M. W. Park]

1530 Wed 9 Jan (GJS)

This document evaluates CE1: Partitioning JVET-L1021. There were two tests that were conducted by proponents and cross-checked by at least one cross-checker. There were no mismatches reported to the coordinators.

The current VTM Software has split restrictions implemented to allow 64x64 pipelining. More precisely, the concept of (square shaped) virtual pipelining data units (VPDUs) is used to allow for 64x64 pipelining inside the picture.

The software for both tests can be found here

https://vcgit.hhi.fraunhofer.de/JVET-L-CE1/VVCSoftware\_VTM.git

SubCE1.1.1

(JVET-M0446, Tencent)

Proponents study non square VPDUs to enhance RD-performance and unify with boundary partitioning of the current VTM software.

Conditions for CU\_ TRIH\_SPLIT and CU\_ TRIV\_SPLIT are changed so that, e.g. 128x32 and 32x128 block sizes are possible. Sub-partitions of such blocks are also allowed. However, 128x64 and 64x128 are not allowed to be split using a ternary split whereas 128x128 can be split using a ternary split. Results do not effect AI.

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| --- | --- | --- | --- |
| **#** | **Tester** | **Comments** | **Cross-checkers** |
| 1.1.1 | M. Xu (Tencent) | The cross-checkers (CC) generally confirm the simulation results and the matching of the implementation with the CE description. Mismatches for encoder timings were reported as follows:  LDB 110% (CC) vs 105% (proponent).  Further comment/suggestions were made by CC:   * Formulate the constraints in a more general way, e.g. instead of not allowing a ternary split for 128x64 and 64x128, the proponents can constraint the size by 2MAX\_TU\_SIZE\_FOR\_PROFILE x MAX\_TU\_SIZE\_FOR\_PROFILE * It should be considered how many extra partitions would be supported if using rectangular VPDUs mixed with squared VPDUs instead of only squared VPDUs. * More details on the latency impact of using different VPDU shapes are desired. For example, in Figure 1 two cases are compared: First: all 64x64 VPDU structures vs Second: First four 32x128 VPDUs and then four 64x64 VPDUs.  Now VPDU4 in case 1 of the figure below would have less pipeline dependency and latency issues if data from VPDU1 is used compared to case 2 of the figure below were data from VPDU3 is always used. * Interest for interactions with other tools such as CPR/WPP were expressed. | C. W. Hsu (MediaTek) |



Example for different VPDU structures. Numbers denote the processing order of VPDUs

While the cross-checker indicated that case 2 had more cases where the immediately previous decoded region was needed for prediction (e.g., intra prediction) than case 1. The proponent indicated that the worst case was the same in both cases. And if what matters is average rather than worst case, case 2 would be more rarely encountered.

It was suggested that the key test sequences for this issue are the high resolution ones, since there is generally little gain for using very large blocks with low-resolution test sequences.

The VTM uses 64x64 VPDUs (for luma). The proposal tries to get coding efficiency by allowing rectangular shapes 32x128/128x32.

In the current draft spec, these rectangular shapes are available for the edge of the picture.

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|  | **All Intra Main 10** | | | | | **Random Access Main 10** | | | | | **Low delay B Main10** | | | | |
|  | **Over VTM-3.0** | | | | | **Over VTM-3.0** | | | | | **Over VTM-3.0** | | | | |
|  | Y | U | V | EncT | DecT | Y | U | V | EncT | DecT | Y | U | V | EncT | DecT |
| Class A1 | 0.00% | 0.00% | 0.00% | 97% | 98% | -0.48% | -0.48% | -0.42% | 117% | 99% |  |  |  |  |  |
| Class A2 | 0.00% | 0.00% | 0.00% | 101% | 100% | -0.48% | -0.37% | -0.31% | 110% | 99% |  |  |  |  |  |
| Class B | 0.00% | 0.00% | 0.00% | 99% | 100% | -0.17% | -0.17% | -0.24% | 110% | 100% | -0.15% | -0.65% | -0.09% | 105% | 96% |
| Class C | 0.00% | 0.00% | 0.00% | 100% | 100% | 0.00% | 0.00% | -0.03% | 104% | 102% | -0.01% | 0.26% | 0.19% | 102% | 98% |
| Class E | 0.00% | 0.00% | 0.00% | 102% | 101% |  |  |  |  |  | -0.54% | -1.06% | -1.41% | 109% | 96% |
| **Overall** | 0.00% | 0.00% | 0.00% | 100% | 100% | -0.25% | -0.23% | -0.23% | 110% | 100% | -0.20% | -0.45% | -0.33% | 105% | 97% |
| Class D | 0.00% | 0.00% | 0.00% | 100% | 101% | 0.02% | -0.12% | -0.09% | 102% | 102% | -0.01% | 0.31% | 0.22% | 100% | 100% |
| Class F | 0.00% | 0.00% | 0.00% | 100% | 100% | -0.11% | -0.11% | -0.04% | 108% | 102% | -0.17% | -0.15% | -0.25% | 102% | 99% |

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|  | **Low delay P Main10** | | | | |
|  |  | **Over VTM-3.0** | | |  |
|  | Y | U | V | EncT | DecT |
| Class A1 |  |  |  |  |  |
| Class A2 |  |  |  |  |  |
| Class B | -0.14% | 0.00% | 0.07% | 106% | 96% |
| Class C | 0.03% | 0.14% | -0.34% | 101% | 100% |
| Class E | -0.49% | -0.87% | -0.91% | 109% | 101% |
| **Overall** | -0.17% | -0.17% | -0.31% | 105% | 99% |
| Class D | 0.01% | -0.40% | -0.36% | 101% | 101% |
| Class F | -0.07% | -0.40% | -0.72% | 102% | 101% |

The proponent highlighted the benefit of 0.5% for Class A in RA configuration.

Further simulation results are available in JVET-M0446 including:

* Simulations without some VTM encoder speedups (0.48% becomes 0.54% benefit for Class A in RA configuration)
* Simulations for limiting the VTM to not use 32x128/128x32 partitions at boundaries (0.0X% penalty for Class A in RA configuration)

It was commented that the coding efficiency benefit of the proposal comes with a substantial encoder search penalty (~13%) and a similar increase in encoder search complexity without changing the syntax/decoding process would also provide some coding efficiency benefit.

Revisit after getting that 0.0X% number. It was suggested that removing the special treatment of the edges without adding support for alternative VPDU shapes seemed to be the likely outcome.

SubCE1.2.1

(JVET-M0236, Canon)

Proponents extend current TU tiling such that TUs do not cross the boundaries of a 64x64 grid. It is also proposed that by using this technology the ternary split at the top level becomes available and therefore an improved RD-performance is possible.

Conditions for TU\_MAX\_TR\_SPLIT are changed such that each resulting TU is contained in a single 64x64 region on a 64x64 grid. This is obtained by using smaller TUs than what is currently being used in the VTM software. For instance, by allowing the ternary split at the top level a 64x128 center block arises which is then tiled into four 64x32 TUs to match the constraint. Results do not effect AI.

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|  | **All Intra Main10** | | | | | **Random Access Main 10** | | | | | | | | **Low delay B Main10** | | | | | | | |
|  | **Over VTM-3.0** | | | | | **Over VTM-3.0** | | | | | | | | **Over VTM-3.0** | | | | | | | |
|  | Y | U | V | EncT | DecT | Y | | U | | V | | EncT | DecT | Y | | U | | V | | EncT | DecT |
| Class A1 | 0.00% | 0.00% | 0.00% | 102% | 106% | -0.52% | | -0.71% | | -0.50% | | 132% | 98% |  | |  | |  | |  |  |
| Class A2 | 0.00% | 0.00% | 0.00% | 100% | 103% | -0.66% | | -0.59% | | -0.45% | | 123% | 100% |  | |  | |  | |  |  |
| Class B | 0.00% | 0.00% | 0.00% | 100% | 102% | -0.28% | | -0.26% | | -0.24% | | 122% | 101% | -0.20% | | -0.47% | | 0.03% | | 118% | 97% |
| Class C | 0.00% | 0.00% | 0.00% | 100% | 103% | -0.03% | | -0.05% | | 0.00% | | 113% | 104% | 0.00% | | 0.24% | | -0.12% | | 106% | 107% |
| Class E | 0.00% | 0.00% | 0.00% | 99% | 99% |  | |  | |  | |  |  | -0.70% | | -0.61% | | -0.40% | | 123% | 99% |
| **Overall** | 0.00% | 0.00% | 0.00% | 100% | 103% | -0.34% | | -0.36% | | -0.27% | | 122% | 101% | -0.26% | | -0.27% | | -0.13% | | 115% | 101% |
| Class D | 0.00% | 0.00% | 0.00% | 96% | 105% | -0.05% | | -0.08% | | -0.03% | | 113% | 105% | 0.00% | | 0.29% | | 0.21% | | 103% | 96% |
| Class F (optional) | 0.00% | 0.00% | 0.00% | 100% | 102% | -0.17% | | -0.22% | | -0.16% | | 120% | 101% | -0.35% | | -0.21% | | -0.36% | | 110% | 104% |

Remarks:

* The gain is substantial (0.59% for Class A in RA configuration)
* There is a substantial encoder complexity increase (~27%)
* This has a latency issue for decoding, since the TU coefficient data needs to be buffered up for VPDU pipeline processing. A related contribution M0237 proposes to shift this buffering burden to the encoder.

No action was taken on this.

Related proposals M0195 and M0285 allows PUs to straddle the VPDU boundaries but requires there to be no residual in those cases (0.38% benefit for Class A in RA configuration with encoder complexity increase of 19% if allowing all modes with zero residual, or 0.2% benefit for Class A in RA configuration with encoder complexity increase of 5% if allowing only skip mode in these cases). No action was taken on these as well.

[JVET-M0236](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5043) CE1: Transform tiling for pipelined processing of CTUs (Test 1.2.1) [C. Rosewarne, A. Dorrell (Canon)]

[JVET-M0446](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5255) CE1: Rectangular virtual pipeline data unit (test 1.1.1) and supplementary results [M. Xu, X. Li, S. Liu (Tencent)]

## CE2: Subblock motion compensation (24)

Contributions in this category were discussed Wednesday 9 Jan. 1540–XXXX (chaired by JRO)

[JVET-M0022](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5386) CE2: Summary report on sub-block based motion prediction [Y. He, C.-Y. Chen, C.-C. Chen]

The goal of Core Experiment 2 (CE2) is to investigate sub-block based motion prediction techniques on top of VTM-3.0. It comprises 5 categories,

* CE 2.1: Affine motion compensation
* CE 2.2: Affine merge mode
* CE 2.3: Sub-block based merge mode
* CE 2.4: Complexity reduction
* CE 2.5: ATMVP and related topics

For each test, a comparative study along with related tests is conducted, results and complexity analysis are provided. Crosschecking reports of all tests are integrated in this document as well.

CE2.1: Affine motion compensation

|  |  |  |
| --- | --- | --- |
| **Test#** | **Description** | **Document#** |
| 2.1.1 | Adaptive precision for affine MVD coding:  a{1-pel,1/4-pel,1/4-pel}, b{1/4-pel,1/4-pel,1/4-pel}, c{1/8-pel,1/8-pel,1/8-pel} | JVET-M0420 |
| 2.1.2 | Adaptive MVD precision for affine inter mode coding: {1-pel,1-pel,1-pel}, {1/4-pel,1/4-pel, 1/4-pel}, {1/16-pel,1/16-pel,1/16-pel} | JVET-M0246 |

The numbers are referring to {top-left,top-right,bottom-left}

Current affine uses 1/4 pel precision for signalling, but 1/16 pel precision in sub-blocks; affine merge uses 1/16 pel (but does not need to signalling)

Both tests use signalling and are only modifying affine MV coding, merge is unchanged. Test 2.1.1 uses 1 flag to signal 1/4 (case b) or not, and 1 flag to signal (if not) if it is a or c. Test 2.1.2 re-uses the adaptive MV precision signalling (but with 2 additional contexts) for affine, and also uses switching 1/16,1/4, 1 pel (instead 1/4, 1, 4 pel) precision.

The method comes with increase in encoder runtime, whereas decoder complexity increase is marginal (some additional logic and 2 contexts)

Method of 2.1.2 has slightly higher gain, and is assessed to be conceptually more straightforward, consistent with AMVR (it is however reported that by just reusing AMVR with same precision steps and same context coding, loss would occur).

The motion vector rounding is also consistent with the current design.

Decision: Adopt JVET-M0246 (Test 2.1.2), extending AMVR to affine. Use the AMVR high level flag for disabling both “normal” AMVR and “affine” AMVR.

Revisit: Specification text to be provided and reviewed.

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|  | **Random Access Main 10** | | | | | **Low delay B Main10** | | | | |
| **Test#** | **Y** | **U** | **V** | **EncT** | **DecT** | **Y** | **U** | **V** | **EncT** | **DecT** |
| 2.1.1 | -0.19% | -0.08% | -0.12% | 105% | 101% | -0.13% | -0.16% | 0.04% | 106% | 100% |
| 2.1.2 | -0.23% | -0.21% | -0.27% | 104% | 99% | -0.20% | -0.08% | -0.30% | 112% | 100% |

CE2.2: Affine merge

|  |  |  |
| --- | --- | --- |
| **Test#** | **Description** | **Document#** |
| 2.2.1.a | Bypass Affine flag for Skip CU | JVET-M0380 |
| 2.2.1.b | CABAC context change for Affine Flag | JVET-M0380 |
| 2.2.2.a | 2 contexts: one for Affine and one for regular Merge index | JVET-M0381 |
| 2.2.2.b | 1 context: one for both Affine Merge index and regular Merge index | JVET-M0381 |
| 2.2.3.a | Applying affine HMVP candidates to affine merge | JVET-M0125 |
| 2.2.3.b | Applying affine HMVP candidates for affine motion vector prediction | JVET-M0125 |
| 2.2.3.c | Combined test of 2.2.3a and 2.2.3b | JVET-M0125 |
| 2.2.3.d | Replace existing inherited affine candidates with affine HMVP candidates | JVET-M0125 |
| 2.2.4.a | Affine merge with offset and block level signalling | JVET-M0431 |
| 2.2.4.b | Based on 2.2.4a, but offset value range depends on picture height | JVET-M0431 |
| 2.2.4.c | Based on 2.2.4b, but POC distance based offset mirroring for Bi-prediction | JVET-M0431 |
| 2.2.4.d | Based on 2.2.4b, but POC distance based offset scaling for Bi-prediction | JVET-M0431 |
| 2.2.5 | Affine MV offset merge candidates | JVET-M0476 |
| 2.2.6.a | Simplification for 6-param and 4-param constructed candidates by setting P = 3 in 7 availability cases | JVET-M0477 |
| 2.2.6.b | Simplification for 6-param and 4-param constructed candidates by setting P = 3 in 2 availability cases | JVET-M0477 |
| 2.2.7.a | “Low complexity” affine merge with temporal candidates (however, increases complexity compared to VTM, see notes below) | JVET-M0256 |
| 2.2.7.b | “Medium complexity” affine merge with temporal candidates (however, increases complexity compared to VTM, see notes below) | JVET-M0256 |
| 2.2.7.c | Withdraw |  |
| 2.2.7.d | Withdraw |  |
| 2.2.7.e | Withdraw |  |
| 2.2.8.a | In affine AMVP, apply some pruning on candidates. Rounding, clipping applied before pruning | JVET-M0282 |
| 2.2.8.b | In affine merge, apply some pruning on inherited candidates | JVET-M0282 |
| 2.2.8.c | 2.2.8.a + 2.2.8.b | JVET-M0282 |
| 2.2.8.d | 2.2.8.c + 4.1.5.c | JVET-M0282 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Random Access Main 10** | | | | | **Low delay B Main10** | | | | |
| **Test#** | **Y** | **U** | **V** | **EncT** | **DecT** | **Y** | **U** | **V** | **EncT** | **DecT** |
| 2.2.1.a | 0.09% | 0.21% | 0.20% | 102% | 98% | 0.03% | 0.04% | 0.06% | 103% | 92% |
| 2.2.1.b | -0.01% | 0.02% | -0.01% | 100% | 100% | 0.00% | 0.02% | 0.06% | 99% | 98% |
| 2.2.2.a | 0.00% | 0.00% | -0.01% | 100% | 98% | 0.03% | -0.05% | 0.10% | 99% | 94% |
| 2.2.2.b | 0.07% | 0.04% | 0.06% | 100% | 104% | 0.05% | 0.03% | 0.15% | 100% | 96% |
| 2.2.3.a | -0.06% | -0.04% | -0.02% | 100% | 100% | -0.06% | 0.04% | 0.09% | 101% | 100% |
| 2.2.3.b | -0.01% | 0.01% | 0.02% | 100% | 100% | 0.00% | 0.00% | 0.09% | 102% | 101% |
| 2.2.3.c | -0.07% | -0.04% | -0.04% | 100% | 100% | -0.03% | -0.05% | -0.18% | 101% | 102% |
| 2.2.3.d | 0.07% | 0.10% | 0.06% | 100% | 100% | 0.09% | 0.09% | 0.02% | 101% | 101% |
| 2.2.4.a | -0.16% | -0.13% | -0.14% | 104% | 100% | 0.01% | -0.05% | -0.07% | 107% | 100% |
| 2.2.4.b | -0.17% | -0.12% | -0.13% | 104% | 100% | -0.02% | 0.09% | -0.04% | 106% | 100% |
| 2.2.4.c | -0.20% | -0.08% | -0.09% | 104% | 100% | 0.04% | -0.01% | 0.19% | 105% | 100% |
| 2.2.4.d | -0.20% | -0.09% | -0.09% | 104% | 99% | 0.02% | 0.07% | 0.07% | 106% | 99% |
| 2.2.5 | -0.06% | -0.02% | -0.05% | 104% | 101% | -0.03% | 0.06% | -0.03% | 105% | 99% |
| 2.2.6.a | 0.00% | 0.01% | -0.01% | 100% | 100% | 0.07% | -0.01% | 0.18% | 99% | 99% |
| 2.2.6.b | 0.02% | 0.04% | 0.00% | 100% | 100% | 0.08% | 0.14% | 0.04% | 99% | 98% |
| 2.2.7.a | -0.08% | -0.02% | -0.13% | 105% | 102% | -0.03% | -0.12% | -0.09% | 116% | 115% |
| 2.2.7.b | -0.10% | -0.10% | -0.14% | 106% | 102% | -0.07% | -0.21% | -0.08% | 117% | 116% |
| 2.2.8.a | 0.00% | 0.01% | 0.00% | 100% | 100% | -0.01% | 0.04% | -0.07% | 100% | 100% |
| 2.2.8.b | -0.01% | -0.01% | 0.00% | 101% | 100% | -0.03% | 0.00% | -0.05% | 100% | 100% |
| 2.2.8.c | -0.02% | 0.00% | 0.00% | 100% | 100% | 0.00% | 0.05% | 0.10% | 100% | 100% |
| 2.2.8.d | -0.04% | -0.01% | -0.01% | 100% | 100% | -0.03% | -0.12% | -0.17% | 100% | 100% |

Complexity analysis

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **AMVP/Merge list size** | **Max number of potential candidates** | **Max number of MV comp.** | **Max number of ref idx comp.** | **Max number of MV scaling** | **Max number of conditional cases to enable constructed candidates** | **Others** |
| 2.2.1.a | same | Same | Same | same | same | same |  |
| 2.2.1.b | same | Same | Same | same | same | same |  |
| 2.2.2.a | same | Same | Same | same | same | same |  |
| 2.2.2.b | same | Same | Same | same | same | same |  |
| 2.2.3.a | same | Merge +5 | Same | same | same |  | \*Affine HMVP 170 bytes |
| 2.2.3.b | same | AMVP + 2 | Same | +2 | same |  | \*Do ref index selection for affine HMVP based on the selected ref. in AMVP  \*Affine HMVP 68 bytes |
| 2.2.3.c | same | Merge +5 /  AMVP +2 | Same | +2 | same |  | \*Affine HMVP 170 bytes |
| 2.2.3.d | same | same | Same | -1 | same |  | Reduce CPMV buffer from 1296 bytes to 170 bytes. Note: 1296 bytes requires optimized affine CPMV buffer update. Otherwise, storage of a full CTU's CPMV needs 6192 bytes.  Position comp: merge + 5/AMVP +4 |
| 2.2.4.a | same | Same | Same | same | same | same |  |
| 2.2.4.b | same | Same | Same | same | same | same |  |
| 2.2.4.c | same | Same | same | same | same | same |  |
| 2.2.4.d | same | same | same | same | same | same |  |
| 2.2.5 | same | same | same | same | same | same |  |
| 2.2.6.a | same | -3 | -8 | -22 | same | same |  |
| 2.2.6.b | same | -3 | -8 | -22 | same | 2(-5) |  |
| 2.2.7.a | same | same | + 38 | -12 | +2 |  |  |
| 2.2.7.b | same | +3 | +98 | +26 | +3 |  |  |
| 2.2.8.a | same | same | +3 | same | same |  |  |
| 2.2.8.b | same | same | +6 | +2 | same |  |  |
| 2.2.8.c | same | same | +3 for AMVP +6 for Merge | +0 for AMVP +2 for Merge | same |  |  |
| 2.2.8.d |  |  |  |  |  |  |  |

2.2.1a has loss, but does not really solve a problem in terms of complexity

2.2.1b uses different neighbor positions (A1/B1) for the context of affine flag coding (which currently uses A2/B3), claiming that these are positions different from those used in merge. However, other elements (e.g. AMVR, triangular, quadtree/MTT split flag) use also A2/B3. Therefore, making this change only for affine flag does not seem to be a unification/simplification.

The current affine merge has 4 context coded bins. Both tests 2.2.2a/b reduce this to only one (as in normal merge mode), where 2.2.2a uses different contexts for affine and normal merge, whereas 2.2.2b uses the same. 2.2.2a has no loss in RA, very small loss in LB, whereas 2.2b also shows 0.07% loss in RA.

Decision: Adopt JVET-M0381 Test 2.2.2a (reducing number of context coded bins in affine merge). Text is available with the contribution.

2.2.3.x establishes a history-based motion vector prediction for affne, however the HMVP candidates are different (specifically collected from affine coded blocks) than in normal HMVP.

It is commented that no coordinates are used for a/b/c (which theoretically might lead to wrong model depending on distance)

a/b/c have additional complexity in list derivation and storage of history camdidates, which is not justified by the small (highest 0.07% for 2.2.3c)

2.2.3d is interesting as it reduces the need of local storage for spatial CPMV (control point motion vectors) and replaces CPMV by history-based candidates. It however also disables the inheritance at CTU boundaries, which is asserted to be the main reason for the loss of 0.07% (there are CE related contributions JVET-M0432, JVET-M0110, JVET-M0168, JVET-M0262, JVET-M0270) that tackle this issue in various ways. The approach should be further studied to solve the complexity reduction with less penalty in terms of compression performance.

Test 2.2.4.x signals offset for affine merge mode (applied to all CPMV). The method b based on picture height only provides small additional benefit. The method d has some additional complexity for scaling, without showing benefit over c (which just uses mirroring). Gain is on average between 0.16% (for a) and 0.20% for c/d, generally higher for high resolution sequences.

Decision: Adopt JVET-M0431, test 2.2.4c, but on top of 2.2.4a (using distance offsets 1/2, 1, 2, 4, and 8-pel as per table 2.1 of M0431). Add a high-level enabling flag.

Revisit: Specification text to be provided and reviewed.

2.2.5 is a similar approach with same number of offset candidates (total 20), but supports larger offset values, and different combinations. Gives less compression benefit.

2.2.6.x reduce the number of constructed affine candidates from 6 to 3. However, loss of 0.07% is observed in LDB (where constructed candidates may be used more often). Furthermore, the study of AHG16 shows that affine merge is not the most critical path in VVC. Therefore, proposals which reduce complexity in this area should rather come with very low penalty in compression.

2.2.7.a removes “mixed” spatial-temporal constructed candidates, replacing them by pure temporal candidates. The total number of candidates is unchanged, but the list construction (pruning) becomes more complicated. Gain is 0.08%/0.03% for RA/LB

2.2.7b keeps the original candidates, and adds three more pure temporal candidates. The list construction (pruning) has significantly higher complexity than current VVC (almost 3x number of MV comparisons). Gain is 0.1%/0.07% for RA/LDB

Some of the reported gain may also be due to encoder changes. No good tradeoff of performance compared to additional complexity. Also reports increased encoder runtime.

2.2.8.x adds some pruning processes to affine MV prediction and merge modes. Benefit in terms of compression not obvious. (Note that the technology had more promising compression benefit before VTM3).

Sub-CE 2.3: Sub-block based merge mode

|  |  |  |
| --- | --- | --- |
| **Test#** | **Description** | **Document#** |
| 2.3.1.a.1 | Planar motion vector prediction (PMVP) as a single mode with the sub-block size setting: 8x4 for BI, 4x4 for UNI | JVET-M0104 |
| 2.3.1.a.2 | PMVP as a single mode with the sub-block size setting: 4x8 for BI, 4x4 for UNI |
| 2.3.1.a.3 | PMVP as a single mode with the sub-block size setting: Adaptive 8x4/4x8 for BI, 4x4 for UNI |
| 2.3.1.a.4 | PMVP as a single mode with the sub-block size setting: 8x8 for BI, 4x4 for UNI |
| 2.3.1.a.5 | PMVP as a single mode with the sub-block size setting: Adaptive 8x4/4x8 for BI and UNI |
| 2.3.1.a.6 | PMVP as a single mode with the sub-block size setting: 8x8 for BI and UNI |
| 2.3.1.b | Withdraw |
| 2.3.1.c | PMVP as a candidate in sub-block (affine) merge list |
| 2.3.1.d | Withdraw |
| 2.3.2.a | The threshold is set as 1 pixel for the sub-blocks inside the 4x16, 16x4 and 8x8 blocks | JVET-M0485 |
| 2.3.2.b | The threshold is set to 0 pixel for 4x16 and 16x4 blocks along vertical and horizontal directions, respectively; and the threshold is set as 1 pixel for the sub-blocks inside 8x8 blocks |
| 2.3.3.a | Regression-based Motion Vector Field (RMVF) as a separate merge mode as described in JVET-L0171 | JVET-M0302 |
| 2.3.3.b | 2.3.3.a + the RMVF-coded blocks are used for affine merge candidate inheritance |
| 2.3.3.c | 2.3.3.a + complexity reduction (i.e., lower number of neighboring motion information for RMVF parameter derivation) |
| 2.3.3.d | 2.3.3.b + 2.3.3.c |

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|  | **Random Access Main 10** | | | | | **Low delay B Main10** | | | | |
| **Test#** | **Y** | **U** | **V** | **EncT** | **DecT** | **Y** | **U** | **V** | **EncT** | **DecT** |
| 2.3.1.a.1 | -0.11% | -0.10% | -0.17% | 103% | 103% | -0.08% | 0.01% | 0.09% | 104% | 103% |
| 2.3.1.a.2 | -0.10% | -0.18% | -0.18% | 103% | 103% | -0.05% | 0.03% | 0.01% | 104% | 103% |
| 2.3.1.a.3 | -0.11% | -0.13% | -0.22% | 103% | 103% | -0.04% | -0.11% | -0.07% | 104% | 104% |
| 2.3.1.a.4 | -0.11% | -0.07% | -0.15% | 103% | 101% | -0.05% | -0.07% | -0.19% | 104% | 102% |
| 2.3.1.a.5 | -0.10% | -0.15% | -0.18% | 103% | 102% | -0.06% | 0.01% | 0.02% | 104% | 103% |
| 2.3.1.a.6 | -0.11% | -0.10% | -0.17% | 103% | 103% | -0.08% | 0.01% | 0.09% | 104% | 103% |
| 2.3.1.c | 0.08% | 0.12% | 0.06% |  |  | 0.07% | -0.01% | 0.22% |  |  |
| 2.3.2.a  (over VTM-3.0) | -0.12% | -0.18% | -0.21% | 104% | 107% | -0.08% | -0.05% | 0.05% | 106% | 112% |
| Over 2.3.1 |  |  |  |  |  |  |  |  |  |  |
| 2.3.2.b | -0.12% | -0.15% | -0.23% | 104% | 107% | -0.08% | 0.22% | 0.08% | 106% | 112% |
| Over 2.3.1 |  |  |  |  |  |  |  |  |  |  |
| 2.3.3.a | -0.18% | -0.17% | -0.26% | 105% | 102% | -0.02% | -0.10% | 0.09% | 106% | 102% |
| 2.3.3.b | -0.20% | -0.25% | -0.24% | 104% | 101% | -0.02% | 0.12% | 0.21% | 103% | 102% |
| 2.3.3.c | -0.19% | -0.13% | -0.19% | 105% | 102% | 0.01% | 0.05% | -0.03% | 106% | 101% |
| 2.3.3.d | -0.19% | -0.22% | -0.23% | 105% | 100% | 0.00% | 0.07% | -0.16% | 106% | 101% |

Test 2.3.1.a adds PMVP as a new mode to determine subblock vectors. 2.3.1.a3 imposes the same restrictions as current (non-affine) subblock MC. Low gain (around 0.1%), whereas encoder/decoder run time increases. The CE report does not have a detailed complexity analysis, but it can be asserted to be not insignificant, as MV scaling is necessary for each subblock.

Test 2.3.1.c puts PMVP as additional candidate into the affine merge list (but uses 8x8 subblocks) – therefore, loss is observed, probably as affine usually has 4x4 subblocks, and/or merge list size is reduced.

PMVP had 0.6% gain before, which is now down to 0.1%. This does not justify adding another subblock mode with additional processing.

Test 2.3.3 is about Regression-based Motion Vector Field (RMVF), where a set of maximum of 112 candidates is fed into the regression in case of a 128x128 block , or 7 candidates in case of an 8x8 block (each of which has to be scaled before). The derivation performs regression versus a 6-parameter affine model. 2.3.3a determines the subblock candidates (8x8 SB) directly, 2.3.3b puts them as a candidate for affine merge, and then uses it with 4x4 subblocks.

Tests c and d correspond to a and b, but reduce the number of input candidates to roughly half. Gain is around 0.2% for b, and 0.19% for c/d. This gain is much lower than reported originally (which was around 0.7%). Also the dependency of the regression on block size and number of candidates is of some concern (integer 16 bit, division-free). No precise analysis of complexity was made, but it is likely that the complexity of the regression (worst case of number of multiplications, availability checks, scaling operations, number of cycles) as used in the current CE would not justify adding another subblock mode, or an additional derivation of the affine model construction. Further study in CE to further reduce the number of candidates, and perform analysis of complexity impact.

[JVET-M0053](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4855) CE2.4.7 Size constrain for inherited affine motion prediction [H. Huang, W.-J. Chien, M. Karczewicz (Qualcomm)]

[JVET-M0054](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4856) CE2.4.6 Modified affine inheritance from above CTU [H. Huang, W.-J. Chien, M. Karczewicz (Qualcomm)]

[JVET-M0104](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4909) CE2.3.1: Planar Motion Vector Prediction [N. Zhang, X. Chen, J. Zheng, Y. Lin (HiSilicon)]

[JVET-M0125](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4930) CE2: History Based Affine Motion Candidate (Test 2.2.3) [J. Zhao, S. Kim (LGE), G. Li, X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0150](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4957) CE2.4.3: Affine restriction for worst-case memory bandwidth reduction [L. Pham Van, W.-J. Chien, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0664](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5485) Crosscheck of JVET-M0150 [S. Jeong, K. Choi (Samsung)] [late]

[JVET-M0165](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4972) CE2.5.1: Simplification of SbTMVP [C.-C. Chen, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0226](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5033) CE2.4.1: Reducing worst-case memory bandwidth of affine mode [Y.-W. Chen, X. Wang (Kwai Inc.)]

[JVET-M0227](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5034) CE2.5.2: A second ATMVP candidate [Y.-W. Chen, X. Wang (Kwai Inc.)]

[JVET-M0246](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5053) CE2: Adaptive Motion Vector Resolution for Affine Inter Mode (Test 2.1.2) [H. Liu, K. Zhang, L. Zhang, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0256](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5063) CE2: Affine temporal constructed candidates (test 2.2.7) [F. Galpin, A. Robert, F. Le Léannec, T. Poirier (Technicolor)]

[JVET-M0699](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5521) Crosscheck of JVET-M0256 (CE2: Affine temporal constructed candidates (test 2.2.7)) [H. Huang (Qualcomm)] [late]

[JVET-M0262](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5069) CE2: Affine model inheritance from single-line motion vectors (Test 2.4.8) [K. Zhang, L. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0282](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5089) CE2: Affine motion predictor pruning (test 2.2.8) [A. Robert, F. Le Léannec, T. Poirier, F. Galpin (Technicolor)]

[JVET-M0302](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5109) CE2: Merge Mode with Regression-based Motion Vector Field (Test 2.3.3) [R. Ghaznavi-Youvalari, A. Aminlou, J. Lainema (Nokia)]

[JVET-M0309](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5116) CE2: Memory bandwidth reduction for affine mode (test 2.4.2) [J. Li, R.-L. Liao, C. S. Lim (Panasonic)]

[JVET-M0380](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5187) CE2: Affine Merge flag coding (Test 2.2.1) [G. Laroche, C. Gisquet, P. Onno, J. Taquet (Canon)]

[JVET-M0381](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5188) CE2: On Subblock Merge index coding (Test CE2.2.2) [G. Laroche, C. Gisquet, P. Onno, J. Taquet (Canon)]

[JVET-M0420](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5229) CE2: Adaptive precision for affine MVD coding (Test 2.1.1) [J. Luo, Y. He, X. Xiu (InterDigital)]

[JVET-M0431](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5240) CE2: Affine merge with prediction offset (Test CE2.2.4) [G. Li, X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0472](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5282) CE2: Affine sub-block size restrictions (Test 2.4.4) [H. Chen, T. Solovyev, H. Yang, J. Chen (Huawei)]

[JVET-M0476](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5286) CE2: Control point MV offset for Affine merge mode (Test 2.2.5) [Y.-C. Yang, Y.-J. Chang (Foxconn)]

[JVET-M0477](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5287) CE2: Simplification of Affine constructed merge candidates (Test 2.2.6) and supplementary results [Y.-C. Yang, Y.-J. Chang (Foxconn)]

[JVET-M0485](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5295) CE2: Sub-block MV clip in planar motion vector prediction (test 2.3.2) [M. Gao, X. Li, M. Xu, S. Liu (Tencent)]

[JVET-M0488](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5298) CE2: Sub-block MV clip in affine prediction (test 2.4.5) [M. Gao, X. Li, M. Xu, S. Liu (Tencent)]

## CE3: Intra prediction and mode coding (16)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0023](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4901) CE3: Summary report on intra prediction and mode coding [G. Van der Auwera, J. Heo, A. Filippov]

1750 Wed 9 Jan (GJS)

This is the summary report of the third Core Experiment (CE3). The goal of CE3 is to study intra prediction tools, including mode coding, for potential inclusion into the VVC standard.

The following is the list of defined sub-tests in CE3:

* CE3.1: Intra prediction modes (5 tests)
* CE3.2: Cross-component prediction (11 tests)
* CE3.3: Intra mode coding (10 tests)

This document summarizes the objective results (BD-rates, runtimes), cross-check reports, and related input contributions.

The source codes of the tests and full test results are uploaded by proponents into the following CE3 GitLab repository:

https://vcgit.hhi.fraunhofer.de/JVET-L-CE3/VVCSoftware\_VTM.git

The following changes were made to the CE3 test description document after the T2 deadline (December 6, 2018) had passed. Besides changes to contact persons and assignment of cross-checkers, the following changes were requested on the JVET reflector and discussed for clarification, if needed:

* CE3.2:
  + Added test CE3.2.2.1 (MMLM; combination of tests CE3.2.1 and CE3.2.2)
  + Added test CE3.2.6.2 (CCLM; testing 3 columns of neighbouring samples on left side of block, 1 row above block)
* CE3.3:
  + Reduction and clarification of test CE3.3.1 from 7 subtests to 4 (decoder-side intra mode derivation)
  + Additional result for test 3.5 (multiple DM for chroma)

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| **Test #** | **Description** | **Doc. #** |
| 1.1.1 | Intra sub-partitions coding mode (conceptually similar to prior “short-distance intra prediction”) with a different trade-off between gain and encoding run-time (at least 16 samples per partition; 2 or 4 partitions) | JVET-M0102 |
| 1.1.2 | Test 1.1.1 with a restriction: the resulting partitions must have a width of at least 4 samples (but height can be 1, 2, or 4) |
| 1.2.1 | Affine linear weighted intra prediction modes with encoder speedup | JVET-M0043 |
| 1.2.2 | Affine linear weighted intra prediction modes with a fixed number of weights needed per NxN block |
| 1.3 | Harmonization simplified linear interpolation intra prediction (LIP) with PDPC | JVET-M0252 |

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|  | **All Intra Main 10 - Over VTM-3.0** | | | | | **Random Access Main 10 - Over VTM-3.0** | | | | |
| **Test #** | **Y** | **U** | **V** | **EncT** | **DecT** | **Y** | **U** | **V** | **EncT** | **DecT** |
| 1.1.1 | -0.59% | -0.44% | -0.47% | 112% | 103% | -0.29% | -0.31% | -0.15% | 102% | 103% |
| 1.1.2 | -0.46% | -0.34% | -0.34% | 112% | 104% | -0.24% | -0.28% | -0.18% | 102% | 102% |
| 1.2.1 | -1.36% | -1.02% | -1.01% | 153% | 105% | -0.85% | -0.92% | -0.98% | 112% | 99% |
| 1.2.2 | -0.95% | -0.42% | -0.46% | 153% | 101% | -0.57% | -0.73% | -0.83% | 110% | 98% |
| 1.3 | -0.08% | -0.14% | -0.11% | 106% | 100% | -0.04% | 0.00% | -0.01% | 101% | 100% |

Regarding 1.1.x, it was commented that this does not really increase decoder complexity. Another participant commented that this has a difficult pipeline dependency. However, other difficult pipline dependencies are already in the VTM, and this is not increasing the difficulty of the worst case.

CE3.1: Related contributions

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| **Doc. #** | **Related test #** | **Title** |
| JVET-M0426 (HHI) | 1.1.2 | CE3-related: Improvement on the Intra Sub-Partitions Coding Mode |

CE3.1: Additional test results

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|  |  | **All Intra Main10 - Over VTM-3.0** | | | | | **Random Access Main10 - Over VTM-3.0** | | | | |
| **Test#** | **Description** | **Y** | **U** | **V** | **EncT** | **DecT** | **Y** | **U** | **V** | **EncT** | **DecT** |
| 1.1.2.1 | Test 1.1.2 with 1-D transform and entropy coding for 4xN (N>4) blocks that cannot be vertically divided (JVET-M0102) | -0.52% | -0.40% | -0.42% | 112% | 104% | -0.25% | -0.25% | -0.16% | 102% | 102% |

It was noted that 1.1.x shows more gain on Class F (SCC content) than on other content, and Class F is not included in the average. A non-proponent participant focused on implementation issues indicated that they had analyzed it and found it acceptable for implementation.

Decision: Adopt 1.1.1 proposal, pending the provision of text and its review.

Regarding 1.2.1, this has (in the decoder perspective) a selection of a matrix of stored fixed values among a set of such matrices, followed by a matrix multiply applied to boundary sample values to generate the prediction signal in the frequency domain and then an inverse transform is applied to generate a spatial domain prediction, followed by an ordinary residual difference.

It was noted that this has a bit more gain on RA than is usual for intra coding efficiency proposals (0.85/1.36=0.625 versus the usual ~0.5).

This has some decoder runtime increase. For 1.2.1 there is an increase in computational operations.

It was commented that the need to include an inverse transform in the 1.2.1 variant is an additional functional block unlike anything typically done for intra.

The amount of stored coefficient data is another issue, especially for the 1.2.1 variant (~300 kbytes). The 1.2.2 variant omits the inverse transform and has a (simple 2-tap one-dimensional average) downsampling that reduces the size of the matrices (to about ~18 kbytes – a total of around 14,000 numbers of 10 bits each), with a corresponding (bilinear) upsampling in the decoder. The proponent pointed to CPR as an instance where added storage of a greater amount is needed (although, for screen content, that has quite high gain).

The encoding complexity is another significant concern; both proposed variants increase that by ~50%. Additional encoder-only variants are reported in M0043 with different trade-offs.

The proponent said the training set did not include the CTC test set.

Between 1/3 and 1/2 of the intra blocks were reportedly using this mode (which is a lot).

Further study was encouraged (not necessarily in a CE). Side activity was encouraged during the meeting to potentially come up with a plan for further study.

For 1.3, the proposal is to add an additional mode; the measured gain was quite small and the encoder runtime increased by about 6%, so no action was taken on this.

[JVET-M0043](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4843) CE3: Affine linear weighted intra prediction (test 1.2.1, test 1.2.2) [J. Pfaff, B. Stallenberger, M. Schäfer, P. Merkle, P. Helle, R. Rischke, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

[JVET-M0094](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4897) CE3: Decoder-side Intra Mode Derivation (tests 3.1.1, 3.1.2, 3.1.3 and 3.1.4) [E. Mora, A. Nasrallah, M. Abdoli, M. Raulet (ATEME)]

[JVET-M0097](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4902) CE3: On MMLM (Test 2.1) [A. K. Ramasubramonian, G. Van der Auwera, T. Hsieh, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0098](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4903) CE3: Joint test on MMLM (Test 2.2.1) [A. K. Ramasubramonian, G. Van der Auwera, T. Hsieh, V. Seregin, M. Karczewicz (Qualcomm), H.-J. Jhu, Y.-J. Chang (Foxconn)]

[JVET-M0102](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4907) CE3: Intra Sub-Partitions Coding Mode (Tests 1.1.1 and 1.1.2) [S. De-Luxán-Hernández, V. George, J. Ma, T. Nguyen, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

[JVET-M0142](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4949) CE3: Modified CCLM downsampling filter for “type-2” content (Test 2.4) [P. Hanhart, Y. He (InterDigital)]

[JVET-M0203](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5010) CE3: DM-based chroma intra prediction mode (Test 3.5) [N. Choi, M. W. Park, K. Choi (Samsung)]

[JVET-M0218](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5025) CE3: Simplified MDMS (test 3.3.1 and test 3.3.2) [J. Choi, J. Heo, S. Yoo, L. Li, J. Choi, J. Lim, S. Kim (LGE)]

[JVET-M0252](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5059) CE3-1.3: Harmonization of Linear interpolation intra prediction (LIP) with Multiple reference line prediction (MRL) [J. Heo, J. Choi, J. Choi, S. Yoo, L. Li, J. Lim (LGE)]

[JVET-M0263](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5070) CE3: CCLM prediction with single-line neighbouring luma samples (Test 2.6.1 and Test 2.6.2) [K. Zhang, L. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0401](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5206) CE3: Classification-based mean value for CCLM coefficients derivation (tests 2.5.1-2.5.4) [X. Ma, A. Filippov, V. Rufitskiy, H. Yang, J. Chen (Huawei)]

[JVET-M0475](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5285) CE3: Multiple neighbour LM (Test 3.2.2) [[H.-J. Jhu](mailto:HongJheng@fginnov.com), Y.-J. Chang (Foxconn)]

[JVET-M0495](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5305) CE3: Intra mode coding (Test 3.2) [L. Zhao, X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0503](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5313) CE3: Chroma intra prediction simplification (Test 3.4.1 and 3.4.2) [C.-H. Yau, C.-C. Lin, C.-L. Lin (ITRI)]

[JVET-M0504](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5314) CE3: adaptive multiple cross-component linear model(Test 3.2.3) [S.-P. Wang, C.-H. Yau, C.-C. Lin, C.-L. Lin (ITRI)]

## CE4: Inter prediction and motion vector coding (18)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0024](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5408) CE4: Summary report on inter prediction and motion vector coding [H. Yang, S. Liu, K. Zhang]

[JVET-M0059](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4861) CE4: Non-scaling STMVP (Test 4.2.1) [T. Zhou, T. Ikai (Sharp)]

[JVET-M0060](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4862) CE4: Enhanced Merge with MVD (Test 4.4.4) [T. Hashimoto, E. Sasaki, T. Ikai (Sharp)]

[JVET-M0061](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4863) CE4: Combination of CE4.4.4.a and CE4.4.5.c (Test 4.4.4.e) [T. Hashimoto, E. Sasaki, T. Ikai (Sharp), J. Li, R.-L. Liao, C. S. Lim (Panasonic)]

[JVET-M0687](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5509) Crosscheck of JVET-M0061 (CE4.4.4e: Combination of CE4.4.4.a and CE4.4.5.c) [L. Xu, F. Chen, L. Wang (Hikvision)] [late]

[JVET-M0086](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4889) CE4: Non-sub-block ATMVP (test 2.5.4) [K. Abe, T. Toma (Panasonic)]

[JVET-M0106](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4911) CE4: STMVP without scaling (tests 4.2.2) [F. Le Léannec, T. Poirier, F. Galpin (Technicolor)]

[JVET-M0124](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4929) CE4: Methods of Reducing Number of Pruning Checks of History Based Motion Vector Prediction (Test 4.1.1) [J. Zhao, S. Kim (LGE)]

[JVET-M0126](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4931) CE4: Modification on History-based Motion Vector Prediction [Y. Han, W.-J. Chien, C.-C. Chen, H. Huang, C.-H. Hung, Y. Zhang, M. Karczewicz (Qualcomm)]

[JVET-M0170](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4977) CE4.3.1: Shared merging candidate list [C.-C. Chen, Y.-C. Lin, M.-S. Chiang, C.-W. Hsu, T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0584](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5401) Crosscheck of JVET-M0170 (CE4: Modification on History-based Motion Vector Prediction) Supplementary Tests [Y. Han, H. Wang, C.-C. Chen, W.-J. Chien (Qualcomm)] [late]

[JVET-M0221](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5028) CE4: STMVP simplification (test 4.2.3a) [Y.-H. Chao, Y. Han, W.-J. Chien, M. Karczewicz (Qualcomm)]

[JVET-M0281](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5088) CE4: Inter motion predictor pruning (test 4.1.5) [A. Robert, F. Le Léannec, T. Poirier, F. Galpin (Technicolor)]

[JVET-M0289](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5096) CE4: Parallel Merge Estimation for VVC (Test 4.3.2) [H. Gao, S. Esenlik, B. Wang, A.M. Kotra, J. Chen (Huawei)]

[JVET-M0291](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5098) CE4: Extension on MMVD (Test 4.2.5) [X. Chen, J. Zheng (HiSilicon)]

[JVET-M0686](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5508) Crosscheck of JVET-M0291 (CE4.2.5: Extension on MMVD) [L. Xu, F. Chen, L. Wang (Hikvision)] [late]

[JVET-M0312](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5119) CE4: MMVD improvement (test 4.4.5) [J. Li, R.-L. Liao, C. S. Lim (Panasonic)]

[JVET-M0313](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5120) CE4: Motion compensation constraints for complexity reduction (test 4.5.1 and test 4.5.2) [R.-L. Liao, J. Li, C. S. Lim (Panasonic)]

[JVET-M0403](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5211) CE4: Generic Vector Coding of Motion Vector Difference (Tests 4.4.1.a and 4.4.1.b) [S. Paluri, M. Salehifar, S. Kim (LGE)]

[JVET-M0698](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5520) Crosscheck of JVET-M0403: CE4: Generic Vector Coding of Motion Vector Difference (Tests 4.4.1.a and 4.4.1.b) [L. Pham Van, W.-J. Chien, M. Karczewicz (Qualcomm)] [late]

[JVET-M0404](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5212) CE4: History based spatial-temporal MV prediction (Test 4.2.4) [X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0481](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5291) CE4: Symmetrical MVD mode (Test 4.4.3) [H. Chen, T. Solovyev, H. Yang, J. Chen (Huawei)]

## CE5: Arithmetic coding engine (10)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0025](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5398) CE5: Summary report on the Arithmetic Coding Engine [H. Kirchhoffer, A. Said]

[JVET-M0172](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4979) CE5.1.9: CABAC engine with simplified range sub-interval derivation [T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0199](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5006) CE5: Counter-based probability estimation (CE5.1.8) [K. Choi, Y. Piao (Samsung)]

[JVET-M0412](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5221) CE5: Per-context CABAC initialization with double windows (Test 5.1.3) [A. Said, J. Dong, H. Egilmez, Y.-H. Chao, M. Karczewicz, V. Seregin (Qualcomm)]

[JVET-M0413](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5222) CE5: Per-context CABAC initialization with single window (Test 5.1.4) [A. Said, J. Dong, H. Egilmez, Y.-H. Chao, M. Karczewicz, V. Seregin (Qualcomm)]

[JVET-M0453](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5262) CE5 on arithmetic coding: experiments 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.6, 5.1.7, 5.1.8, 5.1.10, 5.1.11, 5.1.12, 5.1.13, 5.2, and more [F. Bossen (Sharp)]

[JVET-M0463](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5272) CE5: Report of throughput analysis of CE5 contributions (CE5.2) [J. Dong, A. Said, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0725](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5552) CE5: Results of tests CE5.1.1 and CE5.1.2 [J. Stegemann, H. Kirchhoffer, H. Schwarz, D. Marpe, T. Wiegand (HHI)] [late]

[JVET-M0727](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5556) CE5: Results of tests CE5.1.5, CE5.1.6, and CE5.1.7 [H. Kirchhoffer, C. Bartnik, P. Haase, S. Matlage, J. Stegemann, D. Marpe, H. Schwarz, T. Wiegand (HHI)] [late]

[JVET-M0759](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5590) CE5: Report of subtest 3 on complexity and throughput aspects for hardware [B. Stabernack (HHI), T. Hsieh (Qualcomm)] [late]

[JVET-M0762](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5593) CE5: Report of software throughput analysis for CE5.2 by HHI [H. Kirchhoffer, C. Bartnik, T. Hinz, J. Stegemann, P. Haase, S. Matlage, B. Stabernack, H. Schwarz, D. Marpe, T. Wiegand (HHI)] [late]

## CE6: Transforms and transform signalling (21)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0026](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5343) CE6: Summary Report on Transforms and Transform Signaling [A. Said, X. Zhao]

[JVET-M0079](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4882) CE6: MTS size restriction to 16 (test 3.7) [P. Philippe (bcom Orange)]

[JVET-M0080](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4883) CE6: MTS simplification with TAF (tests 1.5a-d) [P. Philippe (bcom Orange)]

[JVET-M0084](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4887) CE6: JVET-L0262: Replacing all DST-7 / DCT-8 by DST-4 / DCT-4 used in MTS (test 6.1.1e) [K. Abe, T. Toma (Panasonic), M. Ikeda, T. Tsukuba (Sony), K. Naser, F. Le Léannec, E. François (Technicolor)]

[JVET-M0140](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4947) CE6: Sub-block transform for inter blocks (Test 6.4.1) [Y. Zhao, H. Gao, H. Yang, J. Chen (Huawei)]

[JVET-M0141](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4948) CE6: RQT-like sub-block transform for inter blocks (Test 6.4.4) [Y. Zhao, H. Gao, H. Yang, J. Chen (Huawei)]

[JVET-M0200](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5007) CE6: Unified matrix for transform (Test 6-1.2a) [K. Choi, M. Park, M. W. Park, W. Choi (Samsung)]

[JVET-M0244](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5051) CE6: MTS using DST-4 and transposed DCT-2 (test 6-1.3) [Y. Lin, J. Zheng, Q. Yu, N. Zhang (HiSilicon), C. Zhu (UESTC)]

[JVET-M0288](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5095) CE6-2.1: Fast DST-7/DCT-8 based on DFT [M. Koo, M. Salehifar, J. Lim, S. Kim (LGE)]

[JVET-M0292](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5099) CE6-5.1: Reduced Secondary Transform (RST) [M. Koo, M. Salehifar, J. Lim, S. Kim (LGE)]

[JVET-M0303](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5110) CE6: Shape adaptive transform selection (Test 3.1) [J. Lainema (Nokia)]

[JVET-M0319](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5126) CE6: MTS for non-square CUs (test 6.3.3) [J. Jung, D. Kim, G. Ko, J. Son, J. Kwak (WILUS)]

[JVET-M0372](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5179) CE6-2.2: Fast DST-7/DCT-8 based on DFT and matrix multiplication [K. Naser, E. François, F. Le Léannec (Technicolor)]

[JVET-M0496](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5306) CE6: Compound Orthonormal Transform (Test 6.1.1 a/b/c/d) [X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0497](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5307) CE6: Fast DST-7/DCT-8 with dual implementation support (Test 6.2.3) [X. Zhao, X. Li, Y. Luo, S. Liu (Tencent)]

[JVET-M0498](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5308) CE6: MTS up to 16-length (Test 6.3.8) [J. Jung, D. Kim, G. Ko, J.-H. Son, J. S. Kwak (Wilus), X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0499](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5309) CE6: RQT-like transform sub-block splitting (Test 6.4.3) [X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0521](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5332) CE6: Replacement of 4-point DST7/DCT8 with DST4/DCT4 in MTS (Test 6.1.6) [H. Egilmez, V. Seregin, A. Said, T. Hsieh, M. Karczewicz (Qualcomm)]

[JVET-M0522](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5333) CE6: MTS support for large rectangular blocks (Test 6.3.2) [H. Egilmez, V. Seregin, A. Said, M. Karczewicz (Qualcomm)]

[JVET-M0523](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5334) CE6: RQT-like transform partitioning for inter blocks (Test 6.4.2) [H. Egilmez, V. Seregin, A. Said, M. Karczewicz (Qualcomm)]

[JVET-M0538](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5350) CE6: Efficient Implementations of MTS with Transform Adjustments (tests 1.4a-d) [A. Said, H.E. Egilmez, Y.-H. Chao, V. Seregin, M. Karczewicz (Qualcomm)] [late]

## CE7: Quantization and coefficient coding (2)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0027](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4844) CE7: Summary report on quantization and coefficient coding [H. Schwarz, M. Coban, C. Auyeng]

[JVET-M0173](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4980) CE7 (Tests 7.1, 7.2, 7.3, and 7.4): Constraints on context-coded bins for coefficient coding [T.-D. Chuang, S.-T. Hsiang, Z.-Y. Lin, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

## CE8: Screen content coding tools (15)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0028](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5316) CE8: Summary Report on Screen Content Coding [X. Xu, Y.-C. Chao, Y.-C. Sun, J. Xu]

[JVET-M0050](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4852) CE8: Palette Mode in HEVC (test 8.2.1) [Y.-C. Sun, J. Lou (Alibaba), Y.-H. Chao, H. Wang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0051](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4853) CE8: Palette Mode and Intra Mode Combination (test 8.2.2) [Y.-C. Sun, J. Lou (Alibaba)]

[JVET-M0052](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4854) CE8: Separate Palette Coding for Luma and Chroma (test 8.2.5) [Y.-C. Sun, J. Lou (Alibaba), Y.-H. Chao, H. Wang, V. Seregin, M. Karczewicz (Qualcomm), R. Chernyak, S. Ikonin, J. Chen (Huawei)]

[JVET-M0056](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4858) CE8: BDPCM with LOCO-I and independently decodable areas (test 8.3.1a) [F. Henry, A. Mohsen (Orange), P. Philippe, G. Clare (B-com)]

[JVET-M0057](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4859) CE8: BDPCM with horizontal/vertical predictor and independently decodable areas (test 8.3.1b) [F. Henry, M. Abdoli, P. Philippe, G. Clare (Orange)]

[JVET-M0058](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4860) CE8: BDPCM with modified binarization (test 8.3.2) [F. Henry, M. Abdoli, G. Clare, P. Philippe (Orange)]

[JVET-M0332](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5139) CE8: Block vector prediction for CPR (test 8.1.1a and test 8.1.1b) [J. Nam, J. Lim, S. Kim (LGE)]

[JVET-M0407](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5215) CE8: CPR reference memory reuse without increasing memory requirement (CE8.1.2a and CE8.1.2d) [X. Xu, X. Li, S. Liu (Tencent), E. Chai (Ubilinx)]

[JVET-M0408](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5216) CE8: CPR reference memory reuse with reduced memory requirement (CE8.1.2b and CE8.1.2c) [X. Xu, X. Li, S. Liu (Tencent), E. Chai (Ubilinx)]

[JVET-M0455](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5264) CE8: Palette index map scan order constraints (Test 8.2.3) [J. Ye, X. Xu, M. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0456](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5265) CE8: palette mode when dual-tree is enabled (Test 8.2.4) [J. Ye, X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0457](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5266) CE8: Palette predictor list enhancement (Test 8.2.6) [J. Ye, X. Xu, M. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0474](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5284) CE8.1.3: Extended CPR reference with 1 buffer line [L. Pham Van, V. Seregin, W.-J. Chien, T. Hsieh, M. Karczewicz (Qualcomm)]

[JVET-M0543](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5356) Crosscheck of M0474: CE8.1.3- Extended CPR reference with 1 buffer line [S.Paluri, S. Kim (LGE)] [late]

## CE9: Decoder-side motion vector derivation (8)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0029](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5498) CE9: Summary report on decoder side motion vector derivation [X. Xiu, S. Esenlik]

[JVET-M0062](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4864) CE9: An early termination of DMVR (Test 9.2.5) [T. Chujoh, T. Ikai (Sharp)]

[JVET-M0076](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4879) CE9: Block size restriction for DMVR (test 9.2.6) [K. Unno, K. Kawamura, S. Naito (KDDI)]

[JVET-M0147](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4955) CE9: Results of DMVR related Tests CE9.2.1 and CE9.2.2 [S. Sethuraman (Ittiam)]

[JVET-M0287](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5094) CE9: Integer DMVR (Test 9.2.7) [S. Esenlik, H. Gao, A.M. Kotra, B. Wang, J. Chen (Huawei)]

[JVET-M0306](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5113) CE9: DMVR Simplifications (Test 9.2.3) [X. Chen, J. Zheng (HiSilicon)]

[JVET-M0447](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5256) CE9: Constrained intra prediction with DMVR (test 9.2.4) [M. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0487](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5297) CE9: Simplifications on bi-directional optical flow (BDOF) (test 9.1.1) [X. Xiu, Y. He (InterDigital), C.-Y. Lai, Y.-C. Su, T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

## CE10: Combined and multi-hypothesis prediction (15)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0030](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5353) CE10: Summary report on combined and multi-hypothesis prediction [C.-W. Hsu, M. Winken]

[JVET-M0042](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4842) CE10: Uniform Directional Diffusion Filters For Video Coding [J. Rasch, A. Henkel, J. Pfaff, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

[JVET-M0087](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4890) CE10: Low pipeline latency LIC (test 10.5.2) [K. Abe, T. Toma, J. Li (Panasonic)]

[JVET-M0112](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4917) CE10: LIC confined within current CTU (test 10.5.3) [P. Bordes, T. Poirier, F. Le Léannec (Technicolor)]

[JVET-M0176](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4983) CE10.1.1: Multi-hypothesis prediction for improving non-skip & non-merge inter mode and merge mode [M.-S. Chiang, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0177](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4984) CE10.1.4: Simplification of combined inter and intra prediction [M.-S. Chiang, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0611](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5431) Crosscheck of JVET-M0177 (CE10.1.4: Simplification of combined inter and intra prediction) [B. Wang (Huawei)] [late] [miss]

[JVET-M0178](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4985) CE10.2.1: Uni-prediction-based CU-boundary-only OBMC [Z.-Y. Lin, T.-D. Chuang, C.-Y. Chen, C.-W. Hsu, C.-C. Chen, Y.-C. Lin, Y.-W. Huang, S.-M. Lei (MediaTek), X. Xiu, Y. He (InterDigital)]

[JVET-M0179](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4986) CE10.2.2: Integer-MV-based CU-boundary-only OBMC [Z.-Y. Lin, T.-D. Chuang, C.-Y. Chen, C.-W. Hsu, C.-C. Chen, Y.-C. Lin, Y.-W. Huang, S.-M. Lei (MediaTek), X. Xiu, Y. He (InterDigital)]

[JVET-M0180](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4987) CE10.2.3: Subblock OBMC with uni-prediction-based OBMC at CU boundaries [Y.-C. Lin, C.-C. Chen, C.-W. Hsu, Z.-Y. Lin, T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0181](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4988) CE10.2.4: Subblock OBMC with integer-MV-based OBMC at CU boundaries [Y.-C. Lin, C.-C. Chen, C.-W. Hsu, Z.-Y. Lin, T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0189](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4996) CE10.3.1: AMVP mode for triangle prediction [Y. Ahn, D. Sim (Digital Insights)]

[JVET-M0564](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5377) Cross-check of JVET-M0189: CE10.3.1 AMVP mode for triangle prediction [J. Kim, T. Na (SK Telecom), J. Shin, K. Ko (PIXTREE)] [late]

[JVET-M0290](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5097) CE10: Simplification on Combined Inter-Intra Prediction (Test 10.1.3) [W. Xu, B. Wang, H. Yang, J. Chen (Huawei)]

[JVET-M0293](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5100) CE10: Simplification on Combined Inter-Intra Prediction with size restriction (Test 10.1.5) [W. Xu, B. Wang, H. Yang, J. Chen (Huawei), M.-S. Chiang, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0425](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5234) CE10: Multi-hypothesis inter prediction (Test 10.1.2) [M. Winken, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

## CE11: Deblocking (9)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0031](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5564) CE11: Summary Report on Deblocking [A. Norkin, A. M. Kotra]

[JVET-M0075](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4878) CE11: Extended Deblocking Filter (test 11.1.2) [K. Unno, K. Kawamura, S. Naito (KDDI)]

[JVET-M0092](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4895) CE11: Very strong deblocking with conditional activation signaling (Test 11.1.1) [C. Helmrich, B. Bross (HHI)]

[JVET-M0186](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4993) CE11.1.3: Long deblocking filters [C.-M. Tsai, T.-D. Chuang, C.-W. Hsu, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0208](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5015) CE11: long-tap deblocking filter (Test 11.1.4) [W. Choi, K. Choi (Samsung)]

[JVET-M0298](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5105) CE11: Longer tap deblocking filter (test 11.1.5) [A. M. Kotra, B. Wang, S. Esenlik, H. Gao, J. Chen (Huawei)]

[JVET-M0299](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5106) CE11: Deblocking for 4 x N, N x 4 blocks and 8 x N, N x 8 blocks that are not aligned with 8 x 8 sample grid (test 11.2.1) [K. Andersson, Z. Zhang, R. Sjöberg (Ericsson), A. M. Kotra, J. Chen, S. Esenlik, B. Wang, H. Gao (Huawei), C.-M. Tsai, C.-W. Hsu, T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0337](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5144) CE11: Test CE11.2.1 Parallel deblocking filter [H. Jang, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-M0471](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5281) CE11.1.6, CE11.1.7 and CE11.1.8: Joint proposals for long deblocking from Sony, Qualcomm, Sharp, Ericsson [M. Ikeda, T. Suzuki (Sony), D. Rusanovskyy, M. Karczewicz (Qualcomm), W. Zhu, K. Misra, P. Cowan, A. Segall (Sharp Labs of America), K. Andersson, J. Enhorn, Z. Zhang, R. Sjöberg (Ericsson)]

## CE12: Mapping functions (2)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0032](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5538) CE12: Summary report on mapping functions [E. François, P. Yin]

[JVET-M0427](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5236) CE12: Mapping functions (test CE12-1 and CE12-2) [T. Lu, F. Pu, P. Yin, W. Husak, S. McCarthy, T. Chen (Dolby)]

## CE13: Coding tools for 360° omnidirectional video (11)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0033](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5466) CE13: Summary report on coding tools for 360° omnidirectional video [P. Hanhart, J.-L. Lin, C. Pujara]

[JVET-M0143](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4950) CE13: Face row based geometry padding using projection with bilinear interpolation based on test 1.1.a (Test 2.1.b) [P. Hanhart, Y. He (InterDigital)]

[JVET-M0144](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4951) CE13: Adaptive frame packing based on test 1.1.a (Test 4.1) [P. Hanhart, Y. He (InterDigital)]

[JVET-M0235](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5042) CE13: HEC with Pre-rotation based on test 1.1a and 1.1b (Test 4.2) [C. Pujara, A. Konda, A. Singh, R. Gadde, W. Choi, K. Choi, K.P. Choi (Samsung)] [late]

[JVET-M0320](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5127) CE13: HEC with deblocking using spherical neighbors, SAO and ALF disabled across face discontinuities (Test 1.4) [X. Huangfu, Y. Sun, L. Yu (Zhejiang Univ.)] [late]

[JVET-M0321](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5128) CE13: Post-filtering of seam artifacts based on test 1.1.a (Test 3.1) [X. Huangfu, Y. Sun, L. Yu (Zhejiang Univ.)] [late]

[JVET-M0355](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5163) CE13: Results on CE13.2.2 and CE13.5.2 [J. Sauer, M. Bläser (RWTH Aachen University)]

[JVET-M0362](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5169) CE13: In-loop filters disabled across face discontinuities (Test 1.1.a and Test1.1.b) [S.-Y. Lin, L. Liu, J.-L. Lin, Y.-C. Chang, C.-C. Ju (MediaTek), P. Hanhart, Y. He (InterDigital)]

[JVET-M0363](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5170) CE13: HEC with in-loop filters using spherical neighbors (Test 1.3) [S.-Y. Lin, L. Liu, J.-L. Lin, Y.-C. Chang, C.-C. Ju (MediaTek)]

[JVET-M0364](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5171) CE13: Test 1.1.a with face row based geometry padding of reference pictures (Test 2.1.a, Test 2.1.c and Test 2.1.d) [C.-H. Shih, J.-L. Lin, Y.-C. Chang, C.-C. Ju (MediaTek)]

[JVET-M0367](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5174) CE13: Face row based geometry padding of reference pictures and in-loop filters using spherical neighbors (Test 5.1) [C.-H. Shih, S.-Y. Lin, L. Liu, J.-L. Lin, Y.-C. Chang, C.-C. Ju (MediaTek)]

# Non-CE Technology proposals

## CE1 related – Partitioning (4)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0195](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5002) CE1-related: Non-Residual Block on VPDU Boundary [A. Tamse, M. W. Park, M. Park, K. Choi (Samsung)]

[JVET-M0630](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5450) Crosscheck of JVET-M0195 (CE1-related: Non-Residual Block on VPDU Boundary) [C. Rosewarne (Canon)] [late] [miss]

[JVET-M0237](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5044) CE1-related: Transform tiling with residual reordering for pipelined processing of CTUs [C. Rosewarne, A. Dorrell (Canon)]

[JVET-M0285](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5092) CE1-related: Prediction Mode Restriction and Implicit Transform Splitting to Enable VPDU [Y. Zhao, S. Esenlik, H. Yang, J. Chen (Huawei)]

[JVET-M0628](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5448) Crosscheck of JVET-M0285 (CE1-related: Prediction Mode Restriction and Implicit Transform Splitting to Enable VPDU) [C. Rosewarne (Canon)] [late] [miss]

[JVET-M0421](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5230) Non-CE1: Split-first signalling for partitioning [A. Wieckowski, T. Nguyen, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

## CE2 related – Subblock motion compensation (32)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0049](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4851) CE2-related: A restriction on memory bandwidth consumption of affine mode [M. Zhou (Broadcom)]

[JVET-M0441](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5250) Crosscheck of JVET-M0049 (CE2-related: A restriction on memory bandwidth consumption of affine mode) [K. Zhang (Bytedance)] [late]

[JVET-M0110](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4915) CE2-related: Alignment of affine control-point motion vector and subblock motion vector [H. Huang, W.-J. Chien, V. Seregin, H. Wang, M. Karczewicz (Qualcomm)]

[JVET-M0747](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5578) Crosscheck of JVET-M0110 Test 2 (CE2-related: Alignment of affine control-point motion vector and subblock motion vector) [J. Luo (InterDigital)] [late] [miss]

[JVET-M0737](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5568) Crosscheck of JVET-M0110 (CE2-related: Alignment of affine control-point motion vector and subblock motion vector) [A. Tamse (Samsung)] [late] [miss]

[JVET-M0598](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5417) Crosscheck of JVET-M0110 (CE2-related: Alignment of affine control-point motion vector and subblock motion) [T. Zhou, T. Ikai (Sharp)] [late] [miss]

[JVET-M0116](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4921) CE2-related: ATMVP simplification [R. Yu, D. Liu, K. Andersson, R. Sjöberg (Ericsson)]

[JVET-M0460](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5269) Crosscheck of JVET-M0116 (CE2-related: ATMVP simplification) [L. Zhang (Bytedance)] [late] [miss]

[JVET-M0145](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4952) Non-CE2: Motion vector clipping in affine sub-block motion vector derivation [P. Hanhart, Y. He (InterDigital)]

[JVET-M0735](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5565) Crosscheck of JVET-M0145 (Non-CE2: Motion vector clipping in affine sub-block motion vector derivation) [H. Chen (Huawei)] [late] [miss]

[JVET-M0166](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4973) CE2-related: Simplification of constructed affine merge candidate derivation [Z.-Y. Lin, T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0575](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5389) Crosscheck of JVET-M0166 (CE2-related: Simplification of constructed affine merging candidate derivation) [Y. He (InterDigital)] [late] [miss]

[JVET-M0167](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4974) CE2-related: Decoupling of SbTMVP and affine merge candidate derivation in subblock merge mode [Y.-L. Hsiao, T.-D. Chuang, C.-W. Hsu, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0168](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4975) CE2-related: Simplifications for inherited affine candidates [Y.-L. Hsiao, T.-D. Chuang, C.-W. Hsu, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0720](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5547) Crosscheck of JVET-M0168 (CE2-related: Simplifications for inherited affine candidates) [H. Chen, T. Solovyev (Huawei)] [late] [miss]

[JVET-M0192](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4999) CE2-related: MV Derivation for Affine Chroma [A. Tamse, M. W. Park, K. Choi (Samsung)]

[JVET-M0603](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5422) Crosscheck of JVET-M0192 (CE2-related: MV Derivation for Affine Chroma) [G. Li (Tencent)] [late] [miss]

[JVET-M0204](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5011) CE2-related: Simplification of ATMVP [M. Park, M. W. Park, S. Jeong, A. Tamse, K. Choi (Samsung)]

[JVET-M0594](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5413) Crosscheck of JVET-M0204 (CE2-related: Simplification of ATMVP) [T. Zhou, T. Ikai (Sharp)] [late]

[JVET-M0217](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5024) CE2-related: Constructed affine merge candidate simplification [L. Li, J Nam, N Park, H Jang, J Lim, S Kim (LGE)]

[JVET-M0719](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5546) Crosscheck of JVET-M0217 (CE2-related: Constructed affine merge candidate simplification) [H. Chen (Huawei)] [late] [miss]

[JVET-M0228](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5035) CE2-related: Affine mode simplifications [Y.-W. Chen, X. Wang (Kwai Inc.)]

[JVET-M0601](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5420) Crosscheck of JVET-M0228 (CE2-related: Affine mode simplifications) [T.-S. Chang, Y.-C. Sun, J. Lou (Alibaba)] [late]

[JVET-M0240](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5047) CE2-related: Simplification of subblock-based temporal merging candidates [H. Lee, S.-C. Lim, J. Lee, J. Kang, H. Y. Kim (ETRI)]

[JVET-M0620](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5440) Crosscheck of JVET-M0240 (CE2-related: Simplification of subblock-based temporal merging candidates) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0247](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5054) CE2 related: Joint test of AMVR for Affine Inter mode (Test 2.1.1 and Test 2.1.2) [H. Liu, K. Zhang, L. Zhang, J. Xu (Bytedance), D. Luo, Y. He, X. Xiu (InterDigital)]

[JVET-M0266](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5073) CE2-related: History-based affine merge candidates [K. Zhang, L. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0662](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5483) Crosscheck of JVET-M0266 (CE2-related: History-based affine merge candidates) [R.-L. Liao, C. S. Lim (Panasonic)] [late] [miss]

[JVET-M0268](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5075) Non-CE2: Interweaved Prediction for Affine Motion Compensation [K. Zhang, L. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0744](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5575) Crosscheck of JVET-M0268 (Non-CE2: Interweaved Prediction for Affine Motion Compensation) [J. Luo (InterDigital)] [late] [miss]

[JVET-M0270](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5077) CE2-related: An alternative storing method for affine inheritance [K. Zhang, L. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0572](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5385) Crosscheck of JVET-M0270 (CE2-related: An alternative storing method for affine inheritance) [G. Li (Tencent)] [late] [miss]

[JVET-M0273](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5080) CE2-related: Early awareness of accessing temporal blocks in sub-block merge list construction [L. Zhang, K. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0531](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5342) Crosscheck of JVET-M0273 (CE2-related: Early awareness of accessing temporal blocks in sub-block merge list construction) [R. Yu (Ericsson)] [late] [miss]

[JVET-M0310](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5117) CE2-related: Using shorter-tap filter for 4x4 sized partition [J. Li, R.-L. Liao, C. S. Lim (Panasonic)]

[JVET-M0311](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5118) CE2-related: Memory bandwidth reduction for affine mode with less dependency [J. Li, R.-L. Liao, C. S. Lim (Panasonic)]

[JVET-M0622](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5442) Crosscheck of JVET-M0311 (CE2-related: Memory bandwidth reduction for affine mode with less dependency) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0338](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5145) Non-CE2: Simplified derivation process for SbTMVP [H. Jang, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-M0535](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5347) Crosscheck of JVET-M0338 (Non-CE2: Simplified neighboring spatial coding unit derivation for SbTMVP) [R. Yu (Ericsson)] [late] [miss]

[JVET-M0343](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5150) Non-CE2: Simplified derivation process for SbTMVP [H. Jang, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-M0690](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5512) Cross check of JVET-M0343 [K. Misra (Sharp Labs of America)] [late]

[JVET-M0382](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5189) CE2-related: Modification of Triangle and MMVD merge indexes coding [G. Laroche, C. Gisquet, P. Onno, J. Taquet (Canon)]

[JVET-M0560](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5373) Crosscheck of JVET-M0382 (CE2-related: Modification of Triangle and MMVD merge indexes coding) [H. Lee, S.-C. Lim, J. Lee, J. Kang (ETRI)] [late] [miss]

[JVET-M0400](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5208) CE2-related: Worst-case memory bandwidth reduction for VVC [W.-J. Chien, L. Pham Van, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0665](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5486) Crosscheck of JVET-M0400 [S. Jeong, K. Choi (Samsung)] [late] [miss]

[JVET-M0406](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5214) CE2/4-related: Unified merge list size for block and sub-block merge modes [X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0576](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5390) Crosscheck of JVET-M0406 (CE2/4-related: Unified merge list size for block and sub-block merge modes) [C.-Y. Lai (MediaTek)] [late] [miss]

[JVET-M0432](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5241) CE2-related: Combination of CE2.2.3.d and affine inheritance from motion data line buffer [G. Li, X. Xu, X. Li, S. Liu (Tencent), J. Zhao, S. Kim (LGE)]

[JVET-M0740](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5571) Crosscheck of JVET-M0432 (CE2-related: Combination of CE2.2.3.d and affine inheritance from motion data line buffer) [A. Tamse (Samsung)] [late] [miss]

[JVET-M0434](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5243) CE2-related: Constraint on constructed affine merge candidates [G. Li, X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0546](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5359) Crosscheck of JVET-M0434 (CE2-related: Constraint on constructed affine merge candidates) [L. Zhang (Bytedance)] [late] [miss]

[JVET-M0462](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5271) CE2-related: 4x4 chroma affine motion compensation and motion vector rounding unification [L. Pham Van, W.-J. Chien, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0467](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5277) CE2-related: Symmetric MVD for Affine Bi-prediction Coding [J. Luo, Y. He (InterDigital)]

[JVET-M0490](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5300) CE2-related: Simplified context model for triangular prediction mode [M. Gao, X. Li, S. Liu (Tencent)]

[JVET-M0753](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5584) Crosscheck of JVET-M0490 (CE2-related: Simplified context model for triangular prediction mode) [R.-L. Liao, C. S. Lim (Panasonic)] [late] [miss]

[JVET-M0515](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5326) Non-CE2.5: ATMVP Collocated Block Derivation from History-based Candidate [C.-C. Chen, W.-J. Chien, Y. Zhang, C.-H. Hung, Y. Han, H. Huang, M. Karczewicz (Qualcomm)]

[JVET-M0746](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5577) Crosscheck of JVET-M0515 (Non-CE2.5: ATMVP Collocated Block Derivation from History-based Candidate) [J. Luo (InterDigital)] [late] [miss]

[JVET-M0526](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5337) CE2-related: Further simplification of ATMVP collocated block derivation [S.H. Wang (Peking University), X. Zheng (DJI), S.S. Wang, S.W. Ma (Peking University)] [late]

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[JVET-M0602](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5421) Cross-check of JVET-M0526: CE2-related: Further simplification of ATMVP collocated block derivation [S. Bandyopadhyay (InterDigital)] [late] [miss]

[JVET-M0702](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5524) CE2-related: Adaptive sub-block MV clip for affine blocks [X. Li, M. Gao, S. Liu (Tencent)] [late]

[JVET-M0756](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5587) CE2.2.7 related: Affine temporal constructed candidates without pruning [F. Galpin, A. Robert, F. Le Léannec, T. Poirier (Technicolor)] [late] [miss]

## CE3 related – Intra prediction and mode coding (47)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0044](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4845) Non-CE3: Alternative LM Chroma Implementation [S. Keating, K. Sharman (Sony)]

[JVET-M0045](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4846) Non-CE3: PDPC Restriction [S. Keating, K. Sharman (Sony)]

[JVET-M0561](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5374) Crosscheck of JVET-M0045 (Non-CE3: PDPC Restriction) [J. Lee, H. Lee, S.-C. Lim, J. Kang (ETRI)] [late]

[JVET-M0047](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4849) Non-CE3: Intra Angular Prediction and Modified PDPC Based on Two Reference Lines [D. Jiang, J. Lin, F. Zeng, C. Fang (Dahua)]

[JVET-M0048](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4850) Non-CE3: Modified Chroma Derived Mode [F. Zeng, J. Lin, D. Jiang, C. Fang (Dahua)]

[JVET-M0064](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4866) Non-CE3: CCLM table reduction and bit range control [Y. Yasugi, F. Bossen, E. Sasaki (Sharp)]

[JVET-M0548](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5361) Crosscheck of JVET-M0064 (Non-CE3: CCLM table reduction and bit range control) [C.-M. Tsai (MediaTek)] [late] [miss]

[JVET-M0065](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4867) Non-CE3: Intra chroma partitioning and prediction restriction [T. Zhou, T. Ikai (Sharp)]

[JVET-M0442](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5251) Crosscheck of JVET-M0065 (Non-CE3: Intra chroma partitioning and prediction restriction) [K. Zhang (Bytedance)] [late]

[JVET-M0093](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4896) Non-CE3: Improved robustness for calculation of cross-component linear model parameters [C. Helmrich (HHI)]

[JVET-M0095](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4899) Non-CE3: Intra simplifications [G. Van der Auwera, A. K. Ramasubramonian, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0676](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5497) Crosscheck of JVET-M0095 (Non-CE3: Intra simplifications) [P. Merkle (HHI)] [late]

[JVET-M0099](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4904) Non-CE3: Partial sorting for non-MPM modes [A. K. Ramasubramonian, G. Van der Auwera, T. Hsieh, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0658](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5479) Crosscheck of JVET-M0099 (Non-CE3: Partial sorting for non-MPM modes) [K. Choi (Samsung)] [late] [miss]

[JVET-M0100](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4905) CE3-related: DM-dependent chroma intra prediction modes [G. Rath, F. Urban, F. Racapé (Technicolor)]

[JVET-M0439](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5248) Crosscheck of JVET-M0100 (CE3-related: DM-dependent chroma intra prediction modes) [H. Liu (Bytedance)] [late] [miss]

[JVET-M0108](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4913) CE3-related: Reducing the number of reference samples and table size in LM Chroma process [E. François, T. Poirier, F. Le Léannec (Technicolor)]

[JVET-M0571](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5384) Crosscheck of JVET-M0108 (CE3-related: Reducing the number of reference samples and table size in LM Chroma process) [L. Zhang (Bytedance)] [late] [miss]

[JVET-M0643](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5463) Crosscheck of JVET-M0108 (CE3-related: Reducing the number of reference samples and table size in LM Chroma process) [P. Hanhart (InterDigital)] [late] [miss]

[JVET-M0122](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4926) Non-CE3: On block size restrictions for PDPC [A. Filippov, V. Rufitskiy, J. Chen (Huawei)]

[JVET-M0138](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4945) Non-CE3: Intra reference sample deblocking [Z. Zhang, K. Andersson, R. Sjöberg (Ericsson)]

[JVET-M0550](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5363) Crosscheck of JVET-M0138 (Non-CE3: Intra reference sample deblocking) [C.-M. Tsai (MediaTek)] [late] [miss]

[JVET-M0139](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4946) Non-CE3: History-based intra most probable modes derivation [Z. Zhang, P. Wennersten, R. Yu, J. Ström, R. Sjöberg (Ericsson)]

[JVET-M0639](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5459) Crosscheck of JVET-M0139 (Non-CE3: History-based intra most probable modes derivation) [B. Wang (Huawei)] [late] [miss]

[JVET-M0443](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5252) Crosscheck of JVET-M0139 (Non-CE3: History-based intra most probable modes derivation) [J. Li, L. Zhang (Bytedance)] [late] [miss]

[JVET-M0146](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4953) Non-CE3: MDLM template downsampling [P. Hanhart, Y. He (InterDigital)]

[JVET-M0733](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5562) Crosscheck of JVET-M0146 (Non-CE3: MDLM template downsampling) [C. Chevance (Technicolor)] [late]

[JVET-M0149](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4954) Non-CE3: On simplification of PDPC basic equation [A. Filippov, V. Rufitskiy, J. Chen (Huawei)]

[JVET-M0677](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5499) Crosscheck of JVET-M0149 (Non-CE3: simplification of PDPC basic equation) [F. Racapé (Technicolor)] [late] [miss]

[JVET-M0158](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4965) Non-CE3: LUT-free interpolation filters for intra prediction [A. Filippov, V. Rufitskiy, J. Chen (Huawei)]

[JVET-M0680](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5502) Crosscheck of JVET-M0158 (Non-CE3: LUT-free interpolation filters for intra prediction) [F. Racapé (Technicolor)] [late] [miss]

[JVET-M0169](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4976) CE3-related: Shared reference samples for multiple chroma intra CBs [Z.-Y. Lin, T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0715](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5539) Crosscheck of JVET-M0169 (CE3-related: Shared reference samples for multiple chroma intra CBs) [X. Ma (Huawei)] [late] [miss]

[JVET-M0191](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4998) CE3-related: Construction of non-MPM mode list in intra prediction [S. Cha, G. Lee, G. Kim, J. Han (Sejong University)]

[JVET-M0242](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5049) Crosscheck of JVET-M0191 (CE3-related: Construction of non-MPM mode list in intra prediction) [J. Lee, H. Lee, S.-C. Lim, J. Kang (ETRI)] [late]

[JVET-M0210](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5017) Non-CE3: Intra prediction information coding [J. Yao, J. Zhu, W. Cai, K. Kazui (Fujitsu)]

[JVET-M0758](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5589) Crosscheck of JVET-M0210 (Non-CE3: Intra prediction information coding) [C.-C. Kuo, C.-H. Yau, C.-C. Lin (ITRI)] [late] [miss]

[JVET-M0211](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5018) CE3-related: Fixed Reference Samples Design for CCLM [J.-Y. Huo, X.-W. Li, J.-L. Wang, Y.-Z. Ma, F.-Z. Yang (Xidian Univ.), S. Wan (NPU), Y.-F. Yu, Y. Liu (OPPO)]

[JVET-M0716](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5540) Crosscheck of JVET-M0211 (CE3-related:Fixed Reference Samples Design for CCLM) [X. Ma (Huawei)] [late] [miss]

[JVET-M0212](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5019) CE3-related: Improved reference samples range for MDLM [S. Wan (NPU), Q.-H.Ran, X.-W. Li, Y.-Z. Ma, J.-Y. Huo, F.-Z. Yang (Xidian Univ.), Y.-F. Yu, Y. Liu (OPPO)]

[JVET-M0717](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5541) Crosscheck of JVET-M0212 (CE3-related:Improved reference samples range for MDLM) [X. Ma (Huawei)] [late] [miss]

[JVET-M0213](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5020) CE3-related: Chroma intra candidates modification based on directional DM [Y.-Z. Ma, J.-L. Wang, X.-W. Li, J.-Y. Huo, F.-Z. Yang (Xidian Univ.), S. Wan (NPU), Y.-F. Yu, Y. Liu (OPPO)]

[JVET-M0718](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5542) Crosscheck of JVET-M0213 (CE3-related: Chroma intra candidates modification based on directional DM) [X. Ma (Huawei)] [late] [miss]

[JVET-M0214](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5021) CE3-related: Uniform Chroma intra candidates modification based on DM [Y.-Z. Ma, X.-W. Li, J.-L. Wang, J.-Y. Huo, F.-Z. Yang (Xidian Univ.), S. Wan (NPU), Y.-F. Yu, Y. Liu (OPPO)]

[JVET-M0219](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5026) CE3-related: Reduced number of reference samples for CCLM parameter calculation [J. Choi, J. Heo, S. Yoo, L. Li, J. Choi, J. Lim, S. Kim (LGE)]

[JVET-M0586](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5403) Crosscheck of JVET-M0219 (CE3-related: Reduced number of reference samples for CCLM parameter calculation) [K. Zhang (Bytedance)] [late] [miss]

[JVET-M0229](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5036) CE3-related: Simplification of LM Mode [[Y.-W. Chen](mailto:yiwenchen@kwai.com), [X. Wang (Kwai Inc.)](mailto:xianglinwang@kwai.com)]

[JVET-M0632](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5452) Crosscheck of JVET-M0229 (CE3-related: Simplification of LM Mode) [K. Abe (Panasonic)] [late] [miss]

[JVET-M0238](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5045) Non-CE3: Modification of PDPC [J. Lee, H. Lee, S.-C. Lim, J. Kang, H. Y. Kim (ETRI)]

[JVET-M0678](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5500) Crosscheck of JVET-M0238 (Non-CE3: Modification of PDPC) [S. Keating (Sony)] [late]

[JVET-M0239](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5046) Non-CE3: Modification of MPM derivation [J. Lee, H. Lee, S.-C. Lim, J. Kang, H. Y. Kim (ETRI)]

[JVET-M0609](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5429) Crosscheck of JVET-M0239 (Non-CE3: Modification of MPM derivation) [B. Wang (Huawei)] [late] [miss]

[JVET-M0258](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5065) CE3-related: Chroma intra candidates modification based on non-directional DM [J.-Y. Huo, J.-L. Wang, X.-W. Li, Y.-Z. Ma, F.-Z. Yang (Xidian Univ.), S. Wan (NPU), Y.-F. Yu, Y. Liu (OPPO)]

[JVET-M0274](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5081) CE3-related: Modified linear model derivation for CCLM modes [M. Wang, K. Zhang, L. Zhang, H. Liu, J. Xu, S. Wang (Bytedance), J. Li, S. Wang, W. Gao (Peking University)]

[JVET-M0641](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5461) Crosscheck of JVET-M0274 (CE3-related: Modified linear model derivation for CCLM modes) [E. François (Technicolor)] [late] [miss]

[JVET-M0295](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5102) CE3-related: Harmonization of MPM list construction [B. Wang, S. Esenlik, A.M. Kotra, H. Gao, J. Chen (Huawei)]

[JVET-M0324](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5131) CE3-related: Modified Chroma Intra Mode Coding [J. Park, B. Jeon (SKKU)]

[JVET-M0356](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5162) CE3-related: simplified calculation for CCLM parameters derivation [A. Filippov, X. Ma, V. Rufitskiy, H. Yang, J. Chen (Huawei)]

[JVET-M0679](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5501) Crosscheck of JVET-M0356 (CE3-related: On CCLM simplification) [F. Racapé (Technicolor)] [late] [miss]

[JVET-M0723](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5550) Crosscheck of JVET-M0356 (CE3-related: simplified calculation for CCLM parameters derivation) [G. Laroche, P. Onno (Canon)] [late] [miss]

[JVET-M0358](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5165) CE3-related: disabling PDPC based on availability of reference samples [V. Drugeon (Panasonic)]

[JVET-M0629](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5449) Crosscheck of JVET-M0358 (CE3-related: disabling PDPC based on availability of reference samples) [C. Rosewarne (Canon)] [late] [miss]

[JVET-M0365](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5172) Non-CE3: modified PDPC for horizontal and vertical modes [A. Filippov, V. Rufitskiy, J. Chen (Huawei)]

[JVET-M0383](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5190) Non-CE3: Table size reduction and bit width limitation for CCLM implementation [P. Onno, C. Gisquet, G. Laroche, J. Taquet (Canon)]

[JVET-M0741](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5572) Crosscheck of JVET-M0383 (Non-CE3: Table size reduction and bit width limitation for CCLM implementation) [A. Filippov, V. Rufitskiy (Huawei)] [late] [miss]

[JVET-M0384](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5191) Non-CE3: LM in the middle [C. Gisquet, G. Laroche, P. Onno, J. Taquet (Canon)]

[JVET-M0689](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5511) Crosscheck of JVET-M0384 (Non-CE3: LM in the middle) [J. Lainema (Nokia)] [late] [miss]

[JVET-M0391](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5199) CE3-related: Improvements on the Decoder-side Intra Mode Derivation [M. Abdoli, E. Mora, T. Guionnet, M. Raulet (ATEME)]

[JVET-M0651](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5472) Crosscheck of JVET-M0391 (CE3-related: Improvements on the Decoder-side Intra Mode Derivation) [F. Henry, G. Clare (Orange)] [late] [miss]

[JVET-M0392](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5197) Non-CE3: Extended Mode-Dependent Intra Smoothing [A. Filippov, V. Rufitskiy, J. Chen (Huawei)]

[JVET-M0426](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5235) CE3-related: Improvement on the Intra Sub-Partitions Coding Mode [S. De-Luxán-Hernández, V. George, J. Ma, T. Nguyen, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

[JVET-M0458](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5267) Non-CE3: Combined-Hypothesis Intra-Prediction [[G. Kulupana](mailto:gosala.kulupana@bbc.co.uk), [A. Seixas Dias](mailto:andre.seixasdias@bbc.co.uk), [S. Blasi (BBC)](mailto:saverio.blasi@bbc.co.uk)]

[JVET-M0613](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5433) Crosscheck of JVET-M0458 (Non-CE3: Combined-Hypothesis Intra-Prediction) [S. De-Luxán-Hernández (HHI)] [late] [miss]

[JVET-M0478](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5288) Non-CE3: PDPC extension [G. Van der Auwera, A. K. Ramasubramonian, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0682](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5504) Crosscheck of JVET-M0478 (Non-CE3: PDPC extension) [F. Racapé (Technicolor)] [late] [miss]

[JVET-M0493](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5303) CE3-related: Simplified look-up table for CCLM mode [L. Zhao, X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0624](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5444) Crosscheck of JVET-M0493 (CE3-related: Simplified look-up table for CCLM mode) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0494](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5304) CE3-related: Modifications on MPM list generation [L. Zhao, X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0745](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5576) Crosscheck of JVET-M0494 (CE3-related: Modifications on MPM list generation) [J. Luo (InterDigital)] [late] [miss]

[JVET-M0524](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5335) CE3/6-related: Unification of RQT-like transform partitioning for intra and inter blocks [H. Egilmez, V. Seregin, A. Said, M. Karczewicz (Qualcomm)]

[JVET-M0528](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5339) Non-CE3: A unified luma intra mode list construction process [F. Bossen, K. Misra (Sharp Labs of America)]

[JVET-M0626](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5446) Crosscheck of JVET-M0528 (Non-CE3: A unified luma intra mode list construction process) [J. Yao (Fujitsu)] [late] [miss]

[JVET-M0653](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5473) Non-CE3: Harmonization of integer-slope directional modes without interpolation filtering process [A. Filippov, V. Rufitskiy, J. Chen (Huawei)] [late] [miss]

## CE4 related – Inter prediction and motion vector coding (48)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0067](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4869) Non-CE4: Weighted prediction with BDOF and bi-prediction with CU weights harmonization [T. Hashimoto, T. Chujoh, T. Ikai, E. Sasaki (Sharp)]

[JVET-M0394](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5201) Crosscheck of JVET-M0067 (Non-CE4: Weighted prediction with BDOF and bi-prediction with CU weights harmonization) [P. Bordes (Technicolor)] [late]

[JVET-M0068](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4870) Non-CE4: MMVD scaling fix [E. Sasaki, T. Ikai (Sharp)]

[JVET-M0509](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5320) Crosscheck of JVET-M0068 (Non-CE4: MMVD scaling fix) [X. Chen (HiSilicon)] [late] [miss]

[JVET-M0069](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4871) Non-CE4: Syntax change of MMVD [E. Sasaki, T. Chujoh, T. Ikai (Sharp)]

[JVET-M0554](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5367) Crosscheck of JVET-M0069 (Non-CE4: Syntax change of MMVD) [G. Li (Tencent)] [late] [miss]

[JVET-M0585](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5402) Crosscheck of JVET-M0069 (Non-CE4: Syntax change of MMVD) [K. Zhang (Bytedance)] [late] [miss]

[JVET-M0081](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4884) Non-CE4: Simplification of AMVP list generation in AMVR [Y. Kato, K. Abe, T. Toma (Panasonic)]

[JVET-M0111](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4916) AHG13: On bi-prediction with weighted averaging and weighted prediction [Y. Ye, J. Chen, M. Yang (Alibaba), P. Bordes, E. François (Technicolor)]

[JVET-M0117](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4922) CE4-related: On MVP candidate list generation for AMVP [R. Yu, D. Liu, K. Andersson, P. Wennersten, J. Ström, R. Sjöberg (Ericsson)]

[JVET-M0763](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5594) Cross-check of JVET-M0117 [?? (??)] [late] [miss]

[JVET-M0127](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4932) CE4-related: Modification on Merge List [Y. Han, W.-J. Chien, D. Rusanovskyy, Y.-H. Chao, C.-C. Chen, H. Wang, H. Huang, C.-H. Hung, Y. Zhang, M. Karczewicz (Qualcomm)]

[JVET-M0532](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5344) Crosscheck of JVET-M0127 (CE4-related: Modification on Merge List) [H. Dou, Z. Deng, L. Xu (Intel)] [late] [miss]

[JVET-M0171](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4978) CE4-related: MMVD cleanups [C.-Y. Lai, T.-D. Chuang, Y.-L. Hsiao, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0757](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5588) Cross-check of JVET-M0171 (CE4-related: MMVD cleanups) [B.-J. Fuh, C.-H. Yau, C.-C. Lin (ITRI)] [late] [miss]

[JVET-M0193](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5000) CE4-related: Pairwise Average Candidate Reduction [A. Tamse, M. W. Park, K. Choi (Samsung)]

[JVET-M0551](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5364) Crosscheck of JVET-M0193 (CE4-related: Pairwise average candidate reduction) [S.-T. Hsiang (MediaTek)] [late] [miss]

[JVET-M0206](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5013) CE4-related: MMVD improvements [S. Jeong, M. W. Park, K. Choi (Samsung)]

[JVET-M0595](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5414) Crosscheck of JVET-M0206 (CE4-related: MMVD improvements) [T. Hashimoto, T. Ikai (Sharp)] [late] [miss]

[JVET-M0220](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5027) Non-CE4: Subjective quality analysis of non-sub-block ATMVP [Y.-H Chao, W.-J Chien, M. Karczewicz (Qualcomm)]

[JVET-M0230](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5037) CE4-related: Temporal MV buffer reduction [[Y.-W. Chen](mailto:yiwenchen@kwai.com), [X. Wang (Kwai Inc.)](mailto:xianglinwang@kwai.com)]

[JVET-M0591](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5410) Crosscheck of JVET-M0230 (Non-CE4: Temporal MV buffer reduction) [T. Zhou, T. Ikai (Sharp)] [late]

[JVET-M0231](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5038) CE4-related: Regular merge flag coding [X. Wang, Y.-W. Chen (Kwai Inc.)]

[JVET-M0559](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5372) Crosscheck of JVET-M0231 (Non-CE4: Regular merge flag coding) [H. Lee, S.-C. Lim, J. Lee, J. Kang (ETRI)] [late] [miss]

[JVET-M0264](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5071) Non-CE4: Harmonization between HMVP and GBi [J. Li, S. Wang, W. Gao (Peking University), L. Zhang, K. Zhang, H. Liu, J. Xu (Bytedance), X. Xiu, D. Luo, Y. He (InterDigital)]

[JVET-M0574](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5388) Crosscheck of JVET-M0264 (Non-CE4: Harmonization between HMVP and GBi) [J. Zhao (LGE)] [late]

[JVET-M0267](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5074) Non-CE4: Harmonization of MMVD and AMVR [K. Zhang, L. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0599](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5418) Crosscheck of JVET-M0267 (Non-CE4: Harmonization of MMVD and AMVR) [T. Hashimoto, T. Ikai (Sharp)] [late] [miss]

[JVET-M0272](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5079) CE4-related: Restrictions on History-based Motion Vector Prediction [L. Zhang, K. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0642](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5462) Crosscheck of JVET-M0272 on CE4-related: Restrictions on History-based Motion Vector Prediction [X. Li (Tencent)] [late] [miss]

[JVET-M0286](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5093) Non-CE4: Simplifications for triangular prediction mode [T. Solovyev, S. Esenlik, S. Ikonin, J. Chen (Huawei)]

[JVET-M0300](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5107) CE4-related: HMVP and parallel processing with tiles and tile groups [A. M. Kotra, J. Chen, B. Wang, S. Esenlik, H. Gao (Huawei)]

[JVET-M0307](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5114) CE4-related: Candidates optimization on MMVD [N. Park, H. Jang, J. Nam, J. Lim, S. Kim (LGE)]

[JVET-M0621](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5441) Crosscheck of JVET-M0307 (CE4-related: Candidates optimization on MMVD) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0308](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5115) Non-CE4: MMVD simplification [X. Chen, J. Zheng (HiSilicon)]

[JVET-M0592](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5411) Crosscheck of JVET-M0308 (Non-CE4: MMVD simplification) [T. Hashimoto, T. Ikai (Sharp)] [late]

[JVET-M0314](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5121) CE4-related: MMVD improving with signaling distance table [J. Li, R.-L. Liao, C. S. Lim (Panasonic)]

[JVET-M0597](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5416) Crosscheck of JVET-M0314 (CE4-related: MMVD improving with signaling distance table) [T. Hashimoto, T. Ikai (Sharp)] [late] [miss]

[JVET-M0315](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5122) Non-CE4: MMVD scaling simplification [J. Li, R.-L. Liao, C. S. Lim (Panasonic)]

[JVET-M0330](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5137) CE4-related: Simplification of MMVD scheme [L. Xu, F. Chen, L. Wang (Hikvision)]

[JVET-M0590](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5409) Crosscheck of JVET-M0330 (CE4-related: Simplification of candidate list derivation for MMVD mode) [T. Hashimoto, T. Ikai (Sharp)] [late] [miss]

[JVET-M0345](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5152) CE4-related: Remove redundancy between TMVP and ATMVP [S. H. Wang (Peking University), X. Zheng (DJI), S.S. Wang, S.W. Ma (Peking University)]

[JVET-M0754](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5585) Cross-check of JVET-M0345: CE4-related: Remove redundancy between TMVP and ATMVP [S. Bandyopadhyay (InterDigital)] [late] [miss]

[JVET-M0346](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5153) CE4-related: Non-square compression grid for temporal motion data storage [S. H. Wang (Peking University), X. Zheng (DJI), S.S. Wang, S.W. Ma (Peking University)]

[JVET-M0348](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5155) CE4-related: Improvement on 4x4 bi-prediction [X. W. Meng (Peking University), X. Zheng (DJI), S.S. Wang, S.W. Ma (Peking University)]

[JVET-M0350](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5157) CE4-related: Quadtree-based Merge Estimation Region for VVC [T. L. Fu (Peking University), X. Zheng (DJI), S.S Wang, S.W. Ma (Peking University)]

[JVET-M0583](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5400) Crosscheck of JVET-M0350 (CE4-related: Quadtree-based Merge Estimation Region for VVC) [G. Li (Tencent)] [late] [miss]

[JVET-M0359](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5166) Non-CE4: Modification of merge data syntax [G. Ko, D. Kim, J. Jung, J. Son, J. Kwak (WILUS)]

[JVET-M0369](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5176) CE4-related: Syntax changes of merge data [Y. Ahn, D. Sim (Digital Insights)] [late]

[JVET-M0750](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5581) Cross-check of JVET-M0369 (CE4-related: Syntax changes of merge data) [S.-C. Lim, H. Lee, J. Lee, J. Kang (ETRI)] [late] [miss]

[JVET-M0405](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5213) CE4-related: Simplified merge candidate list for small blocks [X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0659](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5480) Crosscheck of JVET-M0405 (CE4-related: Simplified merge candidate list for small blocks) [K. Choi (Samsung)] [late] [miss]

[JVET-M0406](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5214) CE2/4-related: Unified merge list size for block and sub-block merge modes [X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0422](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5231) CE4-related: Simplified MVD coding [X. Li, X. Xu, X. Zhao, S. Liu (Tencent)]

[JVET-M0440](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5249) Crosscheck of JVET-M0422 (CE4-related: Simplified MVD coding) [L. Zhang (Bytedance)] [late] [miss]

[JVET-M0433](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5242) CE4-related: Constraint on GBi index inheritance in Merge Mode [G. Li, X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0700](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5522) Cross-check of JVET-M0433 (CE4-related: Constraint on GBi index inheritance in Merge Mode [J. Zhao (LGE)]

[JVET-M0435](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5244) CE4-related: MMVD offset table signaling [G. Li, X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0623](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5443) Crosscheck of JVET-M0435 (CE4-related: MMVD offset table signaling) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0436](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5245) AHG2: Regarding HMVP Table Size [J. Zhao, S. Kim (LGE)]

[JVET-M0562](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5375) Cross-check of JVET-M0436: AHG2: Regarding HMVP Table Size [S. Bandyopadhyay (InterDigital)] [late] [miss]

[JVET-M0437](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5246) Non-CE4: Size constraint on MMVD [J. Zhao, S. Kim (LGE)]

[JVET-M0555](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5368) Crosscheck of JVET-M0437 (Non-CE4: Size constraint on MMVD) [G. Li (Tencent)] [late]

[JVET-M0444](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5253) CE4-related: Simplified symmetric MVD based on CE4.4.3 [J. Luo, Y. He (InterDigital)]

[JVET-M0721](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5548) Crosscheck of JVET-M0444 (CE4-related: Simplified symmetric MVD based on CE4.4.3) [H. Chen, T. Solovyev (Huawei)] [late] [miss]

[JVET-M0448](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5257) CE4-related: Triangle merge index signaling [M. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0473](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5283) Simplified HMVP [W. Zhu, A. Segall (Sharp)]

[JVET-M0479](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5289) Non-CE4: On clipping of scaled motion vectors [K. Misra, F. Bossen (Sharp)]

[JVET-M0484](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5294) Non-CE4: Line buffer size reduction method for generalized bi prediction [T. Solovyev, H. Gao, S. Esenlik, S. Ikonin, J. Chen (Huawei)]

[JVET-M0502](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5312) CE4-related: Improved context for prediction mode flag [X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0657](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5478) Crosscheck of JVET-M0502 (CE4-related: Improved context for prediction mode flag) [K. Choi (Samsung)] [late] [miss]

[JVET-M0507](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5318) CE4-related: Hybrid Merge Estimation Region [H. Wang, V. Seregin, W.-J. Chien, T. Hsieh, Y. Han, M. Karczewicz (Qualcomm)]

[JVET-M0712](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5535) Crosscheck of JVET-M0507 (CE4-related: Hybrid Merge Estimation Region) [F. Chen, L. Wang (Hikvision)] [late] [miss]

[JVET-M0512](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5323) Non-CE4: On Temporal Motion Buffer Compression [F. Bossen, K. Misra, A. Segall (Sharp Labs of America)]

[JVET-M0764](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5595) Cross-check of JVET-M0512 [?? (??)] [late] [miss]

[JVET-M0518](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5329) CE4-related: Supplemental results on STMVP design of CE4.2.3.a and combination with methods of JVET-M0127 (CE4.1.2.a) and JVET-M0127 [D. Rusanovskyy, Y.-H. Chao, Y. Han, W.-J. Chien, M. Karczewicz (Qualcomm)]

[JVET-M0625](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5445) Crosscheck of JVET-M0518 (CE4-related: Supplemental results on STMVP design of CE4.2.3.a and combination with methods of JVET-M0127 (CE4.1.2.a) and JVET-M0127) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0627](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5447) Non-CE4: Supplementary results of combined solution of JVET-M0255, JVET-M0267 and JVET-M0069 [H. Liu, K. Zhang, L. Zhang (Bytedance), E. Sasaki, T. Chujoh, T. Ikai (Sharp)] [late] [miss]

[JVET-M0726](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5555) Cross-check of JVET-M0255 (AHG11: MMVD without Fractional Distances for SCC) [A. Karabutov (Huawei)] [late]

[JVET-M0661](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5482) AhG-13: On Merge List Size [X. Li, X. Xu, S. Liu (Tencent)] [late]

[JVET-M0713](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5536) CE4-related: simplification of CE4.2.2 [F. Le Léannec, A. Robert, T. Poirier (Technicolor)] [late]

## CE5 related – Arithmetic coding engine (4)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0089](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4892) Non-CE5: CABAC skip mode for super low delay [K. Abe, T. Toma (Panasonic)]

[JVET-M0344](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5151) Crosscheck of JVET-M0089 (Non-CE5: CABAC skip mode for super low delay) [R. Hashimoto (Renesas)]

[JVET-M0196](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5003) CE5-related: Counter-based multi-CABAC for partial context models [Y. Piao, K. Choi (Samsung)]

[JVET-M0545](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5358) Crosscheck of JVET-M0196 (CE5-related: Counter-based multi-CABAC for partial context models) [J. Dong (Qualcomm)] [late]

[JVET-M0389](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5196) CE5-related: Minor optimizations for increasing the throughput of CE5.1.5 and CE5.1.6 [H. Kirchhoffer, C. Bartnik, P. Haase, T. Hinz, S. Matlage, B. Stabernack, J. Stegemann, D. Marpe, H. Schwarz, T. Wiegand (HHI)]

[JVET-M0395](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5202) CE5-related: Alternative implementation of CABAC range sub-interval derivation for CE5.1.5, CE5.1.6 and CE5.1.7 [P. Haase, H. Kirchhoffer, S. Matlage, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

[JVET-M0772](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5603) CE5-related: Clean up of the context model initialization process for CE5.1.5 and CE5.1.6 [J. Stegemann, H. Kirchhoffer, D. Marpe, H. Schwarz, T. Wiegand (HHI)] [late]

## CE6 related – Transforms and transform signalling (25)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0046](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4848) CE6-related: A study of primary transforms [M. Zhou, Y. Hu (Broadcom)]

[JVET-M0465](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5274) Cross-check of JVET-M0046: CE6-related: A study of primary transforms [S. Bandyopadhyay (InterDigital)]

[JVET-M0072](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4874) Non-CE6: On transform skip for larger block [T. Tsukuba, M. Ikeda, T. Suzuki (Sony)]

[JVET-M0748](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5579) Crosscheck of JVET-M0072, in aspect of 8x8 transform skip extension (Non-CE6: On transform skip for lager block) [S. Yoo, J.Lim (LGE)] [late]

[JVET-M0637](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5457) Crosscheck of JVET-M0072 (Non-CE6: On transform skip for lager block) [[T. Toma](mailto:toma.tadamasa@jp.panasonic.com), K. Abe (Panasonic)] [late] [miss]

[JVET-M0085](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4888) CE6-related: Fast algorithm for DST-4/DCT-4 as alternative transforms for MTS [T. Toma, K. Abe (Panasonic), M. Ikeda, T. Tsukuba (Sony)]

[JVET-M0201](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5008) CE6-related: Syntax clean-up related to MTS [K. Choi, M. Park, M. W. Park, W. Choi (Samsung)]

[JVET-M0671](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5492) Crosscheck of JVET-M0201 (CE6-related: Syntax clean-up related to MTS) [X. Cao (Hikvision)] [late] [miss]

[JVET-M0202](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5009) CE6-related: Simplification related to MTS with reduced modes [K. Choi, M. Park, M. W. Park, W. Choi (Samsung)]

[JVET-M0672](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5493) Crosscheck of JVET-M0202 (CE6-related: Simplification related to MTS with reduced modes) [X. Cao (Hikvision)] [late] [miss]

[JVET-M0269](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5076) Non-CE6: Extension of transform skip block size to 8x8 [S. Yoo, J. Choi, J. Heo, J. Choi, L. Li, J. Lim, S. Kim (LGE)]

[JVET-M0709](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5532) Crosscheck of JVET-M0269 (Non-CE6: Extension of transform skip block size to 8x8) [T. Tsukuba (Sony)] [late] [miss]

[JVET-M0275](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5082) Non-CE6: On transform skip conditions [S. Yoo, J. Choi, J. Heo, J. Choi, L. Li, J. Lim, S. Kim (LGE)]

[JVET-M0280](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5087) CE6-related: Context selection for entropy coding the MTS flag [S.-T. Hsiang, S.-M. Lei (MediaTek)]

[JVET-M0738](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5569) Crosscheck of JVET-M0280 (CE6-related: Context selection for entropy coding the MTS flag) [A. Tamse (Samsung)] [late] [miss]

[JVET-M0297](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5104) CE6-related: 32 point MTS based on skipping high frequency coefficients [M. Koo, M. Salehifar, J. Lim, S. Kim (LGE)]

[JVET-M0304](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5111) CE6-related: 2-mode MTS with shape adaptive transform selection [J. Lainema (Nokia)]

[JVET-M0340](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5147) CE6-related: Simplification on MTS for intra residual coding [X. Cao, F. Chen, L.Wang (Hikvision)]

[JVET-M0654](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5475) Crosscheck of JVET-M0340 (CE6-related: Simplification on MTS for intra residual coding) [K. Choi (Samsung)] [late] [miss]

[JVET-M0347](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5154) CE6-related: On MTS CU flag coding [X. Cao, F. Chen, L. Wang (Hikvision)]

[JVET-M0655](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5476) Crosscheck of JVET-M0347 (CE6-related: Simplification on MTS CU flag coding) [K. Choi (Samsung)] [late] [miss]

[JVET-M0354](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5161) CE6-related: MTS with Haar transform for Screen Contents Coding [K. Naser, F. Galpin, T. Poirier (Technicolor)]

[JVET-M0361](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5168) Non-CE6: Mismatch between text specification and reference software on the signalling root CBF [J. Jung, D. Kim, G. Ko, J. Son, J. Kwak (WILUS)]

[JVET-M0366](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5173) CE6 related: Transform Simplification [C. Hollman, D. Saffar, P. Wennersten, J. Ström (Ericsson)]

[JVET-M0379](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5186) CE6-related: Further Simplification on top of CE6-2.2 [K. Naser, E. François, F. Le Léannec (Technicolor)]

[JVET-M0638](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5458) Crosscheck of JVET-M0379 (CE6-related: Further Simplification on top of tests CE6-2.2) [T. Toma, K. Abe (Panasonic)] [late] [miss]

[JVET-M0396](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5203) CE6-related: MTS kernel derivation for efficient memory usage [S. Shrestha, A. Kumar, B. Lee (Chosun Univ), Y. Lee, J. Park (Humax)] [late] [miss]

Initial upload rejected as a placeholder.

[JVET-M0773](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5604) Crosscheck of JVET-M0396 (“CE6-related: MTS kernel derivation for efficient memory usage”) [J. Jung, D. Kim, G. Ko, J. Son, J. Kwak (WILUS)] [late] [miss]

[JVET-M0397](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5204) CE6-related: DST-3 based transform kernels derivation [S. Shrestha, A. Kumar, B. Lee (Chosun Univ.), Y. Lee, J. Park (Humax)]

[JVET-M0398](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5205) CE6-related Further simplification of CE6-1.5 [P. Philippe (bcom Orange)]

[JVET-M0480](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5290) CE6-related: Implicit transform selection for Multi directional LM [S. Iwamura, S. Nemoto, A. Ichigaya (NHK)]

[JVET-M0573](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5387) Crosscheck of JVET-M0480 (CE6-related: Implicit transform selection for Multi directional LM) [K. Kazui (Fujitsu)] [late] [miss]

[JVET-M0482](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5292) CE6-related: Implicit transform selection for Multi-hypothesis inter-intra mode [S. Iwamura, S. Nemoto, A. Ichigaya (NHK)]

[JVET-M0569](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5382) Crosscheck of JVET-M0482 (CE6-related: Implicit transform selection for Multi-hypothesis inter-intra mode) [T. Chujoh (Sharp)] [late]

[JVET-M0501](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5311) CE6 related: Unification of Transform Skip mode and MTS [X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0656](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5477) Crosscheck of JVET-M0501 (CE6 related: Unification of Transform Skip mode and MTS) [K. Choi (Samsung)] [late] [miss]

[JVET-M0524](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5335) CE3/6-related: Unification of RQT-like transform partitioning for intra and inter blocks [H. Egilmez, V. Seregin, A. Said, M. Karczewicz (Qualcomm)]

[JVET-M0539](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5351) CE6-related: Efficient computation of MTS transform combinations [A. Said, H.E. Egilmez, Y.-H. Chao, V. Seregin, M. Karczewicz (Qualcomm)] [late]

[JVET-M0540](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5352) CE6-related: Software tool for computing transform throughput [A. Said, H.E. Egilmez, Y.H. Chao, V. Seregin, M. Karczewicz (Qualcomm)] [late]

## CE7 related – Quantization and coefficient coding (19)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0107](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4912) CE7-related: reduced local neighborhood usage for transform coefficients coding [F. Le Léannec, Y. Chen (Technicolor)]

[JVET-M0113](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4918) CE7-related: Quantization Group size uniformity [P. de Lagrange, E. François, P. Bordes (Technicolor)]

[JVET-M0114](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4919) CE7-related: implicit QP-offset based on block size [P. de Lagrange, E. François, F. Le Léannec (Technicolor)]

[JVET-M0119](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4924) CE7-related: Modified dequantization scaling [K. Sharman, S. Keating (Sony)]

[JVET-M0198](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5005) CE7-related: Unified Rice parameter derivation for coefficient level coding [Y. Piao, K. Choi (Samsung)]

[JVET-M0668](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5489) Crosscheck of JVET-M0198 (CE7-related: Unified rice parameter derivation for coefficient level coding) [M. Coban (Qualcomm)] [late] [miss]

[JVET-M0250](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5057) Non-CE7: Simplified CSBF coding for large block-size transforms [J. Choi, J. Heo, S. Yoo, J. Choi, L. Li, J. Lim, S. Kim (LGE)]

[JVET-M0760](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5591) Crosscheck of JVET-M0250 (Non-CE7: Simplified CSBF coding for large block-size transforms) [Z.-Y. Lin (MediaTek)] [late] [miss]

[JVET-M0251](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5058) Non-CE7: Last position coding for large block-size transforms [J. Choi, J. Heo, S. Yoo, J. Choi, L. Li, J. Lim, S. Kim (LGE)]

[JVET-M0646](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5467) Crosscheck of JVET-M0251 (Non-CE7: Last position coding for large block-size transforms) [H. Schwarz (Fraunhofer HHI)] [late] [miss]

[JVET-M0257](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5064) CE7-related: coefficient scanning and last position coding for TUs of greater than 32 width or height [M. Coban, M. Karczewicz (Qualcomm)]

[JVET-M0761](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5592) Crosscheck of JVET-M0257 (CE7-related: coefficient scanning and last position coding for TUs of greater than 32 width or height) [Z.-Y. Lin (MediaTek)] [late]

[JVET-M0278](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5085) Non-CE7: Residual rearrangement for transform skipped blocks [S. Yoo, J. Choi, J. Heo, J. Choi, L. Li, J. Lim, S. Kim (LGE)]

[JVET-M0683](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5505) Crosscheck of JVET-M0278 (Non-CE7: Residual rearrangement for transform skipped blocks) [Y.-C. Lin (MediaTek)] [late] [miss]

[JVET-M0279](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5086) Non-CE7: Sign coding for transform skip [S. Yoo, J. Choi, J. Heo, J. Choi, L. Li, J. Lim, S. Kim (LGE)]

[JVET-M0649](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5470) Crosscheck of JVET-M0279 (Non-CE7: Sign coding for transform skip) [F. Henry, G. Clare (Orange)] [late] [miss]

[JVET-M0305](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5112) CE7-related: Joint coding of chrominance residuals [J. Lainema (Nokia)]

[JVET-M0688](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5510) Cross-check of JVET-M0305, "CE7-related: Joint coding of chrominance residuals" [C. Gisquet (Canon)] [late] [miss]

[JVET-M0318](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5125) CE7-related: QP prediction and neighbour availability [P. de Lagrange, P. Bordes (Technicolor)]

[JVET-M0469](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5279) CE7-related: unified Rice parameter derivation for coefficient coding [M. Karczewicz, M. Coban (Qualcomm)]

[JVET-M0647](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5468) Crosscheck of JVET-M0469 (CE7-related: unified Rice parameter derivation for coefficient coding) [H. Schwarz (Fraunhofer HHI)] [late] [miss]

[JVET-M0470](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5280) CE7-related: Golomb-Rice/exponential Golomb coding for abs\_remainder and dec\_abs\_level syntax elements [M. Coban, M. Karczewicz (Qualcomm)]

[JVET-M0489](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5299) CE7-related: Reduced context models for transform coefficients coding [M. Gao, X. Li, X. Zhao, S. Liu (Tencent)]

[JVET-M0697](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5519) Cross-check of JVET-M0489 "CE7-related: Reduced context models for transform coefficients coding" [Y. Chen, F. Le Léannec (Technicolor)] [late] [miss]

[JVET-M0491](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5301) CE7-related: Reduced maximum number of context-coded bins for transform coefficient coding [M. Gao, X. Li, X. Zhao, S. Liu (Tencent)]

[JVET-M0684](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5506) Crosscheck of JVET-M0491 (CE7-related: Reduced maximum number of context-coded bins for transform coefficient coding) [Y.-C. Lin (MediaTek)] [late] [miss]

[JVET-M0513](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5324) CE7-related: Context modeling of pred\_mode\_flag [Y. Zhao, S. Hong, H. Yang, J. Chen (Huawei)]

[JVET-M0558](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5371) CE7-related: Template based Rice parameter derivation [M. Karczewicz (Qualcomm)] [late]

[JVET-M0660](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5481) Crosscheck of JVET-M0558 [Y. Piao, K. Choi (Samsung)] [late]

[JVET-M0685](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5507) Non-CE7: On derivation of quantization parameter predictor [K. Misra, A. Segall (Sharp Labs of America)] [late]

## CE8 related – Screen content coding tools (28)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0151](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4958) CE8-related: Virtual search area for current picture referencing (CPR) [L. Pham Van, T. Hsieh, W.-J. Chien, V. Seregin, H. Wang, M. Karczewicz (Qualcomm)]

[JVET-M0174](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4981) CE8-related: Removal of subblock-based chroma MC in CPR [C.-Y. Lai, T.-D. Chuang, Y.-L. Hsiao, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0769](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5600) Crosscheck of JVET-M0174 (CE8-related: Removal of subblock-based chroma MC in CPR) [T.-S. Chang, Y.-C. Sun, J. Lou (Alibaba)] [late] [miss]

[JVET-M0175](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4982) CE8-related: Clarification on interaction between CPR and other inter coding tools [C.-Y. Lai, T.-D. Chuang, Y.-L. Hsiao, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0770](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5601) Crosscheck of JVET-M0175 (CE8-related: Clarification on interaction between CPR and other inter coding tools) [T.-S. Chang, Y.-C. Sun, J. Lou (Alibaba)] [late] [miss]

[JVET-M0253](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5060) Non-CE8: Hash-based Motion Search [J. Xu, J. Li, K. Zhang, L. Zhang (Bytedance), R. Xiong (Peking University)]

[JVET-M0704](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5527) Crosscheck for JVET-M0253: Non-CE8: Hash-based Motion Search [X. Xu (Tencent)] [late] [miss]

[JVET-M0254](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5061) Non-CE8: Subblock Operation Removal for Chroma CPR [J. Xu, K. Zhang, L. Zhang, H. Liu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0255](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5062) AHG11: MMVD without Fractional Distances for SCC [H. Liu, L. Zhang, K. Zhang, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0325](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5132) CE8-related: CPR with previous CTU availability at frame and tile edge [C. Rosewarne, A. Dorrell (Canon)] [late] [miss]

Initial upload rejected as a placeholder.

[JVET-M0326](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5133) CE8-related: Remove the redundancy of CPR-related syntax coding [S. Ye, F. Chen, L. Wang (Hikvision)]

[JVET-M0615](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5435) Crosscheck of JVET-M0326 (CE8-related: Remove the redundancy of CPR-related syntax coding) [Y.-C. Sun (Alibaba)] [late] [miss]

[JVET-M0327](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5134) CE8-related: A new CPR syntax scheme [S. Ye, F. Chen, L. Wang (Hikvision)]

[JVET-M0616](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5436) Crosscheck of JVET-M0327 (CE8-related: A new CPR syntax scheme) [Y.-C. Sun (Alibaba)] [late] [miss]

[JVET-M0333](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5140) Non-CE8: Coding on block vector difference [J. Nam, J. Lim, S. Kim (LGE)]

[JVET-M0705](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5528) Crosscheck for JVET-M0333: Non-CE8: Coding on block vector difference [X. Xu (Tencent)] [late] [miss]

[JVET-M0334](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5141) Non-CE8: Removal of redundant syntax between CPR and other inter coding tools [J. Nam, J. Lim, S. Kim (LGE)]

[JVET-M0767](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5598) Crosscheck of JVET-M0334 (Non-CE8: Removal of redundant syntax between CPR and other inter coding tools) [X. Xu (Tencent)] [late] [miss]

[JVET-M0335](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5142) Non-CE8: modification on SbTMVP process regarding with CPR [H. Jang, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-M0706](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5529) Crosscheck for JVET-M0335 Non-CE8: modification on SbTMVP process regarding with CPR [X. Xu (Tencent)] [late] [miss]

[JVET-M0341](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5148) Non-CE8: MMVD harmonization with CPR [H. Jang, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-M0768](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5599) Crosscheck of JVET-M0341 (Non-CE8: MMVD harmonization with CPR) [X. Xu (Tencent)] [late] [miss]

[JVET-M0393](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5200) Non-CE8: chroma block vector initialization for CPR in dual tree [T. Poirier, F. Le Léannec, F. Galpin (Technicolor)]

[JVET-M0751](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5582) Crosscheck for JVET-M0393: Non-CE8: chroma block vector initialization for CPR in dual tree [X. Xu (Tencent)] [late] [miss]

[JVET-M0402](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5210) Non-CE8: Proposed Cleanup for Current Picture Referencing [B. Heng, M. Zhou, W. Wan (Broadcom)]

[JVET-M0409](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5217) Non-CE8: Mismatch between text specification and reference software on ATMVP candidate derivation when CPR is enabled [X. Xu, X. Li, S. Liu (Tencent), W.-J. Chien, M. Karczewicz (Qualcomm)]

[JVET-M0732](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5561) Crosscheck of JVET-M0409 (Non-CE8: Mismatch between text specification and reference software on ATMVP candidate derivation when CPR is enabled) [T.-S. Chang, Y.-C. Sun, J. Lou (Alibaba)] [late]

[JVET-M0410](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5218) Non-CE8: CPR flag signaling at slice level [X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0670](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5491) Crosscheck of JVET-M0410 (Non-CE8: CPR flag signaling at slice level) [J. Nam (LGE)] [late] [miss]

[JVET-M0411](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5219) Non-CE8: Inter mode related flag signaling when current picture is the only reference picture [X. Xu, X. Li, S. Liu (Tencent)]

[JVET-M0635](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5455) Crosscheck of JVET-M0411 (Non-CE8: Inter mode related flag signaling when current picture is the only reference picture) [C.-Y. Lai (MediaTek)] [late] [miss]

[JVET-M0417](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5226) CE8-related: Combination test of CE8.2.2 and CE8.2.5 [Y.-C. Sun, J. Lou (Alibaba)]

[JVET-M0556](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5369) Crosscheck of JVET-M0417 (CE8-related: Combination test of CE8.2.2 and CE8.2.5) [C.-Y. Lai (MediaTek)] [late] [miss]

[JVET-M0418](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5227) CE8-related: Context modeling on pred\_mode\_flag when current picture is the only reference picture (CPR) [Y.-C. Sun, J. Lou (Alibaba)]

[JVET-M0711](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5534) Crosscheck of JVET-M0418 (CE8-related: Context modeling on pred\_mode\_flag when current picture is the only reference picture (CPR)) [S. Ye (Hikvision)] [late] [miss]

[JVET-M0419](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5228) CE8-related: Context modeling on palette mode flag [Y.-C. Sun, J. Lou (Alibaba)]

[JVET-M0557](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5370) Crosscheck of JVET-M0419 (CE8-related: Context modeling on palette mode flag) [C.-Y. Lai (MediaTek)] [late] [miss]

[JVET-M0449](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5258) CE8-related: BDPCM entropy coding with reduced number of context coded bins [M. Xu, X. Li, X. Xu, M. Gao, S. Liu (Tencent)]

[JVET-M0648](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5469) Crosscheck of JVET-M0449 (CE8-related: BDPCM entropy coding with reduced number of context coded bins) [F. Henry, G. Clare (Orange)] [late] [miss]

[JVET-M0464](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5273) Non-CE8: Unified Transform Type Signalling and Residual Coding for Transform Skip [B. Bross, T. Nguyen, P. Keydel, H. Schwarz, D. Marpe, T. Wiegand (HHI)]

[JVET-M0650](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5471) Crosscheck of JVET-M0464 (Non-CE8: Unified Transform Type Signaling and Residual Coding for Transform Skip, test TSRC-CCB8) [F. Henry, G. Clare (Orange)] [late] [miss]

[JVET-M0708](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5531) Crosscheck of JVET-M0464 (Non-CE8: Unified Transform Type Signaling and Residual Coding for Transform Skip, test TS32Y/uniMTS) [T. Tsukuba (Sony)] [late] [miss]

[JVET-M0483](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5293) CE8-related: CPR mode signaling and interaction with inter coding tools [W.-J. Chien, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0541](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5354) Non-CE8: Combination of MMVD and CPR mode [Y. Li, Z. Chen (Wuhan Univ.), X. Xu, S. Liu (Tencent)] [late]

[JVET-M0542](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5355) Non-CE8: Combination of Multi Hypothesis Intra and CPR mode [Y. Li, Z. Chen (Wuhan Univ.), X. Xu, S. Liu (Tencent)] [late]

[JVET-M0696](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5518) Crosscheck of JVET-M0542 (Non-CE8: Combination of Multi Hypothesis Intra and CPR mode) [T. Poirier (Technicolor)] [late] [miss]

[JVET-M0544](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5357) Non-CE8: CPR with chroma 4x4 sub-block size when dual-tree is on [X. Xu, X. Li, S. Liu (Tencent)] [late]

[JVET-M0669](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5490) Crosscheck of JVET-M0544 (Non-CE8: CPR with chroma 4x4 sub-block size when dual-tree is on) [J. Nam (LGE)]

[JVET-M0765](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5596) CE8-related: Unified Screen Content and Multiview Video Coding - Experimental results [J. Samelak, M. Domański] [late]

## CE9 related – Decoder-side motion vector derivation (12)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0063](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4865) Non-CE9: An improvement of BDOF [T. Chujoh, T. Ikai (Sharp)]

[JVET-M0652](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5474) Crosscheck of JVET-M0063 (Non-CE9: An improvement of BDOF) [K. Choi (Samsung)] [late] [miss]

[JVET-M0073](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4875) Non-CE9: On early termination for BIO [K. Kondo, M. Ikeda, T. Suzuki (Sony)]

[JVET-M0077](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4880) CE9-related: Relaxation of block size restriction for DMVR [K. Unno, K. Kawamura, S. Naito (KDDI)]

[JVET-M0567](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5380) Crosscheck of JVET-M0077 (CE9-related: Relaxation of block size restriction for DMVR) [T. Chujoh (Sharp)] [late]

[JVET-M0078](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4881) CE9-related: Combination of JVET-M0077 and CE9.2.5 [K. Unno, K. Kawamura, S. Naito (KDDI), T. Chujoh, T. Ikai (Sharp)]

[JVET-M0636](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5456) Cross-check of JVET-M0078 (CE9-related: Combination of JVET-M0077 and CE9.2.5) [Y. Kato, K. Abe, T. Toma (Panasonic)] [late] [miss]

[JVET-M0148](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4956) Non-CE9: Simplifications to DMVR search pattern and interpolation for refinement [S. Sethuraman (Ittiam)]

[JVET-M0506](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5317) Crosscheck of JVET-M0148 (Non-CE9: Simplifications to DMVR search pattern and interpolation for refinement) [X. Chen (HiSilicon)] [late] [miss]

[JVET-M0223](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5030) Non-CE9: Co-existence analysis for DMVR with BDOF [S. Sethuraman (Ittiam)]

[JVET-M0241](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5048) CE9-related: A simple gradient calculation at the CU boundaries for BDOF [H. Lee, J. Kang, S.-C. Lim, J. Lee, H. Y. Kim (ETRI)]

[JVET-M0568](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5381) Crosscheck of JVET-M0241 (CE9-related: A simple gradient calculation at the CU boundaries for BDOF) [T. Chujoh (Sharp)] [late]

[JVET-M0249](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5056) Non-CE9: Modifications on Bi-Directional Optical Flow [H. Liu, L. Zhang, K. Zhang, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0731](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5560) Crosscheck of JVET-M0249 (Non-CE9: Modifications on Bi-Directional Optical Flow) [T.-H. Li, Y.-C. Yang (Foxconn)] [late] [miss]

[JVET-M0284](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5091) CE9-related: BDOF Modifications to Enable 64x64 VPDU [H. Chen, X. Ma, S. Esenlik, H. Yang, J. Chen (Huawei)]

[JVET-M0486](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5296) Cross-check of JVET-M0284: CE9-related: BDOF Modifications to Enable 64x64 VPDU [S Bandyopadhyay (InterDigital)] [late] [miss]

[JVET-M0316](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5123) CE9-related: simplification of BDOF [J. Li, R.-L. Liao, C. S. Lim (Panasonic)]

[JVET-M0701](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5523) Cross-check of JVET- M0316 (CE9-related: simplification of BDOF) [J. Zhao (LGE)] [late]

[JVET-M0516](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5327) Non-CE9.2.1.e: Non-local-mean-based MRSAD and Row-subsampled Search Pattern for DMVR [C.-C. Chen, W.-J. Chien, M. Karczewicz (Qualcomm)]

[JVET-M0577](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5391) Crosscheck of JVET-M0516 (Non-CE9.2.1.e: Non-local-mean-based MRSAD and Row-subsampled Search Pattern for DMVR) [S. Esenlik (Huawei)] [late] [miss]

[JVET-M0517](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5328) Non-CE9: Methods for BDOF complexity reduction [S. Sethuraman (Ittiam)]

## CE10 related – Combined and multi-hypothesis prediction (39)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0082](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4885) CE10-related: Simplification of Multi hypothesis intra prediction [Y. Kato, K. Abe, T. Toma (Panasonic)]

[JVET-M0088](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4891) CE10-related: LIC restriction for pipeline structure [K. Abe, T. Toma (Panasonic)]

[JVET-M0371](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5178) Crosscheck of JVET-M0088 (CE10-related: LIC restriction for pipeline structure) [P. Bordes (Technicolor)] [late]

[JVET-M0096](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4900) CE10.1-related: Inter-intra prediction [L. Pham Van, G. Van der Auwera, A. K. Ramasubramonian, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-M0681](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5503) Crosscheck of JVET-M0096 (CE10.1-related: Inter-intra prediction) [F. Galpin, T. Poirier (Technicolor)] [late] [miss]

[JVET-M0115](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4920) CE10-related: pipeline reduction for LIC and GBI [P. Bordes, F. Galpin, T. Poirier (Technicolor)]

[JVET-M0570](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5383) Crosscheck of JVET-M0115 (CE10-related: pipeline reduction for LIC and GBI) [T. Chujoh (Sharp)] [late]

[JVET-M0118](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4923) CE10-related: A fix for merge triangle flag signaling [R. Yu (Ericsson)]

[JVET-M0631](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5451) Crosscheck of JVET-M0118 (CE10-related: A fix for merge triangle flag signalling) [M.-S. Chiang (MediaTek)] [late] [miss]

[JVET-M0182](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4989) CE10-related: Simplification of local illumination compensation [C.-M. Tsai, C.-C. Chen, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0596](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5415) Crosscheck of JVET-M0182 (CE10-related: Simplification of local illumination compensation) [Y. Yasugi, T. Ikai (Sharp)] [late] [miss]

[JVET-M0183](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4990) CE10-related: Simplification of MPM generation for CIIP [M.-S. Chiang, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0693](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5515) Crosscheck of JVET-M0183 (CE10-related: Simplification of MPM generation for CIIP) [Z. Zhang, K. Andersson, R. Sjöberg (Ericsson)] [late] [miss]

[JVET-M0695](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5517) Crosscheck of JVET-M0183 (CE10-related: Simplification of MPM generation for CIIP) [K. Andersson (Ericsson)] [late] [miss]

[JVET-M0184](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4991) CE10-related: Simplification of triangle merging candidate list derivation [T.-D. Chuang, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0729](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5558) Crosscheck of JVET-M0184 (CE10-related: Simplification of triangle merging candidate list derivation) [M. Winken (HHI)] [late] [miss]

[JVET-M0185](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4992) CE10-related: Syntax redundancy removal in triangle prediction [M.-S. Chiang, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0582](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5399) Cross-check of JVET-M0185 (CE10-related: Syntax redundancy removal in triangle prediction) [K. Andersson, R. Yu (Ericsson)] [late] [miss]

[JVET-M0190](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4997) CE10-related: Redundant syntax reduction for triangle prediction [Y. Ahn, D. Sim (Digital Insights)]

[JVET-M0749](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5580) Cross-check of JVET-M0190 (CE10-related: Redundant syntax reduction for triangle prediction) [S.-C. Lim, H. Lee, J. Lee, J. Kang (ETRI)] [late] [miss]

[JVET-M0194](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5001) CE10-related: Triangle Prediction Mode Harmonization [A. Tamse, M. W. Park, S. Jeong, M. Park, K. Choi (Samsung)]

[JVET-M0207](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5014) CE10-related: Joint optimizations of Triangular prediction unit mode and Multi-Hypothesis prediction mode [S. Jeong, M. W. Park, A. Tamse, M. Park, K. Choi (Samsung)]

[JVET-M0775](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5606) Crosscheck of JVET-M0207: CE10-related: Joint optimizations of Triangular prediction unit mode and Multi-Hypothesis prediction mode [L. Pham Van, W.-J. Chien, M. Karczewicz (Qualcomm)] [late]

[JVET-M0216](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5023) CE10-related: syntax clean-up on triangle prediction [L. Li, J. Nam, N. Park, H. Jang, J. Lim, S. Kim (LGE)]

[JVET-M0224](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5031) CE10-related: Local Illumination compensation simplifications [S. Bandyopadhyay, X. Xiu, Y. He (InterDigital)]

[JVET-M0714](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5537) Crosscheck of JVET-M0224 (CE10-related: Local Illumination compensation simplifications) [P. Bordes (Technicolor)] [late] [miss]

[JVET-M0232](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5039) CE10-related: Simplification of CIIP Intra mode coding [Y.-W. Chen, X. Wang (Kwai Inc.)]

[JVET-M0552](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5365) Crosscheck of JVET-M0232 (Non-CE10: Simplification of CIIP Intra mode coding) [M.-S. Chiang (MediaTek)] [late] [miss]

[JVET-M0233](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5040) CE10-related: Triangle prediction merge list construction [X. Wang, Y.-W. Chen (Kwai Inc.)]

[JVET-M0674](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5495) Crosscheck of JVET-M0233 (Non-CE10: Triangle prediction merge list construction) [S. Esenlik (Huawei)] [late] [miss]

[JVET-M0234](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5041) CE10-related: Triangle prediction merge index coding [X. Wang, Y.-W. Chen (Kwai Inc.)]

[JVET-M0675](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5496) Crosscheck of JVET-M0234 (Non-CE10: Triangle prediction merge index coding) [S. Esenlik (Huawei)] [late] [miss]

[JVET-M0271](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5078) CE10-related: Merge list construction process for triangular prediction mode [L. Zhang, K. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0588](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5406) Crosscheck of JVET-M0271 (CE10-related: Merge list construction process for triangular prediction mode) [H. Dou, Z. Deng, L. Xu (Intel)] [late] [miss]

[JVET-M0276](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5083) CE10-related: MPM list alignment between CIIP and intra mode [J. Li, S. Wang, W. Gao (Peking University), L. Zhang, K. Zhang, H. Liu, J. Xu (Bytedance)]

[JVET-M0755](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5586) Crosscheck of JVET-M0276 (CE10-related: MPM list alignment between CIIP and intra mode) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0283](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5090) CE10-related: Reduction of motion predictor pruning in Triangle Merge mode [A. Robert, F. Le Léannec, T. Poirier, F. Galpin (Technicolor)]

[JVET-M0294](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5101) CE10-related: Modification for blocks applied with Combined Inter-Intra prediction [B. Wang, A.M. Kotra, S. Esenlik, H. Gao, J. Chen (Huawei)]

[JVET-M0587](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5404) Crosscheck of JVET-M0294 (CE10-related: Modification for blocks applied with Combined Inter-Intra prediction) [K. Zhang (Bytedance)] [late] [miss]

[JVET-M0296](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5103) CE10-related: Simplification on combined inter-intra mode prediction [B. Wang, S. Esenlik, A.M. Kotra, H. Gao, J. Chen (Huawei)]

[JVET-M0734](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5563) Crosscheck of JVET-M0296 (CE10-related: Simplification on combined inter-intra mode prediction) [L. Zhao (Tencent)] [late] [miss]

[JVET-M0317](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5124) CE10-related: Simplification of triangular prediction unit mode [R.-L. Liao, J. Li, C. S. Lim (Panasonic)]

[JVET-M0710](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5533) Crosscheck of JVET-M0317 (CE10-related: Simplification of triangular prediction unit mode) [F. Chen (Hikvision)] [late] [miss]

[JVET-M0328](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5135) CE10-related: Simplified triangle prediction unit mode [F. Chen, L. Wang (Hikvision)]

[JVET-M0666](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5487) Crosscheck of JVET-M0328 (CE10-related: Simplified triangle prediction unit mode) [R.-L. Liao, C. S. Lim (Panasonic)] [late] [miss]

[JVET-M0329](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5136) CE10-related: Modified enabling condition for triangle prediction unit mode [F. Chen, L. Wang (Hikvision)]

[JVET-M0692](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5514) Crosscheck of JVET-M0329 (CE10-related: Modified enabling condition for triangle prediction unit mode) [S.H. Wang (Peking University), X. Zheng, S.S. Wang, S.W. Ma] [late] [miss]

[JVET-M0331](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5138) CE10-related: A simplification method for Multi-intra-inter mode scheme [L. Xu, F. Chen, L. Wang (Hikvision)]

[JVET-M0533](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5345) Crosscheck of JVET-M0331 (CE10-related: A simplification of inter prediction information derivation for Multi-intra-inter mode scheme) [X. Chen (HiSilicon)] [late] [miss]

[JVET-M0349](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5156) CE10-related: Simplification of triangle prediction merging candidate list derivation [X. W. Meng (Peking University), X. Zheng (DJI), S.S. Wang, S.W. Ma (Peking University)]

[JVET-M0742](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5573) Crosscheck of JVET-M0390 (CE-10: related multi-hypothesis with uni-directional inter prediction restriction) [H. Wang (Qualcomm)] [late] [miss]

[JVET-M0352](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5159) CE10-related: Simplification of triangular partitions [D. Park, Y. Yoon, J.-G. Kim (KAU), J. Lee, J. Kang (ETRI)]

[JVET-M0722](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5549) Crosscheck of JVET-M0352 (CE10-related: Simplification of triangular partitions) [G. Laroche (Canon)] [late] [miss]

[JVET-M0357](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5164) CE10-related: Reduction of the worst-case memory bandwidth and operation number of OBMC [Y. Kidani, K. Kawamura, K. Unno, S. Naito (KDDI)]

[JVET-M0390](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5198) CE10 related: Multi-hypothesis with uni-directional inter prediction restriction [T. Poirier, E. François, K. Naser (Technicolor)]

[JVET-M0742](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5573) Crosscheck of JVET-M0390 (CE-10: related multi-hypothesis with uni-directional inter prediction restriction) [H. Wang (Qualcomm)] [late] [miss]

[JVET-M0399](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5207) CE10-related: Modifications of Triangular PU Mode [H. Wang, W.-J. Chien, V. Seregin, Y.-H. Chao, H. Huang, M. Karczewicz (Qualcomm)]

[JVET-M0694](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5516) Crosscheck of JVET-M0399 (CE10-related: Modifications of Triangular PU Mode) [T. Poirier (Technicolor)] [late] [miss]

[JVET-M0424](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5233) CE10-related: On enhancement of 4-tap interpolation filters [M. Sychev, J. Chen (Huawei)] [late] [miss]

Initial upload rejected as a placeholder.

[JVET-M0752](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5583) Crosscheck of JVET-M0424 [A. Henkel (HHI)] [late] [miss]

[JVET-M0438](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5247) CE10-related: Size constraint on Triangular Prediction [J. Zhao, S. Kim (LGE)]

[JVET-M0663](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5484) Crosscheck of JVET-M0438 (CE10-related: Size constraint on Triangular Prediction) [C.-W. Kuo, R.-L. Liao, C. S. Lim (Panasonic)] [late] [miss]

[JVET-M0450](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5259) CE10-related: LIC inheritance restrictions and interaction with GBI [M. Xu, X. Li, X. Xu, S. Liu (Tencent)]

[JVET-M0454](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5263) CE10-related: Multi-Hypothesis Intra with Weighted Combination [A. Seixas Dias, G. Kulupana, S. Blasi (BBC)]

[JVET-M0610](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5430) Crosscheck of JVET-M0454 (CE10-related: Multi-Hypothesis Intra with Weighted Combination) [B. Wang (Huawei)] [late] [miss]

[JVET-M0492](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5302) CE10-related: Simplified multi-hypothesis intra-inter mode [L. Zhao, X. Zhao, X. Li, S. Liu (Tencent)]

[JVET-M0589](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5407) Crosscheck of JVET-M0492 (CE10-related: Simplified multi-hypothesis intra-inter mode) [H. Dou, Z. Deng, L. Xu (Intel)] [late] [miss]

[JVET-M0500](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5310) CE10-related: Unidirectional illumination compensation [V. Seregin, W.-J. Chien, T. Hsieh, N. Hu, M. Karczewicz (Qualcomm)]

[JVET-M0633](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5453) Crosscheck of JVET-M0500 (CE10-realated: Unidirectional illumination compensation) [K. Abe (Panasonic)] [late] [miss]

[JVET-M0525](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5336) CE10-related: Simplification of intra prediction in CIIP [P.-H. Lin, Y.-J. Chang (Foxconn)]

[JVET-M0578](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5392) Crosscheck of JVET-M0525 (CE10-related: Simplification of intra prediction in CIIP) [M.-S. Chiang (MediaTek)] [late] [miss]

[JVET-M0581](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5397) CE10-related: Bi-directional motion vector storage for triangular prediction [M. Bläser, J. Sauer (RWTH Aachen University)] [late]

[JVET-M0736](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5566) CE10-related: Triangular prediction with MMVD [M. Bläser, J. Sauer (RWTH Aachen University)] [late]

## CE11 related – Deblocking (3)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0187](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4994) CE11-related: Long deblocking filters with reduced line buffer requirement and enhanced parallel processing accessibility [C.-M. Tsai, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0604](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5424) Crosscheck of JVET-M0187 (CE11-related: Long deblocking filters with reduced line buffer requirement and enhanced parallel processing accessibility) [A. M. Kotra (Huawei)] [late] [miss]

[JVET-M0336](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5143) Non-CE11: Considering boundary strength on CPR coded block boundary [H. Jang, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-M0605](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5425) Crosscheck of JVET-M0336 (Non-CE11: Considering boundary strength on CPR coded block boundary) [A. M. Kotra (Huawei)] [late] [miss]

[JVET-M0339](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5146) CE11-related: subblock boundary filter at 8x8 Grid [H. Jang, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-M0606](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5426) Crosscheck of JVET-M0339 (CE11-related: subblock boundary filter at 8x8 Grid) [A. M. Kotra (Huawei)] [late] [miss]

## CE12 related – Mapping functions (2)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0109](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4914) CE12-related: block-based in-loop reshaping [E. François, C. Chevance, F. Hiron (Technicolor)]

[JVET-M0580](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5396) Crosscheck of JVET-M0109 (CE12-related: block-based in-loop luma reshaping) [T. Lu, P. Yin (Dolby)] [late]

[JVET-M0640](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5460) CE12-related: in-loop reshaping with approximate inverse mapping function [E. Francois (Technicolor)] [late] [miss]

[JVET-M0703](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5525) Crosscheck of JVET-M0640 (CE12-related: in-loop luma reshaping with approximate inverse mapping function) [T. Lu, P. Yin] [late]

## CE13 related – Coding tools for 360° omnidirectional video (7)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0322](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5129) CE13-related: In-loop filters disabled across face discontinuities on PHEC with 2-pixel padding [Y. Sun, X. Huangfu, L. Yu (Zhejiang Univ.)] [late]

[JVET-M0323](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5130) CE13-related: Adaptive QP to improve subjective quality for PHEC [Y. Sun, X. Huangfu, L. Yu (Zhejiang Univ.)] [late]

[JVET-M0534](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5346) CE13-related: HEC with Pre-rotation + Adaptive Frame Packing (Test 4.2.a+4.1) [C. Pujara, A. Konda, A. Singh, R. Gadde, W. Choi, K. Choi, K.P. Choi (Samsung)] [late]

[JVET-M0645](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5465) Crosscheck of JVET-M0534 (CE13-related: HEC with Pre-rotation + Adaptive Frame Packing (Test 4.2.a+4.1)) [P. Hanhart (InterDigital)] [late] [miss]

[JVET-M0225](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5032) AHG8: On wrap around motion compensation [B. Choi, W. Feng, S. Liu (Tencent)] [late]

[JVET-M0368](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5175) AHG8: 360Lib support for chroma sample location in PHEC blending process [C.-H. Shih, Y.-H. Lee, J.-L. Lin, Y.-C. Chang, C.-C. Ju (MediaTek)]

[JVET-M0644](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5464) Crosscheck of JVET-M0368 (AHG8: 360Lib support for chroma sample location in PHEC blending process) [P. Hanhart (InterDigital)] [late] [miss]

[JVET-M0452](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5261) AHG8: Hemisphere cubemap projection format [J. Boyce, M. Dmytrychenko (Intel)] [late]

[JVET-M0547](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5360) 360° coding tools using uncoded areas [J. Sauer, M. Bläser (RWTH Aachen University)] [late]

## Loop filtering tools (12)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0103](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4908) Deblocking for multi-hypothesis intra inter prediction [K. Andersson, J. Enhorn, R. Yu, Z. Zhang, R. Sjöberg (Ericsson)]

[JVET-M0549](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5362) Crosscheck of JVET-M0103 (Deblocking for multi-hypothesis intra inter prediction) [C.-M. Tsai (MediaTek)] [late] [miss]

[JVET-M0162](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4969) Adaptive loop filter with a maximum number of luma filters per slice constraint [C.-Y. Chen, Z.-Y. Lin, C.-Y. Lai, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0618](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5438) Crosscheck of JVET-M0162 (Adaptive loop filter with a maximum number of luma filters per slice constraint) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0163](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4970) Adaptive loop filter with history filters [C.-Y. Chen, Z.-Y. Lin, C.-Y. Lai, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0619](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5439) Crosscheck of JVET-M0163 (Adaptive loop filter with history filters) [Y.-W. Chen (Kwai Inc.)] [late] [miss]

[JVET-M0164](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4971) Adaptive loop filter with virtual boundary processing [C.-Y. Chen, T.-D. Chuang, Z.-Y. Lin, C.-Y. Lai, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0730](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5559) Crosscheck of JVET-M0164 (Adaptive loop filter with virtual boundary processing) [T.-H. Li, P.-H. Lin (Foxconn)] [late] [miss]

[JVET-M0277](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5084) Fixes of enabling pcm\_loop\_filter\_disabled\_flag with pcm mode signalling under dual tree partition [L. Zhang, K. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0614](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5434) Crosscheck of JVET-M0277 (Non-CE: Fixes of enabling pcm\_loop\_filter\_disabled\_flag with PCM mode signalling under dual tree partition) [Y.-C. Sun (Alibaba)] [late] [miss]

[JVET-M0301](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5108) Non-CE: Loop filter line buffer reduction [A. M. Kotra, S. Esenlik, B. Wang, H. Gao, J. Chen (Huawei)]

[JVET-M0553](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5366) Crosscheck of JVET-M0301 (Non-CE: Loop filter line buffer reduction) [C.-M. Tsai (MediaTek)] [late] [miss]

[JVET-M0353](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5160) In-loop filtering: Simplification of ALF coefficients merge [M. Ikeda, T. Suzuki (Sony)]

[JVET-M0728](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5557) Crosscheck of JVET-M0353 (Non-CE: Simplification of ALF coefficients merge Variant 3) [N. Hu (Qualcomm)] [late] [miss]

[JVET-M0724](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5551) Crosscheck of JVET-M0353 (Non-CE: Simplification of ALF coefficients merge) [G. Laroche, J. Taquet (Canon)] [late] [miss]

[JVET-M0385](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5192) Non-linear Adaptive Loop Filter [J. Taquet, C. Gisquet, G. Laroche, P. Onno (Canon)]

[JVET-M0766](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5597) Crosscheck of JVET-M0385 (Non-linear Adaptive Loop Filter) [M. Ikeda (Sony)] [late] [miss]

[JVET-M0428](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5237) Encoder optimization with deblocking filter [N. Hu, V. Seregin, W.-J. Chien, M. Karczewicz (Qualcomm)]

[JVET-M0612](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5432) Crosscheck of JVET-M0428 (Encoder optimization with deblocking filter) [Y.-C. Sun (Alibaba)] [late]

[JVET-M0429](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5238) Coding tree block based adaptive loop filter [N. Hu, V. Seregin, H. Egilmez, M. Karczewicz (Qualcomm)]

[JVET-M0243](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5050) Cross-check of JVET-M0429 (Coding tree block based adaptive loop filter) [S.-C. Lim, J. Kang, H. Lee, J. Lee (ETRI)] [late]

[JVET-M0461](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5270) Alternate ALF filter shapes for luma [D. Socek, A. Puri (Intel)]

[JVET-M0468](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5278) Non-CE: Hadamard transform domain filter [S. Ikonin, V. Stepin, J. Chen (Huawei)]

## General prediction aspects (5)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0135](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4940) On adaptive resolution change (ARC) for VVC [Hendry, Y.-K Wang, J. Chen (Huawei), T. Davies, A. Fuldseth (Cisco), Y.-C Sun, T.-S Chang, J. Lou (Alibaba)]

[JVET-M0259](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5066) Use cases and proposed design choices for adaptive resolution changing (ARC) [M. M. Hannuksela, A. Aminlou (Nokia)]

[JVET-M0360](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5167) Video coding based on cross RAP referencing (CRR) [H. Yu, X. Gao, Q. Yuan, X. Lin, L. Yu (Zhejiang Univ.), Y. Fan, Y. Zhao, H. Yang, Y.-K. Wang, J. Chen (Huawei)] [late]

[JVET-M0514](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5325) Removal of CIP from Multi-hypothesis Intra Prediction [C.-C. Chen, W.-J. Chien, M. Karczewicz (Qualcomm)]

[JVET-M0667](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5488) Crosscheck of JVET-M0514 (Removal of CIP from Multi-hypothesis Intra Prediction) [J. Li, C. S. Lim (Panasonic)] [late]

[JVET-M0634](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5454) Affine motion mode in intra coding [S. Cao, H. Han, J. Wang, F. Liang, Y. Yu, Y. Liu] [late]

## Quantization (3)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0083](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4886) AHG10: Quantization matrices for MTS [T. Toma, K. Abe (Panasonic)]

[JVET-M0342](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5149) Crosscheck of JVET-M0083 (AHG10: Quantization matrices for MTS) [M. Ikeda (Sony)]

[JVET-M0105](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4910) Delta QP for Chroma CU [R. Chernyak, S. Ikonin, J. Chen (Huawei)]

[JVET-M0188](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4995) On quantization parameter signalling considering CU area [O. Chubach, T.-D. Chuang, C.-W. Hsu, C.-Y. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0707](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5530) Crosscheck for JVET-M0188: CE7-related: On quantization parameter signalling considering CU area [Y. Wang, X. Xu (Tencent)] [late] [miss]

## Entropy coding (2)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0222](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5029) Context Reduction for CABAC in VVC [Y.-H. Chao, A. Said, V. Seregin, J. Dong, M. Karczewicz (Qualcomm)]

[JVET-M0617](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5437) Crosscheck of JVET-M0222 (Context Reduction for CABAC in VVC) [Y.-C. Sun (Alibaba)] [late] [miss]

[JVET-M0519](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5330) Non-CE: Context modeling for coding the prediction mode flag [S.-T. Hsiang, S.-M. Lei (MediaTek)]

[JVET-M0739](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5570) Crosscheck of JVET-M0519 (Non-CE: Context modeling for coding the prediction mode flag) [A. Tamse (Samsung)] [late] [miss]

## Tools based on NN technology (7)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0159](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4966) AHG9: Convolutional neural network loop filter [Y.-L. Hsiao, C.-Y. Chen, T.-D. Chuang, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0771](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5602) Crosscheck of JVET-M0159 (AHG9: Convolutional neural network loop filter) [H. Dou, Z. Deng, J. Boyce (Intel)] [late] [miss]

[JVET-M0215](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5022) AHG9-related: CNN-based lambda-domain rate control for intra frames [Y. Li, D. Liu, Z. Chen (USTC)]

[JVET-M0351](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5158) Convolutional Neural Network Filter (CNNF) for Intra Frame [C. Lin, J. Yao, L. Wang (Hikvision)] [late]

Initial upload rejected as a placeholder.

[JVET-M0743](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5574) Crosscheck of JVET-M0351 (AHG9: Convolutional Neural Network Filter (CNNF) for Intra Frame) [Y. Dai, D. Liu, Y. Li, F. Wu] [late] [miss]

[JVET-M0508](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5319) AHG9: Test Results of Dense Residual Convolutional Neural Network based In-Loop Filter [Y. Wang, Z. Chen, Y. Li (Wuhan Univ.), L. Zhao, S. Liu, X. Li (Tencent)]

[JVET-M0510](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5321) AHG9: CNN-based in-loop filter proposed by USTC [Y. Dai, D. Liu, Y. Li, F. Wu (USTC)] [late] [miss]

[JVET-M0673](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5494) Crosscheck of JVET-M0510: AHG9: CNN-based in-loop filter proposed by USTC [F. Chen (Hikvision)] [late] [miss]

[JVET-M0566](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5379) Adaptive convolutional neural network loop filter [H. Yin, R. Yang, X. Fang, S. Ma, Y. Yu (Intel)] [late]

[JVET-M0691](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5513) AHG9: Complexity analysis about neural network video coding tools [Y. Li, Z. Chen (Wuhan Univ.), S. Liu (Tencent)] [late] [miss]

## High-level syntax (50)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

### General high-level syntax and parameter sets (21)

#### General high-level syntax and NAL unit header (11)

[JVET-M0101](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4906) AHG17: On VVC HLS [R. Skupin, K. Sühring, Y. Sanchez (HHI), M. M. Hannuksela, K. Kammachi-Sreedhar (Nokia), Y.-K. Wang, Hendry (Huawei), S. Wenger, B. Choi (Tencent), S. Deshpande (Sharp)]

[JVET-M0120](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4925) Proposed NAL Unit Header Design Principles [S. Wenger, B. Choi, S. Liu (Tencent)]

[JVET-M0131](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4936) AHG17: On NAL unit types for IRAP pictures and leading pictures [Y.-K. Wang, Hendry (Huawei)]

[JVET-M0152](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4959) AHG17: On random access point for VVC [B. Choi, S. Wenger, S. Liu (Tencent)]

[JVET-M0153](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4960) AHG17: On leading picture for VVC [B. Choi, S. Wenger, S. Liu (Tencent)]

[JVET-M0156](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4963) AHG17: On component type indication for VVC [B. Choi, S. Wenger, S. Liu (Tencent)] [late]

[JVET-M0157](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4964) AHG17: On picture order count for VVC [B. Choi, S. Wenger, S. Liu (Tencent)] [late]

[JVET-M0161](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4968) AHG17: Signalling random access properties in the NAL unit header [L. Chen, C.-W. Hsu, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0520](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5331) AHG17: On NAL unit header design for VVC [S. Wenger, B. Choi, S. Liu (Tencent)]

[JVET-M0529](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5340) AHG14: Normative Recovery Point Indication [M. Pettersson, R.Sjöberg, M. Damghanian (Ericsson)]

[JVET-M0537](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5349) AHG17: On tile group signaling in NAL unit header and as non-VCL NAL unit [E. Thomas, A. Gabriel (TNO)] [late]

#### Reference picture management (3)

[JVET-M0128](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4933) AHG17: On reference picture management for VVC [Y.-K. Wang, Hendry (Huawei), S. Deshpande (Sharp), M. M. Hannusela (Nokia), G. Ryu, W. Choi (Samsung), X. Wang, Y.-W. Chen (Kawi), L. Zhang (Bytedance), P. Wu, M. Li (ZTE), S.-H. Kim (LG), J. Boyce (Intel), A. M. Tourapis, D. Singer (Apple), F. Edouard, P. Andrivon (Technicolor), Y.-W. Huang, C.-W. Hsu, C.-Y. Chen, T.-D. Chuang, L. Chen (MediaTek), K. Kawamura (KDDI), Y.-C. Sun, J. Lou (Alibaba)]

[JVET-M0154](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4961) AHG17: On decoded picture buffer management for VVC [B. Choi, S. Wenger, S. Liu (Tencent)]

[JVET-M0378](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5185) AHG17: RPS for VVC [R.Sjöberg, M. Damghanian, M. Pettersson (Ericsson)] [late]

#### Picture header and header parameter set (HPS) (4)

[JVET-M0132](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4937) AHG17: On header parameter set (HPS) [Y.-K. Wang, Hendry, J. Chen (Huawei)]

[JVET-M0260](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5067) AHG17: Carriage of tile group header parameters in higher level structures [M. M. Hannuksela (Nokia)]

[JVET-M0377](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5184) AHG17: Picture header NAL unit type [R.Sjöberg, M. Damghanian, M. Pettersson (Ericsson)]

[JVET-M0415](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5224) AHG17: Comments on High-Level Syntax of VVC [S. Deshpande (Sharp)]

#### Miscellaneous general HLS topics (3)

[JVET-M0133](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4938) AHG17: On parsing dependency between parameter sets [Y.-K. Wang (Huawei), J. Boyce (Intel)]

[JVET-M0386](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5193) AHG17: On slice\_type (tile\_group\_type) [K. Sühring, Y. Sanchez, R. Skupin (HHI)]

[JVET-M0579](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=5393) On Frame Rate Support and Extraction in VVC [A. Segall, S. Deshpande (Sharp Labs of America), M. Hannuksela (Nokia)]

### Interoperability and capability points definition and signalling (1)

[JVET-M0451](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5260) Update to interoperability point syntax [J. Boyce (Intel)]

### Tiling and tile partitioning (26)

[JVET-M0774](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5605) AHG12: A summary of JVET-M contributions on picture partitioning [Y.-K. Wang (Huawei), M. M. Hannuksela (Nokia)] [late]

#### Tiling allowing tile size unit less than CTU size (5)

[JVET-M0066](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4868) AHG12: Flexible Tile Partitioning [Y. Yasugi, T. Ikai (Sharp)]

[JVET-M0423](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5232) Cross-check of JVET-M0066: AHG12: Flexible Tile Partitioning [A. Wieckowski (HHI)]

[JVET-M0376](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5183) AHG12: On signaling of flexible tiles [M. Damghanian, R.Sjöberg, M. Pettersson (Ericsson)]

[JVET-M0459](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5268) AHG12: On tiles with partial CTUs [R. Skupin, K. Sühring, Y. Sanchez, T. Schierl (HHI)]

[JVET-M0527](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5338) AHG12: Comments on Tiles and Flexible Tile Partitioning [W. Wan, M. Zhou, T. Hellman, B. Heng, P. Chen (Broadcom)]

#### Flexible tiling (4)

Option 3 of M0261 is effectively another way to achieve the flexible tiling functionality, through dividing pictures into rectangular sub-pictures and each sub-picture may refer to its own PPS and may hence have its own tile partitioning.

[JVET-M0123](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4928) AHG12: On hierarchical tile design [Y. He, A. Hamza (InterDigital)]

[JVET-M0129](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4934) AHG12: On flexible tiling [Y.-K. Wang, Hendry, M. Sychev (Huawei)]

[JVET-M0374](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5181) AHG12: Flexible tiles to support MCTS use cases [R.Sjöberg, M. Damghanian, M. Pettersson (Ericsson)]

[JVET-M0530](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5341) AHG12: On signalling of tiles [M. Coban, M. Karczewicz (Qualcomm)] [late]

#### Rectangular tile grouping (5)

[JVET-M0121](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4927) AHG12: On Rectangular Tile Group [Y. He, A. Hamza (InterDigital)]

[JVET-M0130](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4935) AHG12: On tile grouping [Y.-K. Wang, Hendry, J. Chen, M. Sychev (Huawei)]

[JVET-M0160](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4967) AHG17: Flexible tile grouping for VVC [L. Chen, T.-D. Chuang, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-M0209](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5016) AHG12: On tile group configuration [W. Choi, K. Choi, K. Choi (Samsung)]

[JVET-M0416](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5225) AHG12: On Tile Information Signalling [S. Deshpande (Sharp)]

#### Tile and tile group identification and addressing (4)

[JVET-M0134](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4939) AHG12: On explicit signalling of tile IDs [Hendry, Y.-K. Wang, J. Chen, M. Sychev (Huawei)]

[JVET-M0155](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4962) AHG12: On tile group identification for VVC [B. Choi, S. Wenger, S. Liu (Tencent)] [late]

[JVET-M0373](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5180) AHG12: Merge friendly tile group address signalling [R.Sjöberg, M. Damghanian, M. Pettersson (Ericsson)]

[JVET-M0430](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5239) AHG12: On Tiles and Tile Groups for VVC [R. Skupin, K. Sühring, Y. Sanchez, T. Schierl (HHI)]

#### MCTS and sub-picture sequence (4)

JVET-M0416 also includes one aspect on MCTS signalling in the PPS.

[JVET-M0261](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5068) AHG12: On grouping of tiles [M. M. Hannuksela, A. Aminlou (Nokia)]

[JVET-M0388](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5195) AHG12/AHG17: On merging of MCTSs for viewport-dependent streaming [M. M. Hannuksela (Nokia)]

[JVET-M0445](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5254) AHG12: On motion constrained tiles for VVC [R. Skupin, V. George, K. Sühring, Y. Sanchez, T. Schierl (HHI)]

[JVET-M0536](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5348) AHG12: On picture-level tiles and sequence-level tiles for VVC [E. Thomas, A. Gabriel (TNO)] [late]

#### Miscellaneous tiling topics (3)

[JVET-M0136](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4941) AHG12: Treating tile and tile group boundaries as picture boundaries [J. Chen, Y.-K. Wang, Hendry, M. Sychev (Huawei)]

[JVET-M0137](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4942) AHG12: On tile configuration signalling [M. Sychev, Hendry, Y.-K. Wang (Huawei)]

[JVET-M0375](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5182) AHG12: On uniform tile spacing [M. Damghanian, R.Sjöberg, M. Pettersson (Ericsson)]

### Wavefront parallel processing (2)

[JVET-M0070](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4872) AHG12: Wavefront processing in a tile group [T. Ikai, S. Deshpande, T. Chujoh, E. Sasaki, T. Aono (Sharp)]

[JVET-M0071](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4873) WPP: Improved parallel processing capability with WPP [Y. Fujimoto, M. Ikeda, T. Suzuki (Sony)]

[JVET-M0593](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5412) Crosscheck of JVET-M0071 (AHG12: Improved parallel processing capability with WPP) [Y. Yasugi, T. Ikai (Sharp)] [late] [miss]

# Complexity analysis and reduction (3)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0245](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5052) AHG16-related: Chroma block coding and size restriction [C. Rosewarne, A. Dorrell (Canon)] [late]

Initial upload rejected as placeholder

[JVET-M0248](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5055) AHG16: Motion compensation with padded samples for small coding units [H. Liu, J. Chon, H.-C. Chuang, L. Zhang, K. Zhang, J. Xu (Bytedance)]

[JVET-M0607](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5427) Crosscheck of JVET-M0248 (AHG16: Motion compensation with padded samples for small coding units) [B. Wang (Huawei)] [late] [miss]

[JVET-M0265](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5072) AHG16: Clean-up on MV Rounding [K. Zhang, L. Zhang, H. Liu, J. Xu, Y. Wang, P. Zhao, D. Hong (Bytedance)]

[JVET-M0563](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5376) Cross-check of JVET-M0265 (AHG16: Clean-up on MV Rounding) [X. Chen (HiSilicon)] [late] [miss]

# Encoder optimization (3)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

[JVET-M0091](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4894) AHG10: Clean-up and finalization of perceptually optimized QP adaptation method in VTM [C. Helmrich (HHI)]

[JVET-M0511](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5322) Bug fix for rate control under all-intra [Y. Li, D. Liu, Z. Chen (USTC)] [late]

[JVET-M0600](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=5419) AHG10: Quality dependency factor based rate control for VVC [Z. Liu, Z. Chen, Y. Li (Wuhan Univ.), Y. Wu, S. Liu (Tencent)] [late]

# Metrics and evaluation criteria (0)

Contributions in this category were discussed XXday X Jan. XXXX–XXXX (chaired by XXX).

# Withdrawn (7)

JVET-M0041 Withdrawn

JVET-M0074 Withdrawn

JVET-M0205 Withdrawn

JVET-M0370 Withdrawn

JVET-M0414 Withdrawn

JVET-M0505 Withdrawn

JVET-M0565 Withdrawn

JVET-M0608 Withdrawn

# Plenary meetings, joint Meetings, BoG Reports, and Summary of Actions Taken

## Plenary meeting XXday X Jan XXXX

Reports of the tracks were given by …

## Closing plenary sessions

## Joint meetings

## BoGs (XX)

## List of actions taken affecting Draft 3 of VVC, VTM 3, and 360Lib

The following is a summary, in the form of a brief list, of the actions taken at the meeting that affect the text of the VVC draft text, VTM or 360Lib description. Both technical and editorial issues are included. This list is provided only as a summary – details of specific actions are noted elsewhere in this report and the list provided here may not be complete and correct. The listing of a document number only indicates that the document is related, not that it was adopted in whole or in part.

# Project planning

## Core experiment planning

…

## Drafting of specification text, encoder algorithm descriptions, and software

The following agreement has been established: the editorial team has the discretion to not integrate recorded adoptions for which the available text is grossly inadequate (and cannot be fixed with a reasonable degree of effort), if such a situation hypothetically arises. In such an event, the text would record the intent expressed by the committee without including a full integration of the available inadequate text.

## Plans for improved efficiency and contribution consideration

The group considered it important to have the full design of proposals documented to enable proper study.

Adoptions need to be based on properly drafted working draft text (on normative elements) and HM encoder algorithm descriptions – relative to the existing drafts. Proposal contributions should also provide a software implementation (or at least such software should be made available for study and testing by other participants at the meeting, and software must be made available to cross-checkers in EEs).

Suggestions for future meetings included the following generally-supported principles:

* No review of normative contributions without draft specification text
* VTM algorithm description text is strongly encouraged for non-normative contributions
* Early upload deadline to enable substantial study prior to the meeting
* Using a clock timer to ensure efficient proposal presentations (5 min) and discussions

The document upload deadline for the next meeting was planned to be Wednesday 2 January 2019 (a little later than usual due to the proximity of the New Year holiday).

As general guidance, it was suggested to avoid usage of company names in document titles, software modules etc., and not to describe a technology by using a company name.

## General issues for experiments

It was emphasized during the opening plenary on January 9 that those rules which had been set up or refined during the 12th meeting should be observed. In particular, for some CEs, results were available late, and some changes in the experimental setup (particularly in CE4) were not discussed on the JVET reflector.

Group coordinated experiments have been planned as follows:

* “Core experiments” (CEs) are the coordinated experiments on coding tools which are deemed to be interesting but require more investigation and could potentially become part of the draft standard by the next meeting.
* A CE is a test of a specific fully described technology in a specific agreed way. It is not a forum for thinking of new ideas (like an AHG).
* A description of each experiment is to be approved at the meeting at which the experiment plan is established. This should include the issues that were raised by other experts when the tool was presented, e.g., interference with other tools, contribution of different elements that are part of a package, etc. The experiment description document should provide the names of individual people, not just company names.
* Software for tools investigated in a CE will be provided in one or more separate branches of the software repository. Each CE will have a “fork” of the software, and within the CE there may be multiple branches established by the CE coordinator. The software coordinator will help coordinate the creation of these forks and branches and their naming. All JVET members will have read access to the CE software branches (using shared read-only credentials; the method for members to obtain the credentials is TBA on the reflector).
* During the experiment, revisions of the experiment plans can be made, but not substantial changes to the proposed technology.
* The CE description must match the CE testing that is done. The CE description needs to be revised if there has been some change of plans.
* The CE summary report must describe any changes that were made in the process of finalizing the CE.
* By the next meeting it is expected that at least one independent cross-checker will report a detailed analysis of each proposed feature that has been tested and confirm that the implementation is correct. Commentary on the potential benefits and disadvantages of the proposed technology in cross-checking reports is highly encouraged. Having multiple cross-checking reports is also highly encouraged (especially if the cross-checking involves more than confirmation of correct test results). The reports of cross-checking activities may (and generally should) be integrated into the CE report rather than submitted as separate documents.

It is possible to define sub-experiments within particular CEs, for example designated as CEX.a, CEX.b, etc., where X is the basic CE number.

As a general rule, it was agreed that each CE should be run under the same testing conditions using one software codebase, which should be based on the group test model software codebase. An experiment is not to be established as a CE unless there is access given to the participants in (any part of) the CE to the software used to perform the experiments.

The general agreed common conditions for single-layer coding efficiency experiments are described in the output document JVET-J1010 (update).

Experiment descriptions should be written in a way such that it is understood as a JVET output document (written from an objective “third party perspective”, not a proponent perspective – e.g. not referring to methods as “improved”, “optimized”, etc.). The experiment descriptions should generally not express opinions or suggest conclusions – rather, they should just describe what technology will be tested, how it will be tested, who will participate, etc. Responsibilities for contributions to CE work should identify individuals in addition to company names.

CE descriptions contain a basic description of the technology under test, but should not contain excessively verbose descriptions of a technology (at least not unless the technology is not adequately documented elsewhere). Instead, the CE descriptions should refer to the relevant proposal contributions for any necessary further detail. However, the complete detail of what technology will be tested must be available – either in the CE description itself or in documents that are referenced in the CE description that are also available in the JVET document archive.

Any technology must have at least one cross-check partner to establish a CE – a single proponent is not enough. It is highly desirable have more than just one proponent and one cross-checker.

Some agreements relating to CE activities were established as follows:

* Only qualified JVET members can participate in a CE.
* Participation in a CE is possible without a commitment of submitting an input document to the next meeting. Participation is requested by contacting the CE coordinator.
* All software, results, and documents produced in the CE should be announced and made available to JVET in a timely manner.
* All substantial communications about a CE, other than logistics arrangements, exchange of data, minor refinement of the test plans, and preparation of documents shall be conducted on the main JVET reflector. In the case that large amounts of data are to be distributed is recommended to send an announcement to the JVET reflector without attaching the materials, and send the materials to those who have requested it directly, or provide a link to it, or upload the data as an input contribution to the next meeting.

General timeline for CEs

T1= 3 weeks after the JVET meeting: To revise the CE description and refine questions to be answered. Questions should be discussed and agreed on JVET reflector. Any changes of planned tests after this time need to be announced and discussed on the JVET reflector.

T2 = Test model SW release + 2 weeks: Integration of all tools into a separate CE branch of the VTM is completed and announced to JVET reflector.

* Initial study by cross-checkers can begin.
* Proponents may continue to modify the software in this branch until T3
* 3rd parties encouraged to study and make contributions to the next meeting with proposed changes

T3: 3 weeks before the next JVET meeting: Any changes to the CE test branches of the software must be frozen, so the cross-checkers can know exactly what they are cross-checking. A software version tag should be created at this time and announced on the JVET reflector. The name of the cross-checkers and list of specific tests for each tool under study in the CE plan description by this time. Full test results must be provided at this time (at least for proposals targeting to be promoted to the draft standard at the next meeting).

CE reports may contain additional information about tests of straightforwared combinations of the identified technologies. Such supplemental testing needs to be clearly identified in the report if it was not part of the CE plan.

New branches may be created which combine two or more tools included in the CE document or the VTM (as applicable). [Search/remove obsolete references to BMS.]

It is not necessary to formally name cross-checkers in the initial version of the CE description document. To adopt a proposed feature at the next meeting, we would like see comprehensive cross-checking done, with analysis that the description matches the software, and recommendation of value of the tool given tradeoffs.

The establishment of a CE does not indicate that a proposed technology is mature for adoption or that the testing conducted in the CE is fully adequate for assessing the merits of the technology, and a favourable outcome of CE does not indicate a need for adoption of the technology.

Draft specification text shall be provided with CE input documents.

It was later discussed (Track B Wednesday 9 January afternoon) that it was unclear by which time such spec text should be available. It was mentioned that numerous (if not majority) of current CE contribution documents in the first uploaded version come without spec text. However, availability of spec text is important to have a detailed understanding of the technology and also to judge what its impact on the complexity of the spec will be. Revisit: To be raised in plenary.

CE plans were initially reviewed Thursday 11 Oct 1630 (GJS) and 1800 (J. Boyce); the final review during the meeting was conducted Friday 12 Oct 1100 (GJS).

Lists of participants in CE documents should be pruned to include only the active participants. Read access to software will be available to all members.

## Software development and anchor generation (update)

The planned timeline for software releases was established as follows:

* VTM3.0 will be released by 2018-11-09. VTM3.1 with non-CTC adoptions will be released later.
* Further versions of VTM may be released for additional bug fixing, as appropriate.
* Timeline of 360lib8.0: 1 week after the release of VTM3.0 (2018-11-16). Further versions may be released as appropriate for bug fixing.

# Establishment of ad hoc groups

The ad hoc groups established to progress work on particular subject areas until the next meeting are described in the table below. The discussion list for all of these ad hoc groups was agreed to be the main JVET reflector ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de)).

|  |  |  |
| --- | --- | --- |
| **Title and Email Reflector** | **Chairs** | **Mtg** |
| **Project Management (AHG1)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Coordinate overall JVET interim efforts. * Supervise CE and AHG studies. * Report on project status to JVET reflector. * Provide a report to next meeting on project coordination status. | J.-R. Ohm, G. J. Sullivan (co-chairs) | N |
| **Draft text and test model algorithm description editing (AHG2)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Produce and finalize JVET-L1001 VVC text specification Working Draft 3. * Produce and finalize JVET-L1002 VVC Test Model 3 (VTM 3) Algorithm and Encoder Description. * Gather and address comments for refinement of these documents. * Coordinate with test model software development AhG to address issues relating to mismatches between software and text. | B. Bross, J. Chen (co-chairs), J. Boyce, S. Kim, S. Liu, Y. Ye (vice-chairs) | N |
| **Test model software development (AHG3)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Coordinate development of test model (VTM) software and associated configuration files. * Produce documentation of software usage for distribution with the software. * Discuss and make recommendations on the software development process. * Propose improvements to the guideline document for developments of the test model software. * Coordinate with AHG on Draft text and test model algorithm description editing (AHG2) to identify any mismatches between software and text, and make further updates and cleanups to the software as appropriate. * Coordinate with AHG6 for integration with 360lib software. | F. Bossen, X. Li, K. Sühring (co-chairs) | N |
| **Test material and visual assessment (AHG4)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Maintain the video sequence test material database for development of the VVC standard. * Identify and recommend appropriate test materials for use in the development of the VVC standard. * Identify missing types of video material, solicit contributions, collect, and make available a variety of video sequence test material. * Evaluate new test sequences, particularly including the material recently submitted by the Blender Foundation / Blender Animation Studio and Twitch. * Propose a new structure for the test sequence repository. * Facilitate availability of viewing equipment and facilities arrangements for the next meeting and pre-meeting testing as feasible. | T. Suzuki (chair), V. Baroncini, R. Chernyak, P. Hanhart, A. Norkin, J. Ye (vice-chairs) | N |
| **Memory bandwidth consumption of coding tools (AHG5)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Develop improved software tools for measuring both average and worst case of memory bandwidth, and provide information for usage of these tools. * Study cache configurations for measuring decoder memory bandwidth consumption. * Identify coding tools in CEs and VTM with significant memory bandwidth impact. * Study the impact of memory bandwidth on specific application cases. | R. Hashimoto (chair), T. Ikai, X. Li, D. Luo, H. Yang, M. Zhou (vice-chairs) | N |
| **360° video conversion software development (AHG6)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Prepare and deliver the 360Lib-8.0 software version and common test condition configuration files according to JVET-L1012. * Generate CTC (PHEC) anchors and PERP results for VTM according to JVET-L1012, and finalize the reporting template for the common test conditions. * Produce documentation of software usage for distribution with the software. | Y. He, K. Choi (co-chairs) | N |
| **Coding of HDR/WCG material (AHG7)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study and evaluate available HDR/WCG test content. * Study objective metrics for quality assessment of HDR/WCG material, including investigation of the correlation between subjective and objective results of the CfP responses. * Compare the performance of the VTM and HM for HDR/WCG content. * Prepare for expert viewing of HDR content at the 13th JVET meeting if feasible. * If feasible, arrange a demonstration event for viewing of JVET-L0205 and JVET-L0245 coded material and possibly other material. * Coordinate implementation of HDR anchor aspects in the test model software with AHG3. * Study additional aspects of coding HDR/WCG content. | A. Segall (chair), E. François, W. Husak, D. Rusanovskyy (vice-chairs) | Y.  Date TBA (likely in Burbank US, or DE, FR, or UK) |
| **360° video coding tools and test conditions (AHG8)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study the effect on compression and subjective quality of different projections formats, resolutions, and packing layouts. * Discuss refinements of common test conditions, test sequences, and evaluation criteria. * Solicit additional test sequences, and evaluate suitability of test sequences on head-mounted displays and normal 2D displays. * Study coding tools dedicated to 360° video, their impact on compression, and implications to the core codec design. * Study the effect of viewport resolution, field of view, and viewport speed/direction on visual comfort. * Study complexity of GPU rendering of projection formats * Study syntax for signalling of projection formats | J. Boyce (chair), K. Choi, P. Hanhart, J.-L. Lin (vice-chairs) | N |
| **Neural networks in video coding (AHG9)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Investigate the benefit of using neural networks in video compression such as CNN loop filter, intra prediction, re-sampling in adaptive resolution coding, and encoder side partition mode decisions. * Investigate the complexity impact of using neural networks in video compression. * Investigate the complexity measurement of neural network coding tools. * Investigate the impact of training materials on the performance of neural network coding tools. * Investigate the impact of the training process on performance and complexity. | S. Liu (chair), B. Choi, K. Kawamura, Y. Li, L. Wang, P. Wu, H. Yang (vice-chairs) | N |
| **Encoding algorithm optimization (AHG10)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study the impact of using techniques such as GOP structures and perceptually optimized adaptive quantization for encoder optimization. * Study the impact of MTS transforms on quantization matrices and the need for default matrices. * Study the impact of adaptive quantization on individual tools in the test model. * Study the quantization adaptation tool in the test model. * Investigate the feasibility of adding a CTC test category in which adaptive quantization is turned on. * Study quality metrics for measuring subjective quality using e.g. the CfP response MOS scores. * Investigate other methods of improving objective and/or subjective quality, including adaptive coding structures, adaptive quantization without signalling, and multi-pass encoding. * Study methods of rate control and their impact on performance, subjective and objective quality. | A. Duenas, A. Tourapis (co-chairs), C. Helmrich, S. Ikonin, A. Norkin, R. Sjöberg, T. Toma (vice-chairs) | N |
| **Screen content coding (AHG11)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Investigate coding tools targeted at screen content in terms of compression benefit and implementation complexity. * Identify test materials and discuss testing conditions for screen content coding. | S. Liu (chair), J. Boyce, A. Filippov, Y.-C. Sun, J. Xu, M. Zhou (vice-chairs) | N |
| **High-level parallelism and coded picture regions (AHG12)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study tile group designs, including rectangular tile groups. * Study flexible (including non-CTU-aligned) tile partitioning including identifying implications on coding tools and implementation. * Study support of independently coded picture regions, including easy rewriting of such regions into a conforming sub-bitstream. * Prepare software and configurations for the test model to facilitate parallel processing tests. * Study the coding efficiency impact of parallel processing and coded picture regions. | T. Ikai (chair), M. M. Hannuksela, R. Sjöberg, R. Skupin, W. Wan, Y.-K. Wang S. Wenger (vice-chairs) | N |
| **Tool reporting procedure (AHG13)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Prepare output document JVET-L1005, which describes the methodology of tool-off testing and a list of tools to be tested by identified testers. * Provide configurations files, bitstreams, and results of the tool-on/tool-off testing. * Use the tool usage counts and memory bandwidth usage to study the decoder complexity of features in on/off testing. * Prepare a report with results of the tests. | W.-J. Chien, J. Boyce (co-chairs), R. Chernyak, K. Choi, R. Hashimoto, Y.**-**W. Huang, S. Liu, D. Luo (vice-chairs) | N |
| **Progressive intra refresh (AHG14)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Define relevant test conditions to evaluate low-latency encoding with progressive intra refresh for random access without intra frames. * Study non-normative ways to produce progressive intra refresh with minimum losses in coding efficiency. * Propose software modifications for integrating encoder-only intra refresh in the VTM model. * Characterize progressive intra refresh performance objectively and subjectively. * Study normative solutions to improve intra refresh performance against encoder-only intra refresh. | J.-M. Thiesse (chair), A. Duenas, K. Kazui, A. Tourapis (vice-chairs) | N |
| **Bitstream decoding properties signalling (AHG15)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study syntax alternatives for interoperability point signalling * Study selection of constraint flags to be included in the VTM and their impact on syntax, semantics, and decoding process | J. Boyce (chair), J. Chen, S. Deshpande, M. Karczewicz, A. Tourapis, Y.-K. Wang, S. Wenger (vice-chairs) | Tel. TBA  (one or two, at least two weeks notice for each) |
| **Implementation studies (AHG16)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study draft and proposed coding tools to identify implementation issues relating to decoder pipelines, decoder throughput, and other aspects of implementation difficulty. * Solicit hardware analysis of complex tools. * Particularly consider intra reconstruction throughput for small blocks. * Provide feedback on potential solutions to address identified issues. | M. Zhou (chair), J. An, E. Chai, K. Choi, S. Ethuraman, T. Hsieh, X. Xiu (vice-chairs) | N |
| **High-level syntax (AHG17)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study NAL unit header, sequence parameter set, picture parameter set, and tile group header syntax designs * Study the proposed picture header designs and alternatives * Study reference picture buffering and list construction * Study random access signalling * Assist in software development and text drafting for the high-level syntax in the VVC design. | R. Sjöberg (chair), S. Deshpande, M. M. Hannuksela, R. Skupin, Y.-K. Wang, S. Wenger (vice-chairs) | N |

# Output documents

The following documents were agreed to be produced or endorsed as outputs of the meeting. Names recorded below indicate the editors responsible for the document production. Where applicable, dates of planned finalization and corresponding parent-body document numbers are also noted.

It was reminded that in cases where the JVET document is also made available as MPEG output document, a separate version under the MPEG document header should be generated. This version should be sent to GJS and JRO for upload.

[JVET-L1000](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4833) Meeting Report of the 12th JVET Meeting [G. J. Sullivan, J.-R. Ohm] (2018-12-31, near next meeting)

Initial versions of the meeting notes (d0 … d8) were made available on a daily basis during the meeting.

[JVET-L1001](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4834) Versatile Video Coding (Draft 3) [B. Bross, J. Chen, S. Liu] [WG 11 [N 18027](http://phenix.it-sudparis.eu/mpeg/doc_end_user/current_document.php?id=64796&id_meeting=176)] (2018-11-23)

(Initial version planned to be made available by 2018-11-02.)

See the list of elements under section 12.6.2, as agreed by the Wed. 18 October plenary.

[JVET-L1002](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4835) Algorithm description for Versatile Video Coding and Test Model 3 (VTM 3) [J. Chen, Y. Ye, S. Kim] [WG 11 [N 18028](http://phenix.it-sudparis.eu/mpeg/doc_end_user/current_document.php?id=64797&id_meeting=176)] (2018-12-14)

(Initial version planned to be made available by 2018-11-09.)

See the list of elements under section 12.6.2, as agreed by the Wed. 18 October plenary.

Remains valid – not updated: [JVET-K1003](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=4112) Guidelines for VVC reference software development [K. Sühring] (2018-07-31)

New version?

[JVET-L1004](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4836) Algorithm descriptions of projection format conversion and video quality metrics in 360Lib (Version 8) [Y. Ye, J. Boyce] (2018-11-23)

For this output, it was agreed to add discussion of chroma location.

[JVET-L1005](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4837) Methodology and reporting template for coding tool testing [W.-J. Chien and J. Boyce] (2018-10-26)

For this output, it was agreed to remove discussion of BMS, update for tools adopted at the 12th meeting, and update the schedule.

[JVET-L1006](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4838) Methodology and reporting template for neural network coding tool testing [Y. Li, S. Liu] (2018-10-26)

This output was produce to capture aspects specific to enable study of neural network techniques.

[JVET-L1010](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4839) JVET common test conditions and software reference configurations for SDR video [F. Bossen, J. Boyce, X. Li, V. Seregin, K. Sühring] (2018-10-26)

For this output, it was agreed to remove discussion of BMS and to make Class F testing mandatory (but not included in the reported averages).

[JVET-L1011](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4832) JVET common test conditions and evaluation procedures for HDR/WCG video [A. Segall, E. François, S. Iwamura, D. Rusanovskyy] (2018-10-26)

A correction was needed.

[JVET-L1012](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4840) JVET common test conditions and evaluation procedures for 360° video [P. Hanhart, J. Boyce, K. Choi, J.-L. Lin] (2018-10-26)

Aspects include to enable wrap-around MVs for ERP, andupdating to use PHEC as an anchor.

[JVET-L1021](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4826) Description of Core Experiment 1 (CE 1): Partitioning [J. Ma, F. Le Léannec, M. W. Park]

This CE was planned to study L0313 and L0128, which are ways to deal with the intent to enable 64x64 pipeline decoding operation, trying to improve the coding efficiency relative to the current approach.

In the closing review on Friday it was commented that part of L0313 is less consistent with the 64x64 pipeline goal than L0128, and could be more difficult to implement on some hardware architectures. It was agreed to only include the rectangular variant of L0313, not the L-shaped variant, in the testing.

[JVET-L1022](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4828) Description of Core Experiment 2 (CE2): Subblock motion compensation [Y. He, C.-Y. Chen, C.-C. Chen]

This CE was planned to study affine motion, planar MV prediction, subblocks for ATMVP, and related constraints.

It was noted that the draft CE plan contained a large number of subtests, and it was requested for the number to be reduced during the CE plan finalization. It was noted that part of the issue was that the plan included several combinations.

A need for coordination between CE2 and CE4 was identified, as there are some overlapping aspects.

[JVET-L1023](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4819) Description of Core Experiment 3 (CE3): Intra Prediction and Mode Coding [G. Van der Auwera, J. Heo, A. Filippov]

This CE was planned to study about 11 contributed methods relating to intra prediction and intra mode coding.

[JVET-L1024](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4830) Description of Core Experiment 4 (CE4): Inter prediction and motion vector coding [H. Yang, S. Liu, K. Zhang]

This CE was planned to study list derivation, merge, motion vector coding, and inter-prediction-related constraints.

A need for coordination between CE2 and CE4 was identified, as there are some overlapping aspects.

It was asked whether non-adjacent merge candidates should be included in the CE, due to complexity concerns. A proponent said that some versions of this does not require extra memory (either with 8x8 grid or within the current 64x64 region), and suggested to study these versions. The CE finalization will consider this and may remove some subtests.

It was suggested to include some testing of using longer lists of merge candidates. Just increasing the list size of VTM 3 merge mode (currently 6) was suggested to be used as another anchor.

[JVET-L1025](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4827) Description of Core Experiment 5 (CE5): Arithmetic Coding Engine [H. Kirchhoffer, A. Said]

This CE was planned to study alternative arithmetic coding engines and customized window sizes.

It was commented that including the bypass bins in the throughput testing seemed unnecessary and complicates the model. The bypass processing is the same for all cases. It was agreed to remove that aspect.

[JVET-L1026](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4821) Description of Core Experiment 6 (CE6): Transforms and transform signalling [A. Said, X. Zhao]

This CE was planned to study transform core designs, fast transform factorizations, transform signalling, subblock transforms, and secondary transforms.

It was noted that the draft CE plan contained a large number of subtests, and it was requested for the number to be reduced during the CE plan finalization. It was noted that part of the issue was that the plan included several combinations.

[JVET-L1027](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4823) Description of Core Experiment 7 (CE 7): Quantization and coefficient coding [H. Schwarz, M. Coban, C. Auyeung]

This CE was planned to study reducing the number of context coded bins in coefficient coding, and reducing the number of passes.

[JVET-L1028](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4825) Description of Core Experiment 8 (CE8): Screen Content Coding Tools [X. Xu, Y.-H. Chao, Y.-C. Sun, J. Xu]

This CE was planned to study CPR modifications, palette mode modifications, and block-based DPCM.

[JVET-L1029](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4829) Description of Core Experiment 9 (CE9): Decoder-Side Motion Vector Derivation [X. Xiu, S. Esenlik]

This CE was planned to study bidirectional optical flow, bilateral matching and template based matching techniques for DMVR.

[JVET-L1030](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4824) Description of Core Experiment 10 (CE10): Combined and multi-hypothesis prediction [C.-W. Hsu, M. Winken, X. Xiu]

This CE was planned to study OBMC, multiple shape partitions, prediction with more than two hypotheses, local illumination compensation, diffusion filter, and other blending of multiple predictors (if any).

[JVET-L1031](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4831) Description of Core Experiment 11 (CE11): Deblocking [A. Norkin, A. M. Kotra]

This CE was planned to study longer tap-length filters and deblocking on a 4x4 grid.

The number of actual tests was planned to be reduced, relative to the initial presented version.

[JVET-L1032](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4820) Description of Core Experiment 12 (CE12): Mapping functions [E. François, P. Yin]

This CE was planned to include in-loop mapping functions for SDR.

[JVET-L1033](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4818) Description of Core Experiment 13 (CE13): Coding tools for 360° omnidirectional video [P. Hanhart, J.-L. Lin, C. Pujara]

This CE was planned to study changes to in-loop filters, inter prediction, post-filtering, projection rotations and packings.

# Future meeting plans, expressions of thanks, and closing of the meeting

Future meeting plans were established according to the following guidelines:

* Meeting under ITU-T SG 16 auspices when it meets (starting meetings on the Tuesday or Wednesday of the first week and closing it on the Tuesday or Wednesday of the second week of the SG 16 meeting – a total of 6–7.5 meeting days), and
* Otherwise meeting under ISO/IEC JTC 1/SC 29/WG 11 auspices when it meets (starting meetings on the Wednesday or Thursday prior to such meetings and closing it on the last day of the WG 11 meeting – a total of 8.5 meeting days).

In cases where high workload is expected for a meeting, an earlier starting date may be defined.

Some specific future meeting plans (to be confirmed) were established as follows:

* Tue. 19 – Wed. 27 March 2019, 14th meeting under ITU-T auspices in Geneva, CH.
* Wed. 3 – Fri. 12 July 2019, 15th meeting under WG 11 auspices in Gothenburg, SE.
* Tue. 1 – Wed. 9 October 2019, 16th meeting under ITU-T auspices in Geneva, CH.
* Wed. 8 – Fri. 17 January 2020, 17th meeting under WG 11 auspices in Brussels, BE.

The agreed document deadline for the 14th JVET meeting was planned to be XXday X March 2019. Plans for scheduling of agenda items within that meeting remained TBA.

WG 11, the local hosting organization XXXX, and the supporting organizations XXXX were thanked for the excellent hosting and organization of the 13th meeting of the JVET.

XXX was thanked for providing viewing equipment used during the 13th JVET meeting.

XXXX were thanked for providing additional test material for usage in standardization efforts.

The 13th JVET meeting was closed at approximately XXXX hours on Friday 18 January 2019.

# Annex A to JVET report: List of documents

# Annex B to JVET report: List of meeting participants

The participants of the thirteenth meeting of the JVET, according to a sign-in sheet circulated during the meeting sessions (approximately XXX people in total), were as follows: