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| *Title:* | **CE2: Summary Report on Illumination Compensation Complexity Reduction** | | |
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# Abstract

This document is the summary report of Core Experiment 2 (CE2) on Illumination Compensation Complexity Reduction. Tools under test will be evaluated according to their impact on compression efficiency and implementation complexity.

# Participants

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1. **List of contribution**

|  |  |  |
| --- | --- | --- |
| **Doc No.** | **Title** | **Type** |
| [JCT3V-K0032](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=2444) | 3D-CE2: Complexity reduction on illumination compensation for 3D-HEVC | Proposal |
| [JCT3V-K0037](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=2449) | 3D-CE2: Cross check of Complexity reduction on illumination compensation for 3D-HEVC: Disabling Bi-prediction for IC (JCT3V-K0032) | Crosscheck |
| [JCT3V-K0057](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=2469) | 3D-CE2: Crosscheck of Complexity reduction on illumination compensation for 3D-HEVC (JCT3V-K0032) | Crosscheck |
| [JCT3V-K0068](http://phenix.it-sudparis.eu/jct2/doc_end_user/current_document.php?id=2482) | 3D-CE2: Crosscheck of complexity reduction on illumination compensation for 3D-HEVC - Enabling 4x4 chroma and disabling bi-prediction (JCT3V-K0032) | Crosscheck |

# Summary of proposals & results

In the current 3D-HEVC, for each block coded with illumination compensation (IC), the LLS (linear least square) method is utilized to calculate α and β parameters for luma component, and only β parameter is required for chroma component. To reduce the usage of LLS which requires numbers of additional multiplication operations and memory accessing, this contribution proposes to disable bi-prediction for IC.

The following aspects should be further studied in this context:

* The consequences of this restriction may require more careful investigation beyond CTC.
* Investigate the worst case issue.
* Investigate the interaction with disabling 4x4 chroma IC.

Three cases are conducted to analyze the complexity reduction and evaluate the coding performance under the common test conditions and IBP test conditions including:

(1) disabling bi-prediction IC.

(2) enabling chroma 4x4 IC.

(3) disabling bi-prediction IC and enabling chroma 4x4 IC.

Table 1 shows the complexity analysis on the latest Draft Text 6. As shown in Table 1, IC becomes the worst case on operation complexity, especially in a general system where general multiplication is time-consuming.

Table 1. Complexity analysis of WD Text 6

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Number of operation [%] | |
| 3D-HEVC |  | Mult [%] | Add [%] |
| MC | 100% | 100% |
| ARP | 33% | 28% |
| IC | 104.7% | 106.6% |
| VSP | 18% | 17% |
| DBBP | 85% | 102% |

The complexity analysis with the simplified IC for three cases is summarized in Table 2.

Table 2. Complexity analysis for the WD text with the simplified IC

|  |  |  |
| --- | --- | --- |
| Method | MUL | ADD |
| WD6 | 104.7% | 106.6% |
| WD6+Disabling Bi-IC | 52.3% | 51.8% |
| WD6+Enabling Chroma 4x4 IC | 104.7% | 109.8% |
| WD6+Disabling Bi-IC + Enabling Chroma 4x4 IC | 52.3% | 53.4% |

Six tests are conducted to evaluate the coding performance for the above three cases under the common test conditions (CTC) and IBP test conditions in HTM13, respectively. The results are summarized in Table 3 for CTC test conditions and Table 4 for IBP test conditions.

Table 3. Experimental results of three cases under CTC

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Test* | *Video 1* | *Video 2* | *Video/video BR* | *Video/total BR* | *Synthesized/total BR* |
| Disabling bi-prediction IC | 0.00% | 0.02% | 0.01% | 0.01% | 0.01% |
| Enabling chroma 4x4 IC | -0.03% | 0.02% | 0.00% | 0.00% | 0.00% |
| Disabling bi-prediction IC & Enabling chroma 4x4 IC | -0.03% | 0.05% | 0.01% | 0.01% | 0.01% |

Table 4. Experimental results of three cases under IBP

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Test* | *Video 1* | *Video 2* | *Video/video BR* | *Video/total BR* | *Synthesized/total BR* |
| Disabling bi-prediction IC | 0.05% | 0.15% | 0.03% | 0.03% | 0.02% |
| Enabling chroma 4x4 IC | 0.08% | 0.11% | 0.03% | 0.03% | 0.05% |
| Disabling bi-prediction IC & Enabling chroma 4x4 IC | 0.04% | 0.13% | 0.03% | 0.03% | 0.03% |