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| **Joint Collaborative Team on 3D Video Coding Extensions**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  6th Meeting: Geneva, CH, 25 Oct. – 1 Nov. 2013 | Document: JCT3V-F0104\_r2 |

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| *Title:* | **CE3-related: Removal of redundancy on VSP, ARP and IC** | | |
| *Status:* | Input Document to JCT-3V | | |
| *Purpose:* | Proposal | | |
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# Abstract

Since VSP, ARP and IC are mutually exclusive, allowing that combination is redundant. That results in coding efficiency degration, especially prominent when ARP or IC is enabled but VSP merge mode is inserted in vain. In this proposal, it is proposed to insert VSP merge candidate on the condition that ARP and IC is not enabled in the CU. IC flag is also not signalled when ARP is enabled. The experimental result reportedly shows 0.1 %, 0.1 %, and 0.1 % gain in texture, video and synthesis respectively.

Revision1: On top of the above, VSP inheritance control is proposed. The experimental result reportedly shows 0.1 %, 0.1 %, and 0.2 % gain in texture, video and synthesis respectively.

Revision2: Added independent test results for:

Test3) Merge candidates list derivation based on IC flag

Test4) Merge candidates list derivation based on ARP flag

Test5) Merge candidates list derivation based on IC + ARP flag

It is asserted to suggest Test 3 or Test 5’s Adoption.

Coding performance comparison between MC method and Merge method on Illumination compensation

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate |
| **[F0146]**  **MC on IC** | **0.00%** | **-0.12%** | **-0.13%** | **-0.06%** | **-0.05%** | **-0.07%** |
| **[F0104 test3]**  **Merge on IC** | **0.00%** | **-0.15%** | **-0.25%** | **-0.11%** | **-0.11%** | **-0.09%** |

Coding performance improvement by Merge method on ARP

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate |
| **[F0104 test4]**  **Merge on ARP** | **0.00%** | **-0.27%** | **-0.29%** | **0.01%** | **0.02%** | **-0.09%** |

Coding performance comparison on combination case

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate |
| **[F0104 test 5]**  **Merge on IC + ARP** | **0.00%** | **-0.49%** | **-0.46%** | **-0.09%** | **-0.06%** | **-0.14%** |

# Introduction

In the current design, when the PU is a VSP merge mode, ARP and IC is not utilized in motion compensation process although ARP flag (iv\_res\_pred\_weight\_idx) or IC flag (ic\_flag) is equal to 0. So VSP, ARP and IC are mutually exclusive. Reversely, when ARP or IC is utilized, inserting VSP merge mode wastes one merge mode.

VSP inheritance that VSP motion information from neighboring blocks is inherited regardless of ARP flag or IC flag is also considered redundant.

# Proposal

We propose to insert VSP merge candidate on the condition that ARP and IC is not enabled in the CU.

Also IC flag is not signalled when ARP is enabled. The exclusiveness of IC flag doesn’t produce much coding efficiency but removing redundancy is reasonable and encoder can be speed up without loss.

VSP inheritance control:

In addition, the VSP motion information from neighboring blocks is adaptively inherited to the merge candidate list depending on the given PU’s ic\_flag and iv\_res\_pred\_weight\_idx.

As depicted in Figure 1, if the given PU’s ic\_flag is equal to 0, the merge candidate list is constructed as the current design that properly inherits VSP motion information from neighboring blocks. Otherwise, if ic\_flag is equal to 1, VSP motion information from neighboring blocks is inherited as DCP motion information, which could be done by simply not considering the VSP flag.



Figure 1. Depending on the given PU’s if\_flag, the VSP motion information from neighboring blocks is adaptively inherited to the merge candidate list.

# Proposed Text

**H.8.5.2.1.1 Derivation process for luma motion vectors for merge mode**

* 1. 6When availableFlagVSP is equal to 1 and ic\_flag is equal to 0 and && !iv\_res\_pred\_weight\_idx is equal to 0, the entry mergeCandList[ numMergeCand ] is set equal to VSP, the entry mergeCandIsVspFlag[ numMergeCand ] is set equal 1 and the variable numMergeCand is increased by 1.

|  |  |
| --- | --- |
| coding\_unit( x0, y0, log2CbSize , ctDepth) { | **Descriptor** |
| if( transquant\_bypass\_enable\_flag ) { |  |
| **cu\_transquant\_bypass\_flag** | ae(v) |
| } |  |
| if( slice\_type != I ) |  |
| **skip\_flag**[ x0 ][ y0 ] | ae(v) |
| if( skip\_flag[ x0 ][ y0 ] ) { |  |
| prediction\_unit( x0, y0, log2CbSize ) |  |
| if ( iv\_res\_pred\_flag[ nuh\_layer\_id ] && TempRefPicInListsFlag ) |  |
| **iv\_res\_pred\_weight\_idx** | ae(v) |
| if ( icEnableFlag && iv\_res\_pred\_weight\_idx == 0 ) |  |
| **ic\_flag** | ae(v) |
| } |  |
| else { |  |
| nCbS = ( 1 << log2CbSize ) |  |
| if( slice\_type != I ) |  |
| **pred\_mode\_flag** | ae(v) |
| if( ( PredMode[ x0 ][ y0 ] ! = MODE\_INTRA | | log2CbSize = = Log2MinCbSize ) &&  !predPartModeFlag) |  |
| **part\_mode** | ae(v) |
| if( PredMode[ x0 ][ y0 ] = = MODE\_INTRA ) { |  |
| … |  |
| } else { |  |
| if( PartMode = = PART\_2Nx2N ) { |  |
| prediction\_unit( x0, y0, nCbS, nCbS ) |  |
| if ( iv\_res\_pred\_flag[ nuh\_layer\_id ] && TempRefPicInListsFlag ) |  |
| **iv\_res\_pred\_weight\_idx** | ae(v) |
| } else if( PartMode = = PART\_2NxN ) { |  |
| … |  |
| } |  |
| } |  |
| if ( icEnableFlag && iv\_res\_pred\_weight\_idx == 0) |  |
| **ic\_flag** | ae(v) |

WD with VSP inheritance control:

See the attached WD

# Simulation results

Test1 VSP inserting control and ic\_flag signaling

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate | enc time | dec time | ren time |
| Balloons | 0.0% | -0.8% | -0.6% | -0.2% | -0.1% | -0.2% | 97.5% | 101.9% | 100.6% |
| Kendo | 0.0% | -0.8% | -0.8% | -0.2% | -0.1% | -0.2% | 97.1% | 100.7% | 100.4% |
| Newspaper\_CC | 0.0% | -0.6% | -0.4% | -0.1% | -0.1% | -0.1% | 98.0% | 100.7% | 99.7% |
| GT\_Fly | 0.0% | -0.1% | -0.1% | 0.0% | 0.0% | 0.0% | 100.1% | 100.5% | 100.0% |
| Poznan\_Hall2 | 0.0% | -0.2% | -0.7% | -0.2% | -0.2% | -0.2% | 97.9% | 99.6% | 99.8% |
| Poznan\_Street | 0.0% | -0.3% | -0.5% | 0.0% | 0.0% | -0.1% | 98.0% | 98.6% | 99.7% |
| Undo\_Dancer | 0.0% | -0.3% | -0.4% | -0.1% | 0.0% | -0.1% | 98.2% | 100.5% | 99.7% |
| 1024x768 | 0.0% | -0.7% | -0.6% | -0.2% | -0.1% | -0.2% | 97.5% | 101.1% | 100.2% |
| 1920x1088 | 0.0% | -0.2% | -0.4% | -0.1% | -0.1% | -0.1% | 98.6% | 99.8% | 99.8% |
| **Average** | **0.0%** | **-0.4%** | **-0.5%** | **-0.1%** | **-0.1%** | **-0.1%** | **98.1%** | **100.4%** | **100.0%** |
|  |  |  |  |  |  |  |  |  |  |
| Shark | 0.0% | -0.3% | -0.2% | 0.0% | 0.0% | 0.0% | 100.4% | 95.0% | 98.1% |

Test 2: Test 1 plus VSP inheritance control

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate | enc time | dec time | ren time |
| Balloons | 0.0% | -1.0% | -0.6% | -0.2% | -0.2% | -0.2% | 96.7% | 85.8% | 110.7% |
| Kendo | 0.0% | -0.9% | -0.9% | -0.2% | -0.2% | -0.3% | 96.0% | 97.2% | 107.9% |
| Newspaper\_CC | 0.0% | -0.6% | -0.5% | -0.1% | -0.1% | -0.2% | 96.8% | 106.3% | 109.5% |
| GT\_Fly | 0.0% | -0.2% | -0.1% | 0.0% | 0.0% | 0.0% | 99.7% | 102.0% | 111.8% |
| Poznan\_Hall2 | 0.0% | -0.4% | -0.4% | -0.1% | -0.1% | -0.3% | 97.9% | 102.7% | 116.8% |
| Poznan\_Street | 0.0% | -0.3% | -0.6% | 0.0% | -0.1% | -0.1% | 97.7% | 117.3% | 111.1% |
| Undo\_Dancer | 0.0% | -0.2% | -0.4% | -0.1% | 0.0% | -0.1% | 98.0% | 103.3% | 114.3% |
| 1024x768 | 0.0% | -0.8% | -0.7% | -0.2% | -0.1% | -0.2% | 96.5% | 96.4% | 109.3% |
| 1920x1088 | 0.0% | -0.3% | -0.4% | -0.1% | -0.1% | -0.1% | 98.3% | 106.3% | 113.5% |
| **average** | **0.0%** | **-0.5%** | **-0.5%** | **-0.1%** | **-0.1%** | **-0.2%** | **97.5%** | **102.1%** | **111.7%** |
|  |  |  |  |  |  |  |  |  |  |
| Shark | 0.0% | -0.3% | -0.3% | 0.0% | 0.0% | 0.0% | 99.6% | 99.9% | 107.3% |

Test 3: Merge candidates derivation based on IC

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate | enc time | dec time | ren time |
| Balloons | 0.00% | -0.51% | -0.31% | -0.18% | -0.17% | -0.19% | 101.3% | 102.5% | 99.0% |
| Kendo | 0.00% | -0.50% | -0.75% | -0.28% | -0.28% | -0.27% | 101.2% | 101.3% | 98.3% |
| Newspaper\_CC | 0.00% | -0.14% | -0.14% | -0.09% | -0.08% | -0.02% | 100.9% | 97.9% | 101.5% |
| GT\_Fly | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.7% | 98.0% | 99.9% |
| Poznan\_Hall2 | 0.00% | -0.03% | -0.32% | -0.17% | -0.19% | -0.15% | 100.5% | 98.6% | 97.2% |
| Poznan\_Street | 0.00% | 0.06% | -0.02% | -0.01% | -0.02% | -0.04% | 100.7% | 107.4% | 99.7% |
| Undo\_Dancer | 0.00% | 0.08% | -0.21% | -0.02% | -0.01% | -0.02% | 100.2% | 91.7% | 99.9% |
| 1024x768 | 0.00% | -0.38% | -0.40% | -0.18% | -0.18% | -0.16% | 101.1% | 100.6% | 99.6% |
| 1920x1088 | 0.00% | 0.03% | -0.14% | -0.05% | -0.05% | -0.05% | 100.6% | 98.9% | 99.2% |
| **average** | **0.00%** | **-0.15%** | **-0.25%** | **-0.11%** | **-0.11%** | **-0.10%** | **100.8%** | **99.6%** | **99.4%** |

Test 4: Merge candidates derivation based on ARP

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate | enc time | dec time | ren time |
| Balloons | 0.0% | -0.6% | -0.3% | 0.0% | 0.0% | -0.1% | 99.2% | 101.0% | 100.4% |
| Kendo | 0.0% | -0.3% | -0.3% | 0.1% | 0.1% | -0.1% | 98.8% | 100.7% | 100.1% |
| Newspaper\_CC | 0.0% | -0.3% | -0.1% | 0.0% | 0.0% | 0.0% | 99.4% | 102.2% | 99.5% |
| GT\_Fly | 0.0% | -0.2% | -0.1% | 0.0% | 0.0% | 0.0% | 99.8% | 100.8% | 99.8% |
| Poznan\_Hall2 | 0.0% | 0.0% | -0.4% | 0.0% | 0.1% | -0.2% | 99.7% | 100.0% | 99.6% |
| Poznan\_Street | 0.0% | -0.3% | -0.5% | 0.0% | 0.0% | -0.1% | 100.0% | 99.9% | 99.6% |
| Undo\_Dancer | 0.0% | -0.2% | -0.4% | -0.1% | 0.0% | -0.1% | 99.3% | 101.3% | 99.8% |
| 1024x768 | 0.0% | -0.4% | -0.2% | 0.0% | 0.1% | -0.1% | 99.1% | 101.3% | 100.0% |
| 1920x1088 | 0.0% | -0.2% | -0.3% | 0.0% | 0.0% | -0.1% | 99.7% | 100.5% | 99.7% |
| **average** | **0.00%** | **-0.27%** | **-0.29%** | **0.01%** | **0.02%** | **-0.09%** | **99.5%** | **100.8%** | **99.8%** |

Test 4: Merge candidates derivation based on IC + ARP

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | video 0 | video 1 | video 2 | video PSNR / video bitrate | video PSNR / total bitrate | synth PSNR / total bitrate | enc time | dec time | ren time |
| Balloons | 0.0% | -0.8% | -0.6% | -0.1% | -0.1% | -0.2% | 99.3% | 101.7% | 100.1% |
| Kendo | 0.0% | -0.8% | -0.9% | -0.2% | -0.1% | -0.2% | 98.4% | 102.1% | 99.3% |
| Newspaper\_CC | 0.0% | -0.6% | -0.4% | -0.1% | -0.1% | -0.1% | 99.2% | 102.8% | 99.7% |
| GT\_Fly | 0.0% | -0.2% | -0.1% | 0.0% | 0.0% | 0.0% | 99.8% | 100.7% | 99.8% |
| Poznan\_Hall2 | 0.0% | -0.5% | -0.4% | -0.1% | -0.1% | -0.2% | 99.2% | 101.1% | 100.1% |
| Poznan\_Street | 0.0% | -0.5% | -0.6% | -0.1% | -0.1% | -0.2% | 99.4% | 99.4% | 99.4% |
| Undo\_Dancer | 0.0% | -0.1% | -0.3% | 0.0% | 0.0% | -0.1% | 99.5% | 101.2% | 100.0% |
| 1024x768 | 0.0% | -0.7% | -0.6% | -0.1% | -0.1% | -0.2% | 99.0% | 102.2% | 99.7% |
| 1920x1088 | 0.0% | -0.3% | -0.3% | -0.1% | -0.1% | -0.1% | 99.5% | 100.6% | 99.8% |
| **average** | **0.00%** | **-0.49%** | **-0.46%** | **-0.09%** | **-0.06%** | **-0.14%** | **99.3%** | **101.3%** | **99.8%** |

# Conclusion

In this proposal, it is proposed to insert VSP merge candidate on the condition that ARP and IC is not enabled in the CU. IC flag is also not signalled when ARP is enabled. The experimental result reportedly shows 0.1 %, 0.1 %, and 0.1 % gain in texture, video and synthesis respectively.

On top of the above, VSP inheritance control is proposed. The experimental result reportedly shows 0.1 %, 0.1 %, and 0.2 % gain in texture, video and synthesis respectively.

# References

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# Patent rights declaration(s)

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