

# **CE6.H related: Reference samples sub-sampling for SDC and DMM**

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# Summary

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- Motivation

- ◆ Reduce the number of computing operations for the calculation of the constant prediction value (predDCVal) for DMM and SDC

- Experimental results

- ◆ Sub-sampling for SDC: -0.01% for CTC, 0.01% for All-intra on synthesized view
- ◆ Sub-sampling for SDC and DMM: -0.05% for CTC, 0.02% for All-intra on synthesized view

- Cross-check: JCT3V-C0189 by Intel

# Calculation of constant prediction value in current design

- DMM: Use the above row and the left column's neighboring samples to derive the sum of sample's depth values and the sum of the samples

→ For  $x = 0 \dots nT - 1$  the following applies:

→ When `partitionPattern[x][0]` is equal to X, the following applies:

`sumNeigh` += `p[x][0]` →  
`numNeigh` += 1 →

- SDC: Use the prediction samples to derive the sum of sample's depth values and the sum of the samples

→ For  $y = 0 \dots nT - 1$

→ For  $x = 0 \dots nT - 1$  the following applies:

→ When `partitionPattern[x][0]` is equal to X, the following applies:

`sumNeigh` += `predSamples[x][0]` →  
`numNeigh` += 1 →

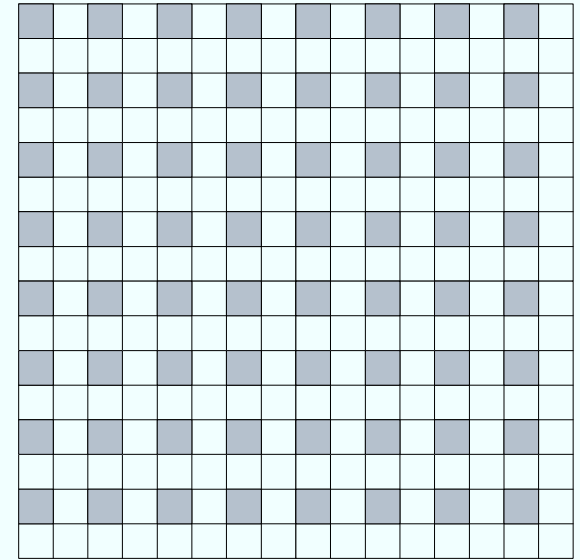
## Calculation of constant production value in carbon design (2)

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- The number of the computing operation for 32x32 and 64x64 blocks is huge
  - ◆ SDC: 4096 “addition” operation for 64x64 blocks

# Reference sample sub-sampling

- Apply the sub-sampling method to the neighboring samples / prediction samples to derive the constant prediction value when the blocksize is 32 or 64
- The number of the computing operation can be reduced to  $\frac{1}{4}$  as the current design



# Experimental results

## Reference sample sub-sampling for SDC only (CTC)

|              | video 0 | video 1 | video 2 | video only | synthesized only | coded & synthesized | enc time | dec time | ren time |
|--------------|---------|---------|---------|------------|------------------|---------------------|----------|----------|----------|
| Balloons     | 0.00%   | 0.00%   | 0.00%   | 0.00%      | 0.00%            | 0.00%               | 99.7%    | 96.2%    | 97.7%    |
| Kendo        | 0.00%   | 0.00%   | 0.00%   | 0.00%      | -0.04%           | -0.03%              | 100.5%   | 99.8%    | 100.7%   |
| Newspapercc  | 0.00%   | 0.00%   | 0.00%   | 0.00%      | 0.00%            | 0.01%               | 100.3%   | 101.6%   | 99.3%    |
| GhostTownFly | 0.00%   | 0.00%   | 0.00%   | 0.00%      | -0.04%           | -0.03%              | 99.9%    | 99.2%    | 99.5%    |
| PoznanHall2  | 0.00%   | 0.00%   | 0.00%   | 0.00%      | 0.06%            | 0.04%               | 100.2%   | 99.9%    | 100.4%   |
| PoznanStreet | 0.00%   | 0.00%   | 0.00%   | 0.00%      | 0.02%            | 0.01%               | 95.3%    | 102.5%   | 102.1%   |
| UndoDancer   | 0.00%   | 0.00%   | 0.00%   | 0.00%      | -0.06%           | -0.04%              | 95.2%    | 98.9%    | 98.3%    |
| 1024x768     | 0.00%   | 0.00%   | 0.00%   | 0.00%      | -0.01%           | -0.01%              | 100.2%   | 99.2%    | 99.3%    |
| 1920x1088    | 0.00%   | 0.00%   | 0.00%   | 0.00%      | -0.01%           | 0.00%               | 97.6%    | 100.1%   | 100.0%   |
| average      | 0.00%   | 0.00%   | 0.00%   | 0.00%      | -0.01%           | -0.01%              | 98.7%    | 99.7%    | 99.7%    |

# Experimental results (2)

## Reference sample sub-sampling for SDC only (All-intra)

|                | video 0      video 1      video 2 |             |             | video only      synthesized only |              | coded & synthesized | enc time     | dec time     | ren time     |
|----------------|-----------------------------------|-------------|-------------|----------------------------------|--------------|---------------------|--------------|--------------|--------------|
| Balloons       | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.03%        | 0.03%               | 100.2%       | 97.7%        | 98.9%        |
| Kendo          | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.03%        | 0.02%               | 99.7%        | 99.8%        | 99.2%        |
| Newspapercc    | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.02%        | 0.02%               | 100.1%       | 99.9%        | 99.9%        |
| GhostTownFly   | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.00%        | 0.00%               | 100.2%       | 101.1%       | 98.1%        |
| PoznanHall2    | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.02%        | 0.01%               | 100.0%       | 97.7%        | 99.8%        |
| PoznanStreet   | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.01%        | 0.00%               | 99.7%        | 100.3%       | 101.2%       |
| UndoDancer     | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.00%        | 0.00%               | 99.4%        | 100.4%       | 101.0%       |
| 1024x768       | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.02%        | 0.02%               | 100.0%       | 99.1%        | 99.4%        |
| 1920x1088      | 0.0%                              | 0.0%        | 0.0%        | 0.00%                            | 0.01%        | 0.01%               | 99.8%        | 99.8%        | 100.1%       |
| <b>average</b> | <b>0.0%</b>                       | <b>0.0%</b> | <b>0.0%</b> | <b>0.00%</b>                     | <b>0.01%</b> | <b>0.01%</b>        | <b>99.9%</b> | <b>99.5%</b> | <b>99.8%</b> |

# Experimental results (3)

## Reference sample sub-sampling for SDC and DMM (CTC)

|                | video 0      video 1      video 2 |              |              | video only      synthesized only |               | coded & synthesized | enc time     | dec time      | ren time      |
|----------------|-----------------------------------|--------------|--------------|----------------------------------|---------------|---------------------|--------------|---------------|---------------|
| Balloons       | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.00%         | 0.02%               | 100.0%       | 98.3%         | 98.1%         |
| Kendo          | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.05%        | -0.03%              | 100.6%       | 102.6%        | 100.1%        |
| Newspapercc    | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.05%        | -0.04%              | 100.5%       | 104.1%        | 99.7%         |
| GhostTownFly   | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.02%        | -0.01%              | 99.9%        | 101.6%        | 99.7%         |
| PoznanHall2    | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.19%        | -0.13%              | 100.1%       | 102.9%        | 101.4%        |
| PoznanStreet   | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.01%        | -0.01%              | 95.7%        | 105.1%        | 103.6%        |
| UndoDancer     | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.06%        | -0.04%              | 95.5%        | 98.8%         | 99.2%         |
| 1024x768       | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.03%        | -0.02%              | 100.4%       | 101.6%        | 99.3%         |
| 1920x1088      | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.07%        | -0.05%              | 97.8%        | 102.1%        | 101.0%        |
| <b>average</b> | <b>0.00%</b>                      | <b>0.00%</b> | <b>0.00%</b> | <b>0.00%</b>                     | <b>-0.05%</b> | <b>-0.04%</b>       | <b>98.9%</b> | <b>101.9%</b> | <b>100.3%</b> |



# Experimental results (4)

## Reference sample sub-sampling for SDC and DMM (All-intra)

|                | video 0      video 1      video 2 |              |              | video only      synthesized only |              | coded & synthesized | enc time      | dec time      | ren time      |
|----------------|-----------------------------------|--------------|--------------|----------------------------------|--------------|---------------------|---------------|---------------|---------------|
| Balloons       | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.03%        | 0.03%               | 100.9%        | 100.0%        | 100.5%        |
| Kendo          | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.02%        | 0.02%               | 101.9%        | 101.3%        | 103.4%        |
| Newspapercc    | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.02%        | 0.01%               | 101.7%        | 100.9%        | 101.1%        |
| GhostTownFly   | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | -0.01%       | -0.01%              | 100.7%        | 101.1%        | 101.1%        |
| PoznanHall2    | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.02%        | 0.02%               | 100.6%        | 101.3%        | 101.6%        |
| PoznanStreet   | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.01%        | 0.00%               | 100.5%        | 103.9%        | 102.2%        |
| UndoDancer     | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.04%        | 0.03%               | 100.3%        | 102.3%        | 103.3%        |
| 1024x768       | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.02%        | 0.02%               | 101.5%        | 100.7%        | 101.6%        |
| 1920x1088      | 0.00%                             | 0.00%        | 0.00%        | 0.00%                            | 0.01%        | 0.01%               | 100.5%        | 102.2%        | 102.0%        |
| <b>average</b> | <b>0.00%</b>                      | <b>0.00%</b> | <b>0.00%</b> | <b>0.00%</b>                     | <b>0.02%</b> | <b>0.01%</b>        | <b>100.9%</b> | <b>101.5%</b> | <b>101.9%</b> |

# Conclusions

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- Reference sample sub-sampling is proposed to the calculation of the constant prediction value in SDC and DMM
- The proposed sub-sampling method can significant reduce the number of computing operation
- For the case of SDC + DMM, the proposed sub-sampling method has no impact on the coding performance for All-intra configuration, and has some coding gain (0.05%) for CTC
- Suggest to adopt the reference sample sub-sampling for SDC and DMM when blocksize is equal to 32 or 64



# Thank you!

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