



# AHG6: Comparison between ALF and bi-prediction MC in low-delay conditions

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# Overall Summary

- Comparison ALF and Bi-Prediction MC in low-delay conditions
  - 15 full HD sequences: 5 from CTC class B and 10 from KTA 1080p

| Anchor: Main-LP, ALF-off | ALF (Main-LP, ALF-on) | Bi-Prediction MC (Main-LB, ALF-off) |
|--------------------------|-----------------------|-------------------------------------|
| BD-rate                  | -8.3%                 | -10.5%                              |
| HM Encoding Time         | 100%                  | 140%                                |
| HM Decoding Time         | 116%                  | 109%                                |
| MC Bandwidth             | 99%                   | 161%                                |

- Off-chip DRAM power is 251X of on-chip SRAM
- Off-chip DRAM latency is 26X of on-chip SRAM
- For real-time low-delay encoding-decoding applications (e.g. video phones and video conferencing) with full HD resolution, ALF could be a better trade-off than bi-prediction MC.

# Power Consumption

- In 40nm silicon technology, the power consumption of data access in different memory types for accessing 64 bits.

| Memory Type               | Power (pW) | Latency |
|---------------------------|------------|---------|
| DRAM                      | 1399.60    | 26T     |
| SRAM512x64SP (Read/Write) | 5.57       | 1T      |
| SRAM512x64SP (Write)      | 8.18       | 1T      |
| Register (Read)           | 0.37       | < 1T    |
| Register (Write)          | 0.94       | < 1T    |

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**Thank you**



# BD-Rates & Run Times

- 15 full HD sequences
  - 5 sequences from Class B of CTC
  - 10 sequences from KTA
- Anchor: Main-LP without ALF
  - ALF preserves 79% of the coding gain achieved by Main-LB without ALF.

|           | Main-LP with ALF |       |       | Main-LB without ALF |        |        |
|-----------|------------------|-------|-------|---------------------|--------|--------|
| BD-Rate   | Y                | U     | V     | Y                   | U      | V      |
| CTC FHD   | -6.1%            | -5.0% | -4.1% | -11.4%              | -10.3% | -10.0% |
| KTA FHD   | -9.5%            | -5.3% | -5.3% | -10.0%              | -9.3%  | -8.6%  |
| Average   | -8.3%            | -5.2% | -4.9% | -10.5%              | -9.6%  | -9.1%  |
| Enc. Time | 100%             |       |       | 140%                |        |        |
| Dec. Time | 116%             |       |       | 109%                |        |        |

# Power Consumption

- A H.264/AVC decoder takes 42.3mW when decoding a full HD 60fps bitstream.
  - Normalized to 40nm silicon technology
- DRAM power consumption
  - Data access includes MC bandwidth and the bandwidth of decoded pictures
  - MC bandwidth is gathered from the bitstreams in previous experiments and normalized to the specification of full HD 60fps.

|                           | Main-LP, ALF-Off                | Main-LP, ALF-On                 | Main-LB, ALF-Off                |
|---------------------------|---------------------------------|---------------------------------|---------------------------------|
| <b>DRAM Access (MB/s)</b> | 348.6 (Read)<br>+ 186.6 (Write) | 345.3 (Read)<br>+ 186.6 (Write) | 551.5 (Read)<br>+ 186.6 (Write) |
| <b>Power (mW)</b>         | 93.6                            | 93.1                            | 129.1                           |

- Main-LB without ALF needs more 35.5mW in power consumption, which is roughly equal to 20%-30% power increase of the entire decoding system (Decoder+DRAM)