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On PCM memory usage reduction in HM software
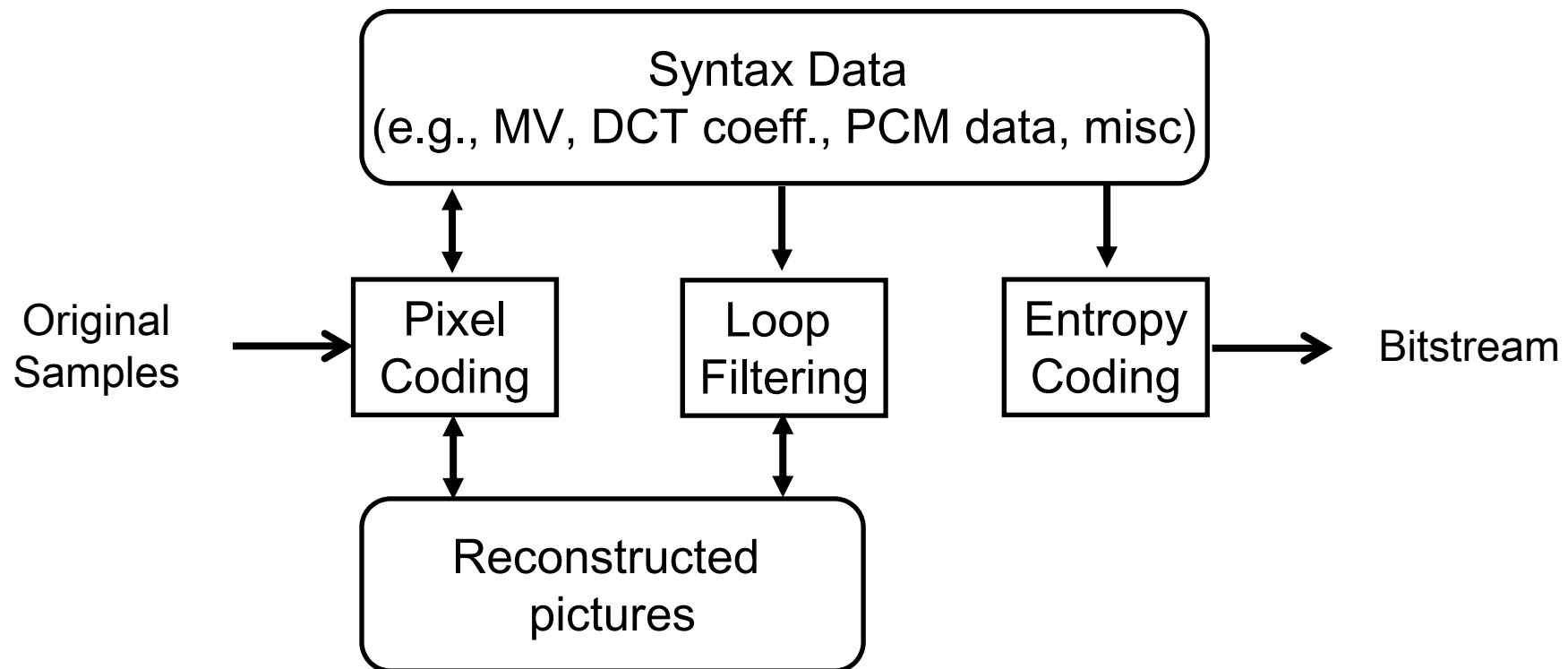## (JCTVC-G116/ M21666)

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Summary

- Ticket57: Excessive memory allocation issue of HM software

- Removal of PCM data buffer in DPB

- Simulation results
 - No change in BD-rate results
  - Slight improvement in run time (2-3%)

Excessive memory allocation issue of HM software (Ticket57)

● HM software decouples pixel coding and entropy coding; it keeps syntax data (needed for entropy-coding) of *every CU of every frame in DPB*.

```
                    ┌─────────────────────────────────────┐
                    │             Syntax Data              │
                    │  (e.g., MV, DCT coeff., PCM data, misc)│
                    └─────────────────────────────────────┘
                       ↕              ↓              ↓
Original Samples →  ┌────────┐    ┌────────┐    ┌────────┐
                    │ Pixel  │    │  Loop  │    │ Entropy│ → Bitstream
                    │ Coding │    │Filtering│    │ Coding │
                    └────────┘    └────────┘    └────────┘
                       ↕              ↕
                    ┌─────────────────────────┐
                    │      Reconstructed       │
                    │        pictures          │
                    └─────────────────────────┘
```

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PCM data buffer issue

● In JCTVC reflector, it was mentioned that PCM data buffer may significantly slow down software run time.

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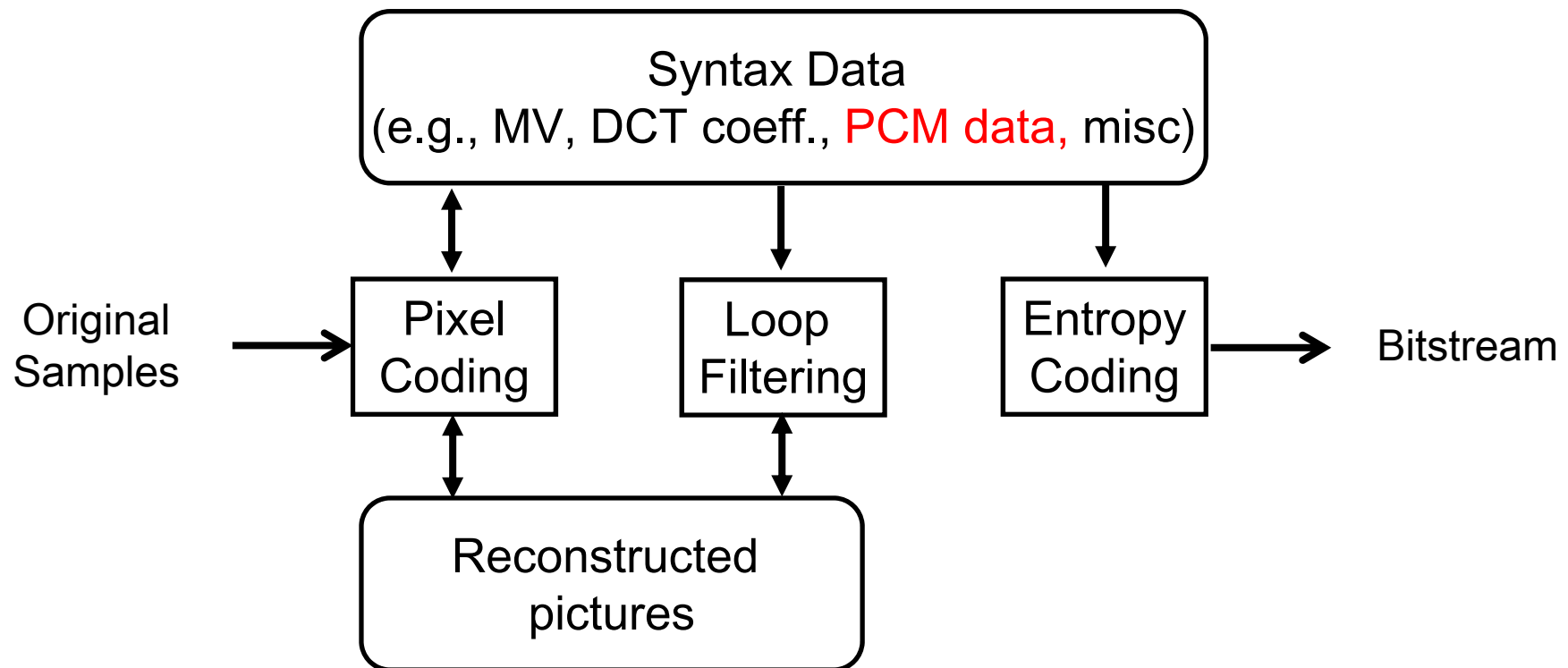
Removal of PCM data buffer in DPB

● Do not keep PCM data in syntax data in DPB.

● Instead, change data passes of pixel coding and entropy coding.

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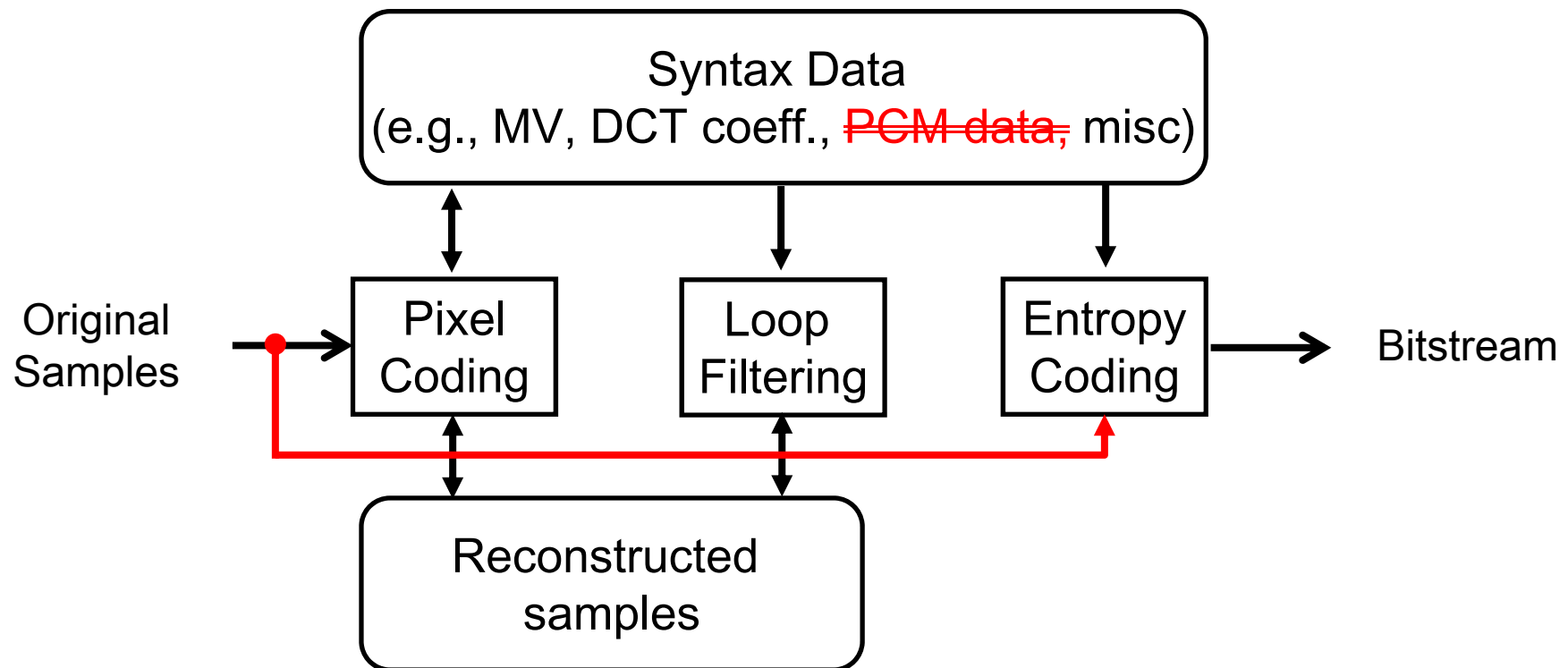
Simulation

- Common test conditions (JCTVC-F900)
  - No use of PCM mode

- Computing platform
  - Windows 7 64-bit on Core7 2.8GHz and Mem. 12GB

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Simulation results (AI and RA cases)

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class E	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class F	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Overall	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Enc Time[%]	97%			96%		
Dec Time[%]	97%			98%		

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class E						
Class F	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Overall	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Enc Time[%]	98%			98%		
Dec Time[%]	97%			97%		

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Simulation results (LB and LP cases)

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class E	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class F	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Overall	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Enc Time[%]		98%			97%	
Dec Time[%]		97%			96%	

	Low delay P HE			Low delay P LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class E	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Class F	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Overall	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Enc Time[%]		98%			98%	
Dec Time[%]		97%			97%	

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Discussions

● Removal of PCM data buffer does not change software running time significantly (on a computer with 12GB memory);

● It also does not solve the problem of Ticket 57;

● Removal of PCM data buffer from HM software seems to be a non-urgent task.

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Conclusions

- Ticket57: Excessive memory allocation issue of HM software

- Removal of PCM data buffer in DPB

- Simulation results
  - No change in BD-rate results
  - Slight improvement in run time (2-3%)

- Removal of PCM data buffer in DPB from HM software seems to be a non-urgent task

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Acknowledgement

Thanks to Panasonic for inspecting our HM-4.0 patch for PCM buffer reduction!

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