TE1.a:
Implementation report of refinement motion compensation using DMVD on TMuC

JCTVC-C138

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1. Overview

Overview

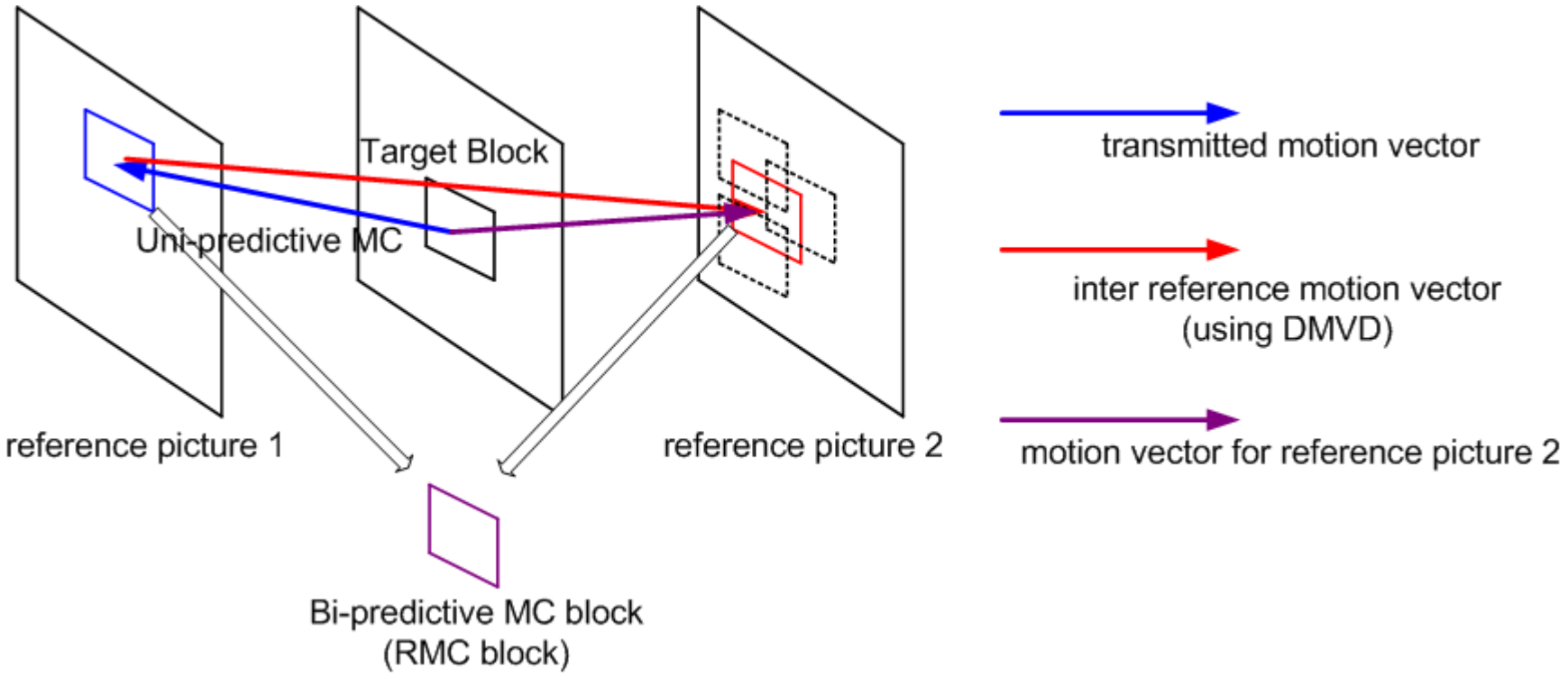
- Proposed technique
  - RMC on TE1 activity
    (Refinement Motion Compensation using DMVD)
  - Inter prediction
  - DMVD between reference pictures
- Implementation
  - Ported into TMuC0.7
  - Decoding / Encoding Procedure
- BD-rate
  - Average 1.8% gain for Random Access High
  - Average 0.0% for Low Delay High

2. Implementation of RMC

Concept of RMC

(Refinement Motion Compensation using DMVD)

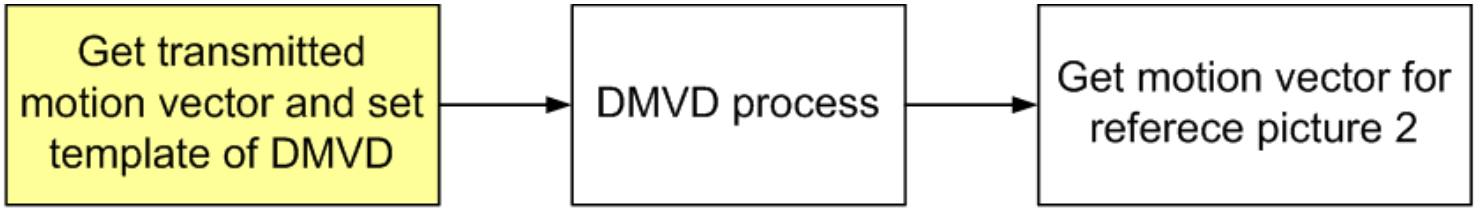
RMC was proposed for Geneva meeting (JCTVC-B032)

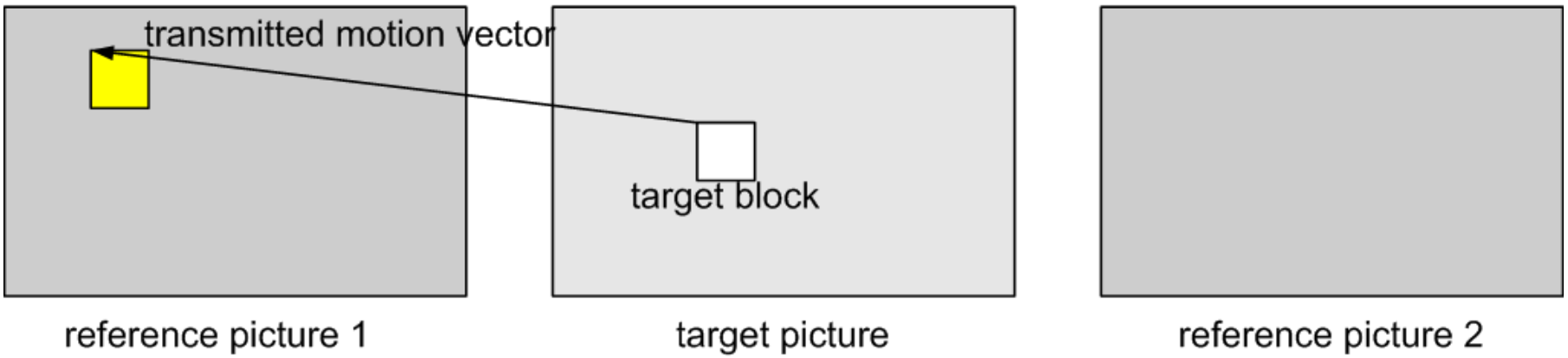


Uni-predictive MC block leads other reference picture with DMVD

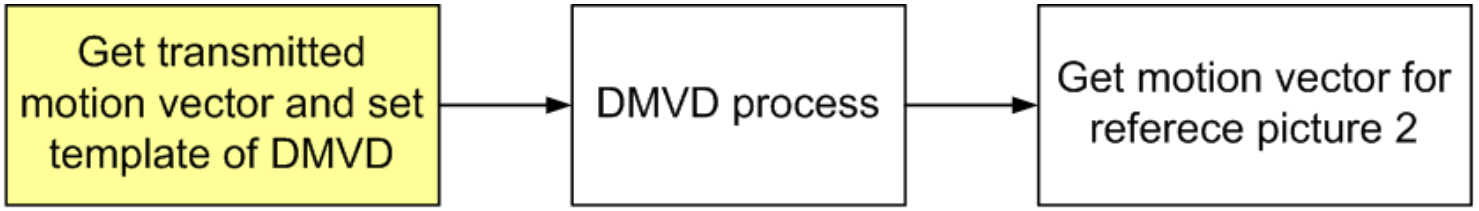
The basic parts of RMC are implemented into TMuC0.7 and evaluated

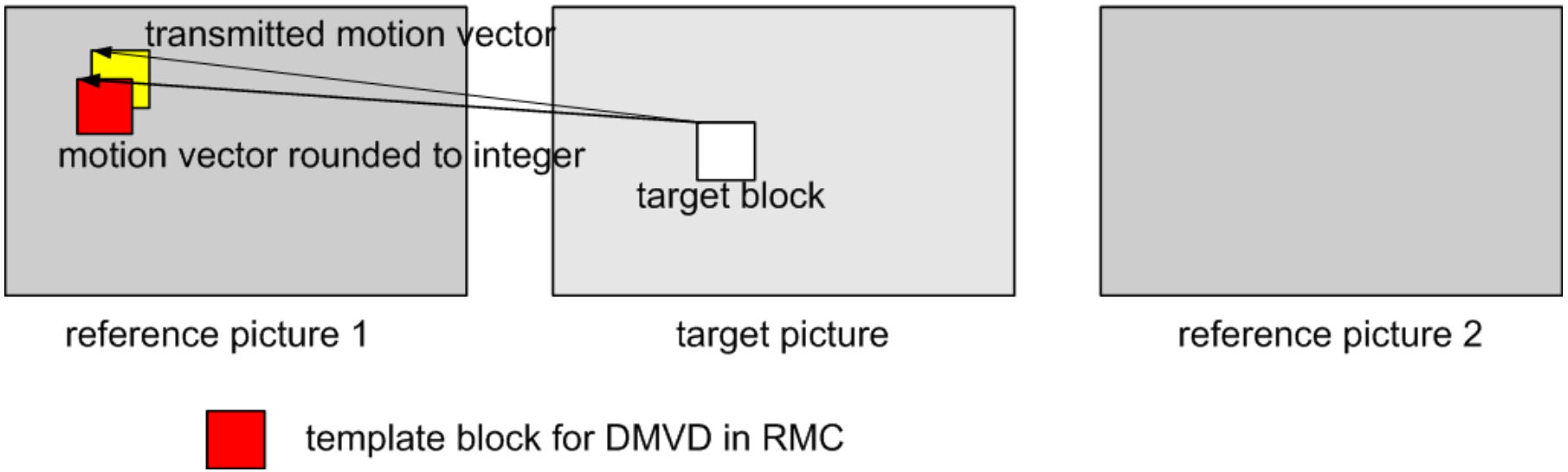
Decoding Procedure





Decoding Procedure





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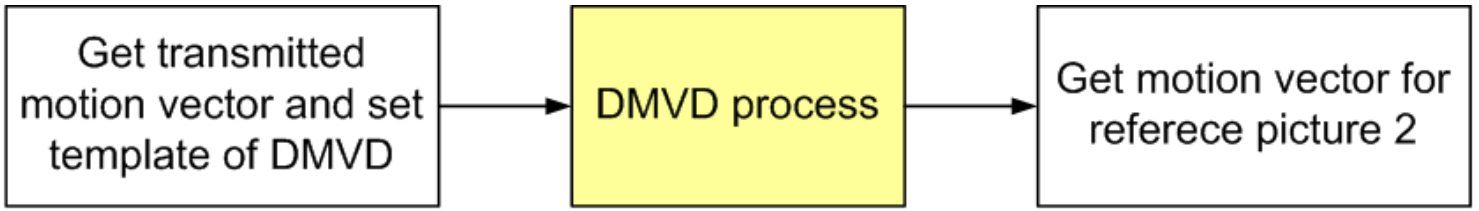
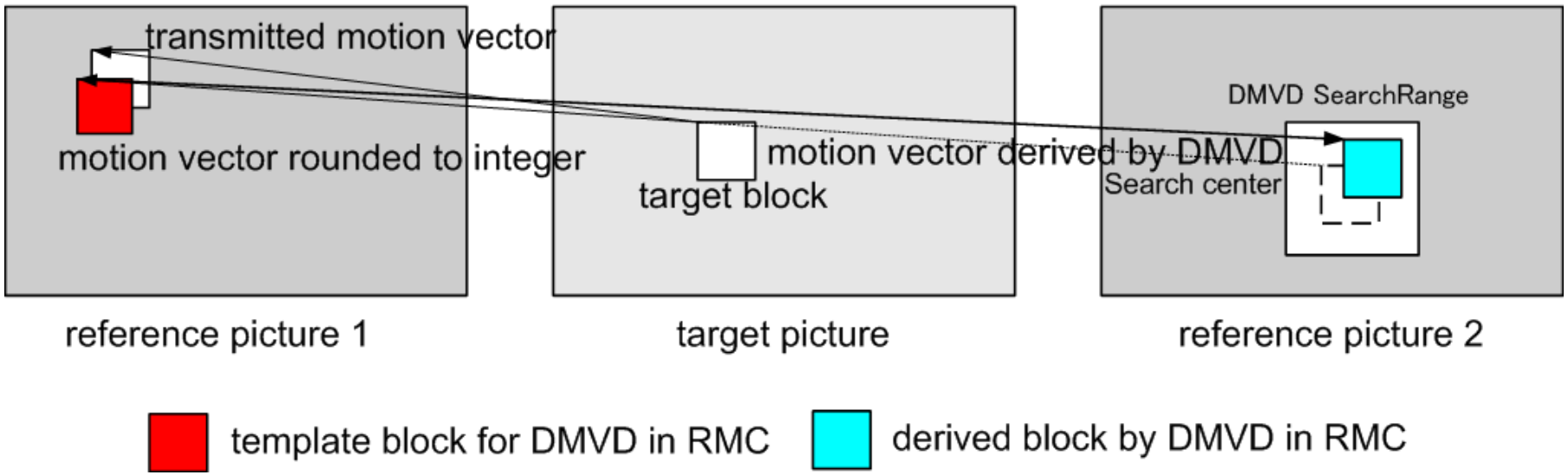
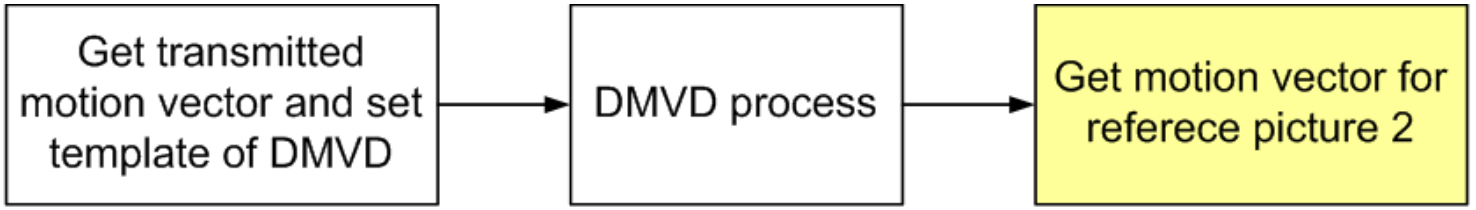
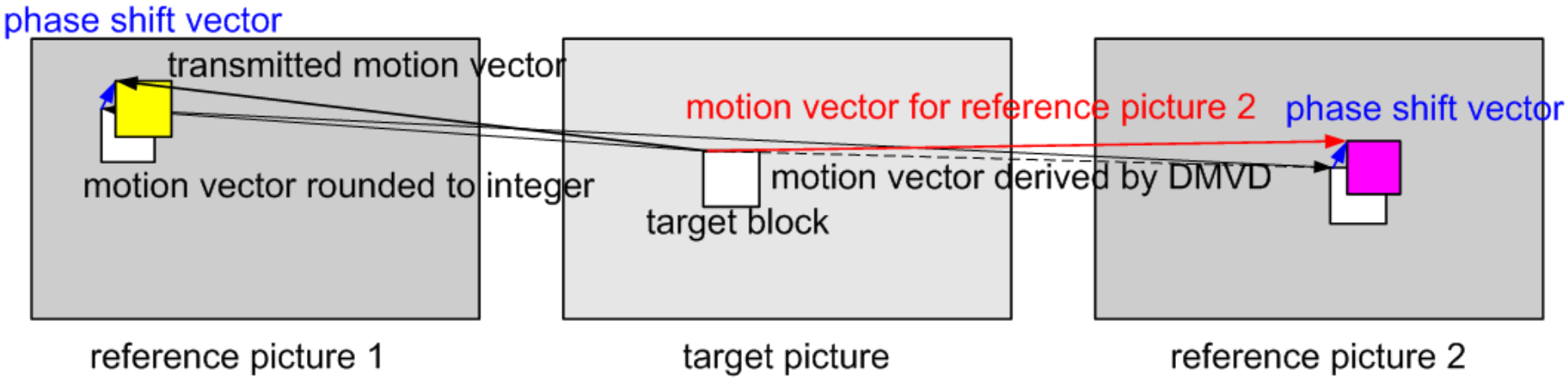


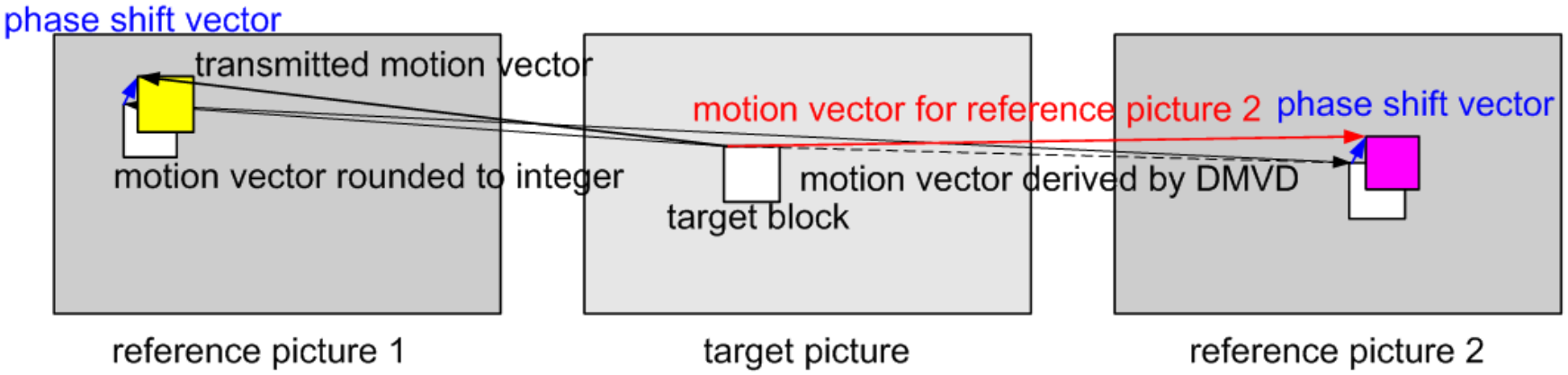


Decoding Procedure





The relationship of motion vectors in RMC



MC block for reference picture 1

motion vector for reference picture 1 : transmitted vector

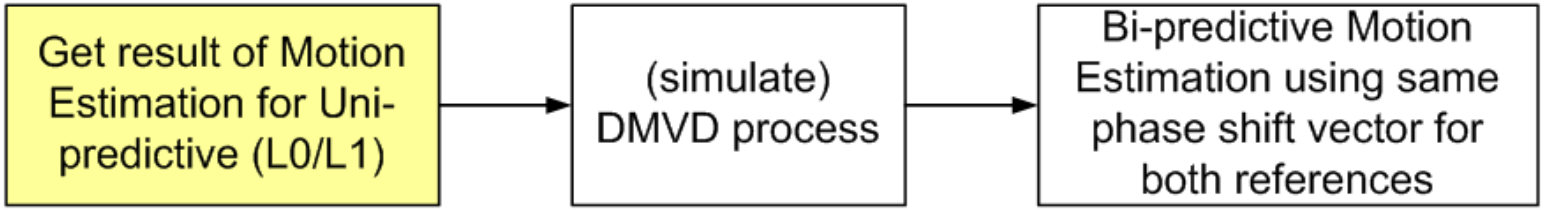
(motion vector rounded to integer + phase shift vector)

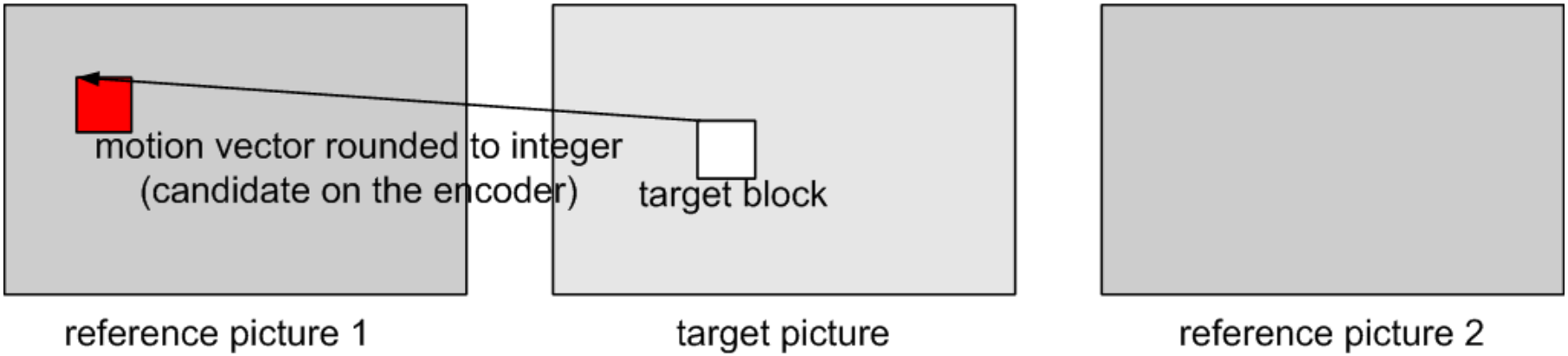
MC block for reference picture 2

motion vector for reference picture 2 : transmitted vector + motion vector dereived by DMVD

(motion vector rounded to integer + motion vector dereived by DMVD + phase shift vector)

Encoding Procedure





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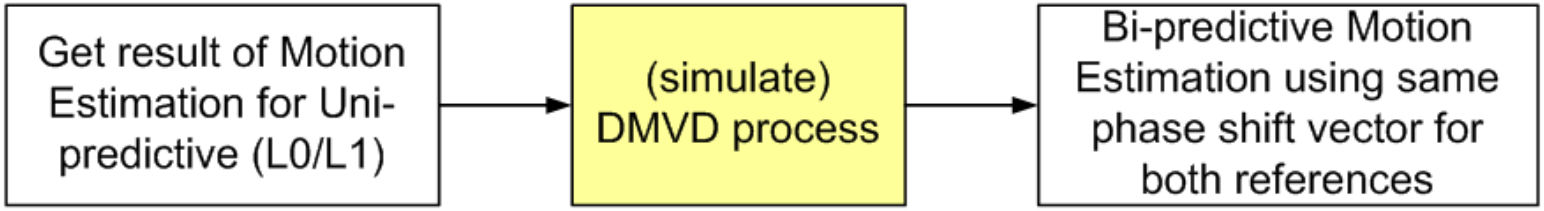

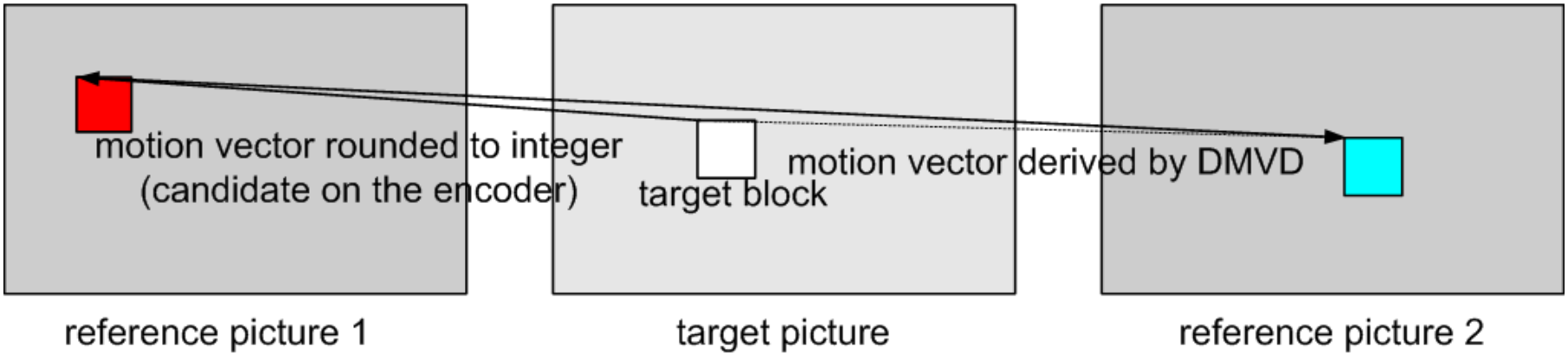

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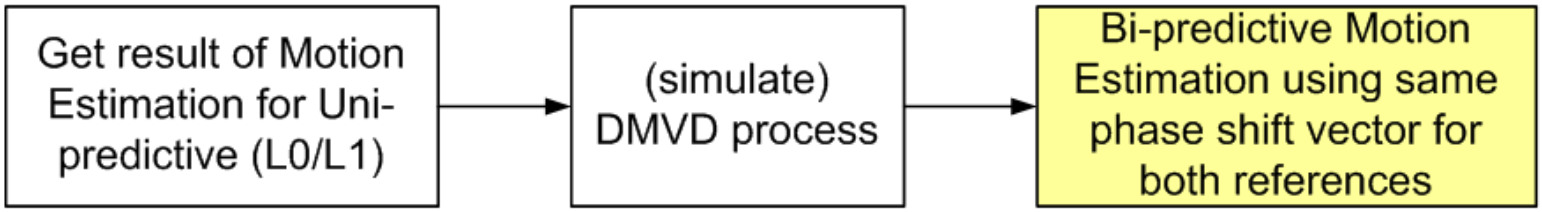
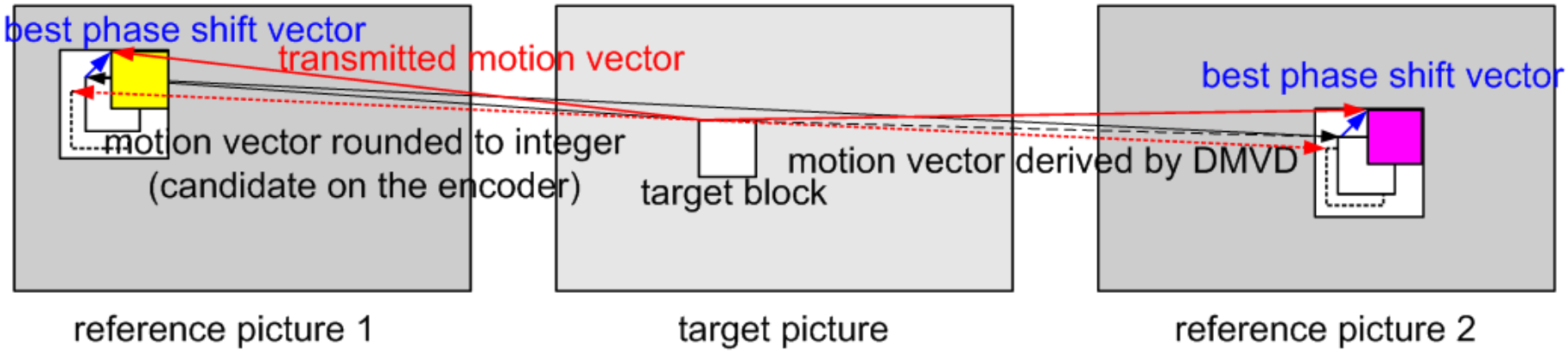




- Encoder estimates best phase shift vector using bi-predictive ME
  - Search Range -1/2 <=phase vector < 1/2
  - Evaluation Method SATD (Luminance Only)

Specification of DMVD

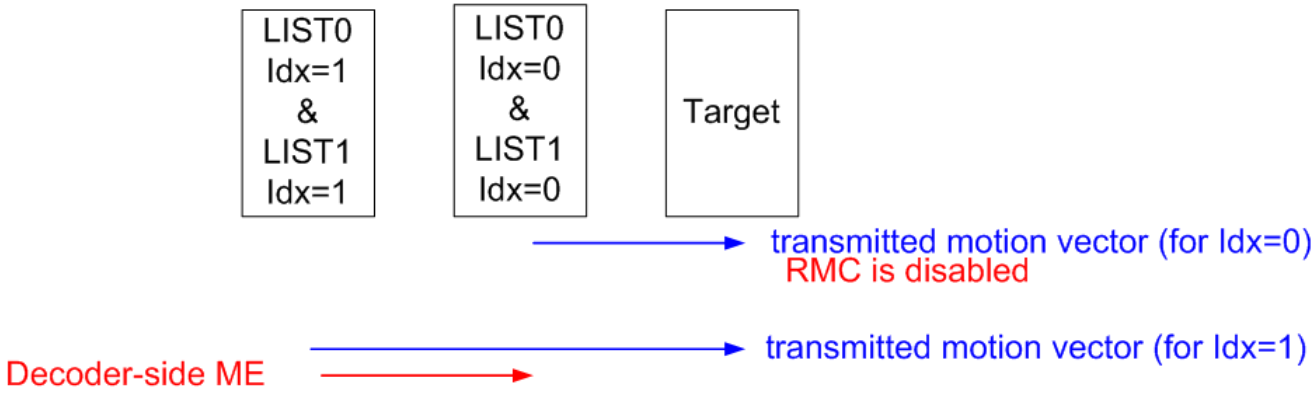
- Spec of Motion Estimation in DMVD
  - Block Matching Size — MC block size
  - Initial Position — like as temporal direct
  - Search Range for full-pixel ME — ±3 pixel
  - Search Range for sub-pixel ME — ±1/2 pixel and ±1/4 pixel
  - Sub-pixel accuracy — 1/4 pixel
  - Evaluation Method — SAD (Luminance Only)

Implicit Settings for reference picture 2

- ref_idx control — ref_idx=0 for another list
- In the case of the same reference picture — disable RMC mode

Relation of reference pictures in the case of Bi-predictive Interpolation

Relation of reference pictures in the case of Bi-predictive Extrapolation



3. Simulation Results

Simulation Results

- Conditions
  - TE1 anchor condition
    - Random Access High / Low Delay High
    - TE common condition without MRG, MVC tools
- BD-rate
  - Average 1.8% gain for Random Access High
  - Average 0.0% for Low Delay High

	Random access			Low delay		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-2.6	-3.1	-2.9			
Class B	-1.6	-1.4	-1.6	0.0	0.0	-0.1
Class C	-1.9	-2.0	-2.2	0.0	0.0	0.1
Class D	-1.6	-1.6	-1.7	0.1	0.1	0.1
Class E				0.1	-0.1	0.1
All	-1.8	-1.8	-1.9	0.0	0.0	0.1

Simulation Results

- BD-rate (results of each test sequences)

Class	Sequence	Random access		
		Y BD-rate	U BD-rate	V BD-rate
A	Traffic	-2.1	-1.8	-1.9
	PeopleOnStreet	**-3.1**	**-4.4**	**-4.0**
B	Kimono	-1.5	-1.0	-1.0
	ParkScene	-1.0	-1.1	-1.2
	Cactus	-2.3	-1.8	-2.0
	BasketballDrive	-2.4	-2.3	-2.3
	BQTerrace	-1.0	-0.9	-1.3
C	BasketballDrill	-2.5	-2.4	-2.3
	BQMall	-2.0	-1.8	-2.1
	PartyScene	-1.3	-1.7	-1.7
	RaceHorces	-2.0	-2.2	-2.6
D	BasketballPass	-2.8	-2.7	-2.7
	BQSquare	0.2	0.0	0.1
	BlowingBubbles	-0.8	-0.9	-1.3
	RaceHorces	-2.8	-2.6	-2.8

Class	Sequence	Low Delay		
		Y BD-rate	U BD-rate	V BD-rate
B	Kimono	0.0	0.2	-0.1
	ParkScene	0.0	-0.1	-0.3
	Cactus	0.0	0.0	0.2
	BasketballDrive	0.0	0.0	0.1
	BQTerrace	-0.1	-0.3	-0.3
C	BasketballDrill	0.0	0.1	0.3
	BQMall	-0.1	0.1	0.0
	PartyScene	0.0	0.1	0.2
	RaceHorces	0.0	-0.1	0.0
D	BasketballPass	0.1	0.0	0.3
	BQSquare	0.1	1.0	0.5
	BlowingBubbles	0.1	-0.2	0.2
	RaceHorces	0.0	-0.4	-0.4
E	Vidyo1	0.2	0.3	0.1
	Vidyo3	0.1	-0.2	-0.7
	Vidyo4	0.1	-0.6	1.0

Simulation Results

- Complexity
  - Encoder : result of execution time (one time)
  - Decoder
    - Mean value of three times
    - Execution without output of yuv file

	Random access	Low delay
Enc Time[%]	146%	103%
Dec Time[%]	138%	103%

4. Conclusion

Conclusion

- Proposed technique
  - RMC on TE1 activity
    (Refinement Motion Compensation using DMVD)
- BD-Bitrate
  - Average 1.8% gain for Random Access High
  - Average 0.0% for Low Delay High
- Software
  - Ported into TMuC0.7
- Future Work
  - Improve RMC algorithm (especially for Bi-predictive Extrapolation)
  - Integrate skip/direct/merge method including other TE1 techniques

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HOLDINGS

ITU
ISO
IEC
ISO/IEC JTC1/SC29 WG11
MPEG
MOVING PICTURE EXPERTS GROUP