

JVT-T079: **Updated Results for** **Independent Parsing of** **spatial and CGS layers**

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Introduction

§ JVT-S069

- Proposal for syntax modification of SVC enhancement layers
- Allows independent / parallel parsing of layers with different dependency_id (spatial or CGS enhancement layers)
- Possibility to build decoders with reduced complexity
- Minor loss in coding efficiency (less than 1% rate increase)
- Integrated into JSVM reference software as an option

§ This contribution

- No technical changes compared to JVT-S069
- Provides results for latest JSVM software (version 5.11)
- Propose to adopt the syntax modification

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Current Joint Draft / JSVM

§ Sequential operations at the decoder side for an AU

1. Parse syntax elements of layer 0 (base layer)
2. Decoding MV for layer 0 (MV prediction)
3. Derive EL motion information (for parsing next layer)
4. Parse syntax elements of layer 1 (base layer)
5. Decoding MV for layer 1 (MV prediction)
6. Derive EL motion information (for parsing next layer)
7. Parse syntax elements of layer 2 (base layer)
8. ...

§ Main disadvantages

- Interdependencies of parsing and decoding process
- Many operation have to be applied in sequential order
- Little room for parallelization
- Inter-layer MV prediction for all enhancement layer macroblocks

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Independent parsing

§ Syntax modification with following properties

- Syntax elements of enhancement layers are not conditioned on base layer syntax elements or derived parameters

§ Main properties

- Parsing / decoding doesn't need to be changed
- But, allows decoder implementations with reduced complexity
 - Could start with parsing the highest layer
 - Only required syntax elements (inter-layer prediction) of lower layer need to be parsed into memory
 - Non-required syntax elements don't need to be stored
 - Remapping of motion parameters needs only to be done for macroblock that are reference by inter-layer prediction
 - Parallel parsing of layers inside an AU

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Proposed syntax modifications

§ General

- Remove macroblock mode with quarter-sample motion refinement (syntax element `base_mode_refinement_flag`)
- Remove `intra_base_flag` (not required for single-loop decoding)
- `transform_8x8_flag` always coded when `base_mode_flag` is equal to 1
- Remove condition of `motion_pred_flag_IX` on base layer motion data
- `residual_prediction_flag` always coded when `base_mode_flag` is equal to 1

§ VLC only

- Use Inter mapping for coding CBP when `base_mode_flag` is equal to 1

§ CABAC only

- New context for `residual_prediction_flag` (base on `base_mode_flag`)
- New spatial context for `motion_pred_flag_IX`
- For context determination, macroblock with `base_mode_flag` equal to 1 are interpreted as non-Direct, non-Intra, and non-Intra4x4



Syntax
modifications

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Analysis of coding efficiency loss

§ Implementation

- Option in current JSVM reference software
- Used version 5.11 for simulations
- Verify that it works with recently adopted tools

§ Extensive simulations for different scenarios

- Coarse-grain scalability
 - Different number of layers, different delta QP's
 - Different bit-rate ranges
 - CABAC and VLC
- Spatial scalability
 - QCIF to CIF
 - CIF to 4CIF
 - Different bit-rate ranges
 - CABAC and VLC

CGS simulations

§ 3 layer test

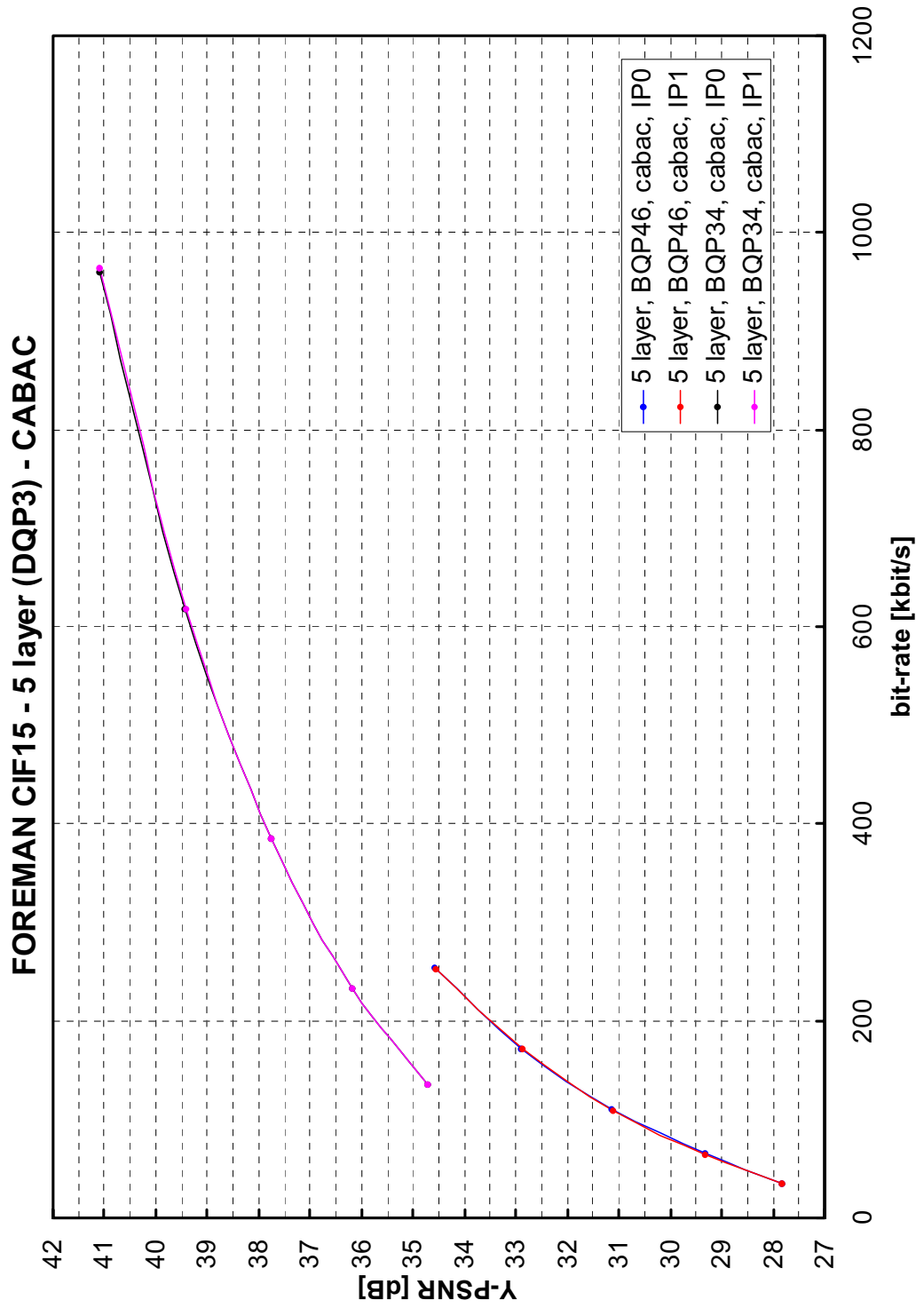
- CIF 15Hz test sequences, GOP size 16
- 3 CGS layer with DQP of 6 between layers
- QP's for low-rate test: 46, 40, 34
- QP's for high-rate test: 34, 28, 22
- Entropy coding: VLC and CABAC

§ 5 layer test

- CIF 15Hz test sequences, GOP size 16
- 5 CGS layer with DQP of 3 between layers
- QP's for low-rate test: 46, 43, 40, 37, 34
- QP's for high-rate test: 34, 31, 28, 25, 22
- Entropy coding: VLC and CABAC

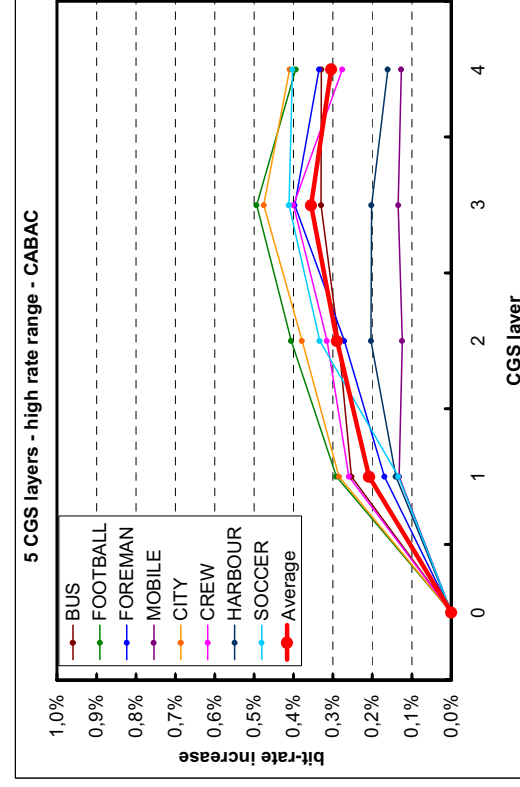
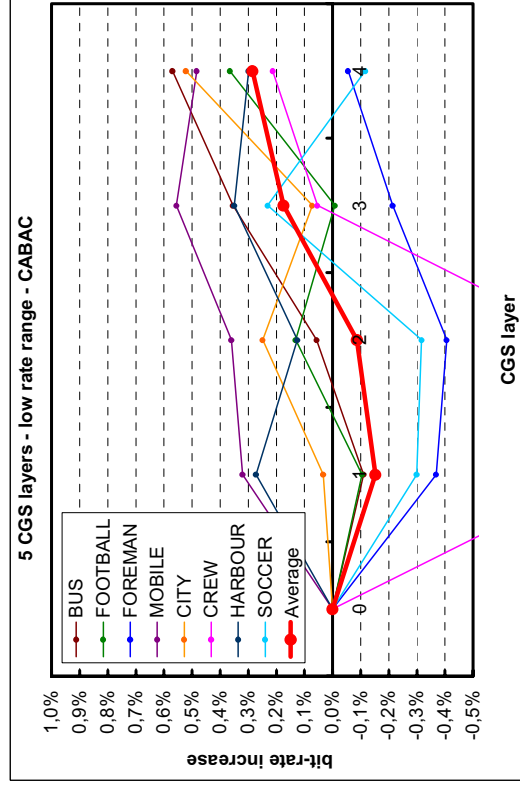
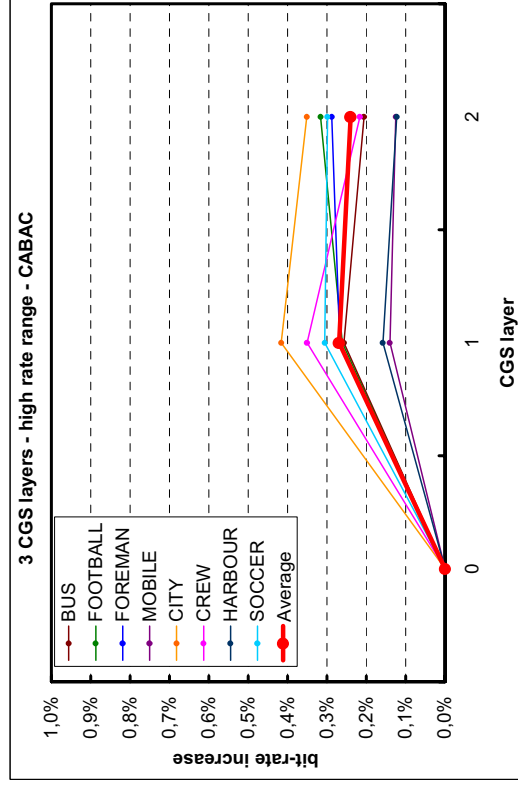
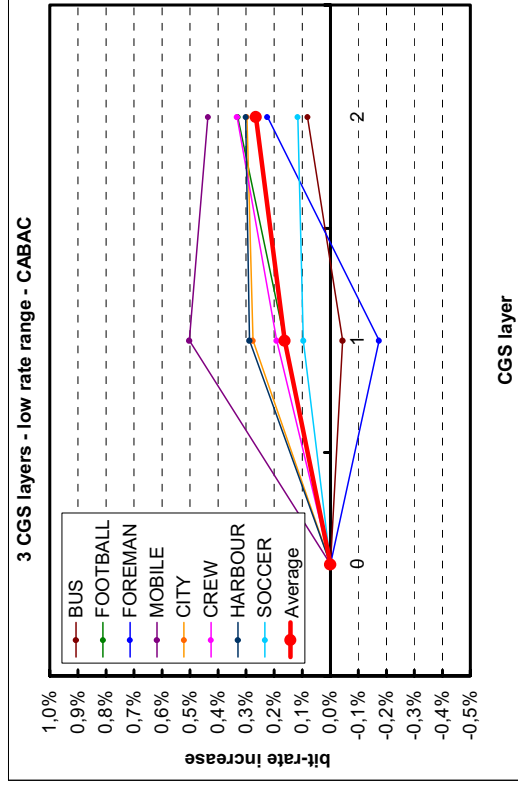
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CGS Test – Example

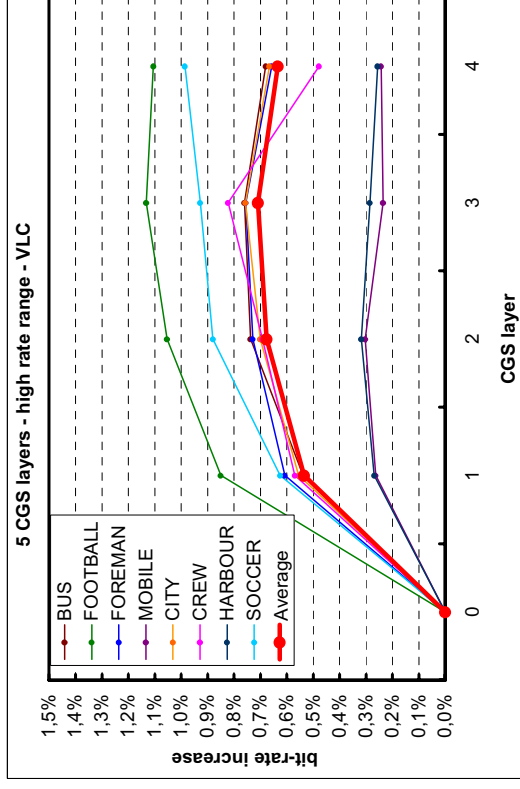
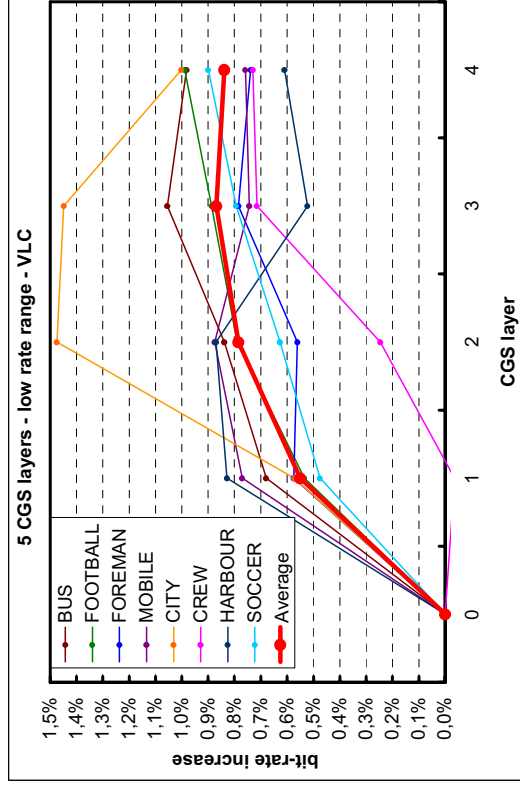
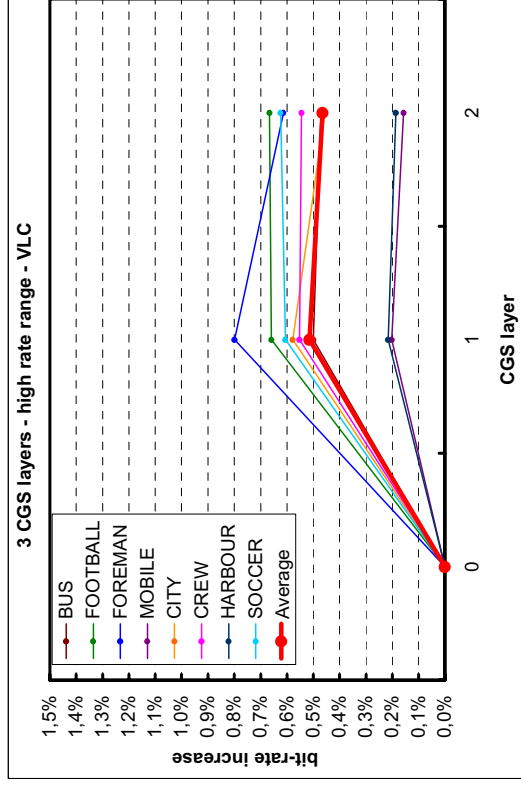
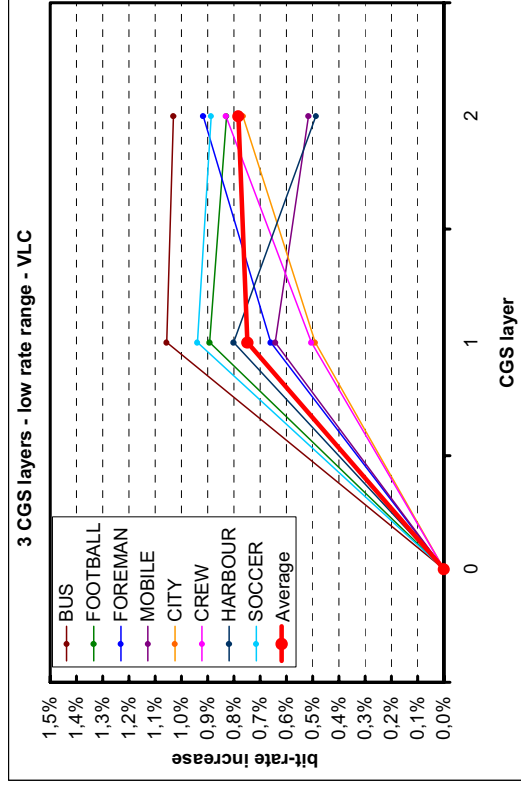


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CGS test – Summary – CABAC



CGS test – Summary – VLC



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Spatial scalability tests

§ QCIF 15Hz -> CIF 15Hz

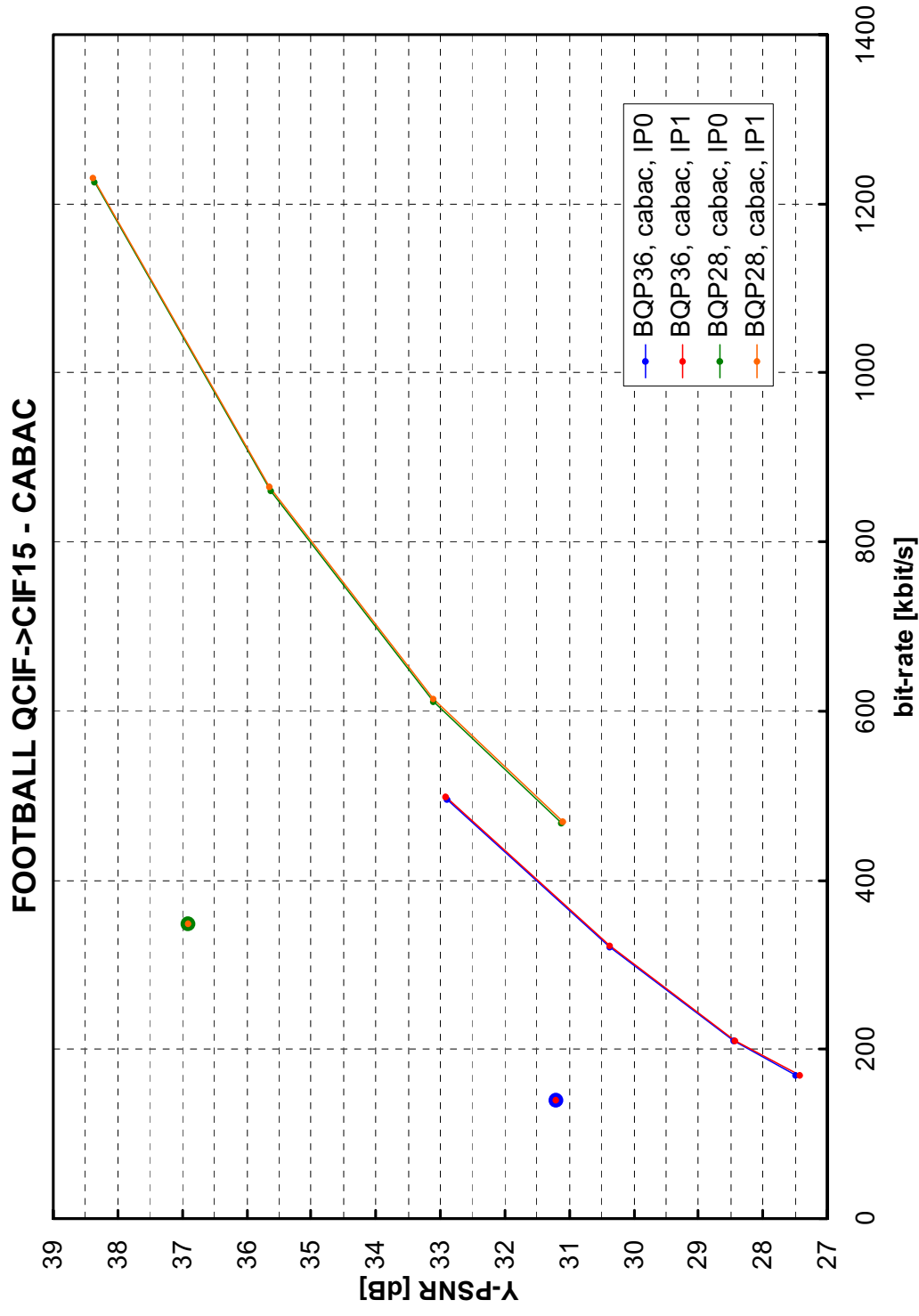
- GOP size 8
- Entropy coding: VLC and CABAC
- Low-rate test: Base layer QP: 36
 Enhancement layer QP: 46, 42, 38, 34
- High-rate test: Base layer QP: 28
 Enhancement layer QP: 38, 34, 30, 26

§ CIF 30Hz -> 4CIF 30Hz

- GOP size 32, intra period 32
- Entropy coding: VLC and CABAC
- Low-rate test: Base layer QP: 36
 Enhancement layer QP: 46, 42, 38, 34
- High-rate test: Base layer QP: 28
 Enhancement layer QP: 38, 34, 30, 26

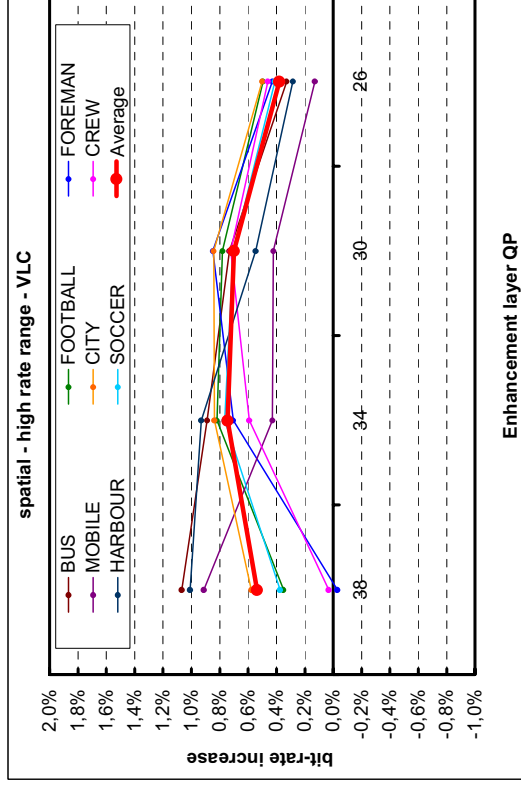
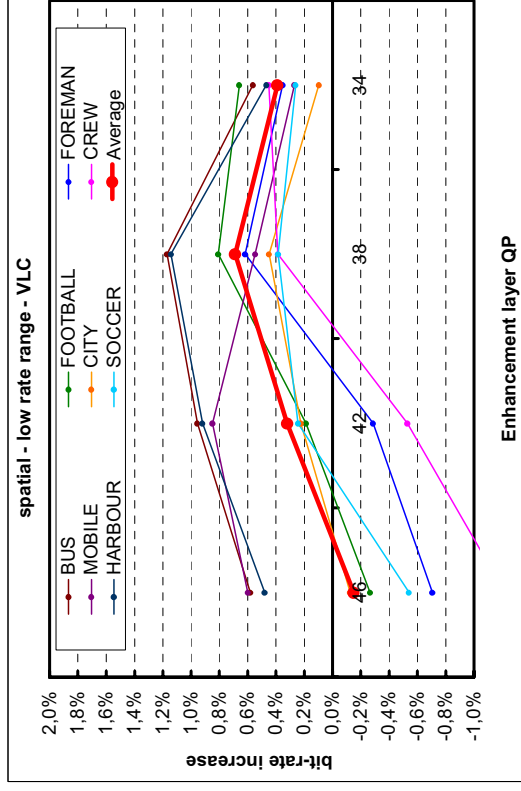
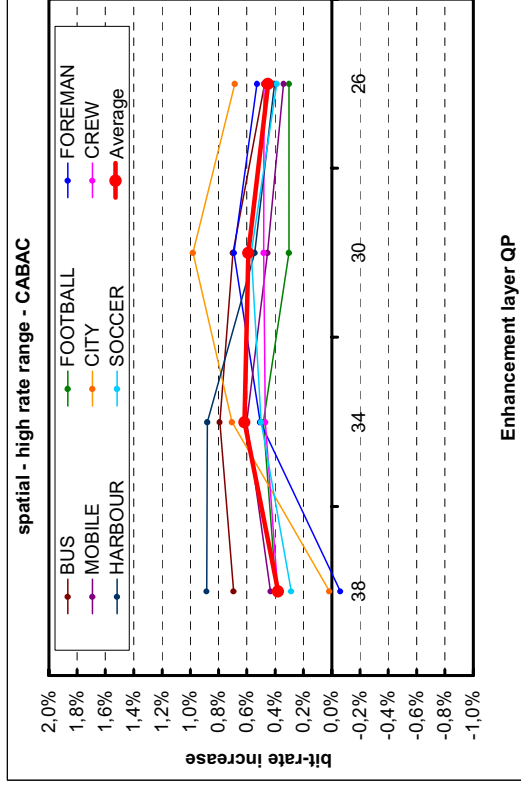
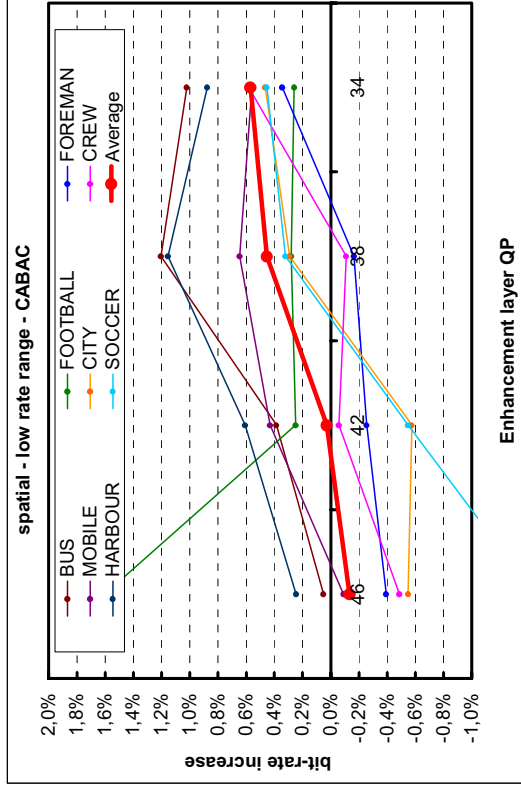
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Spatial scalability test – Example

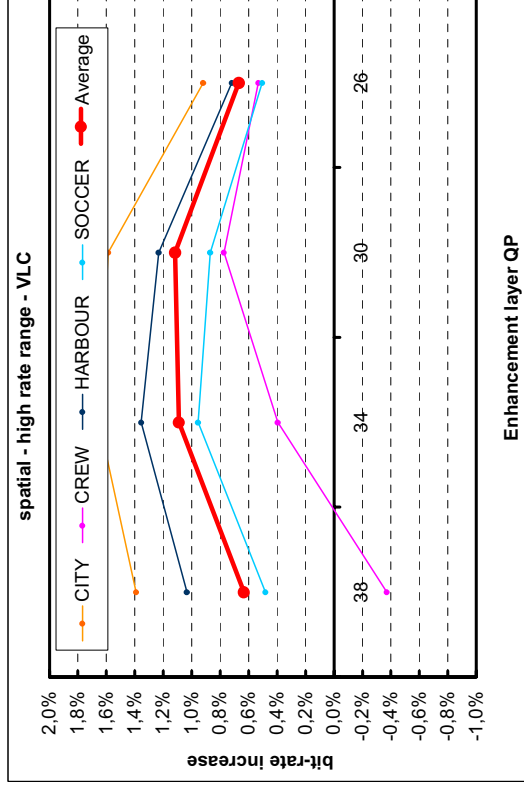
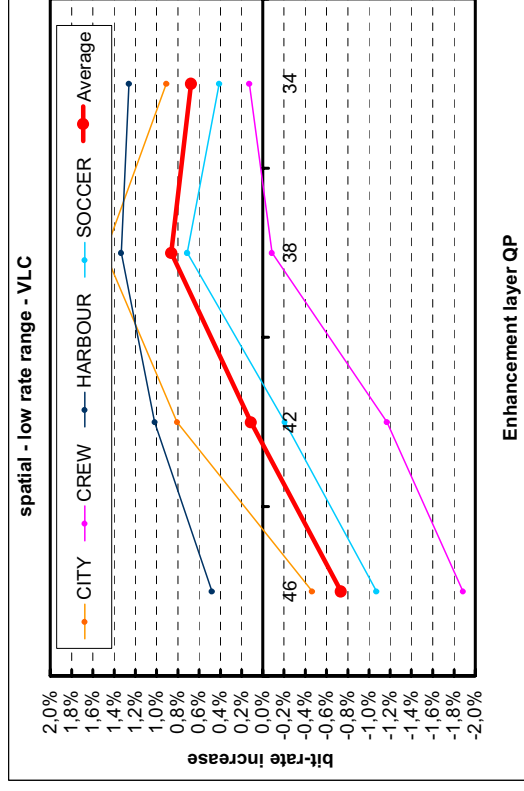
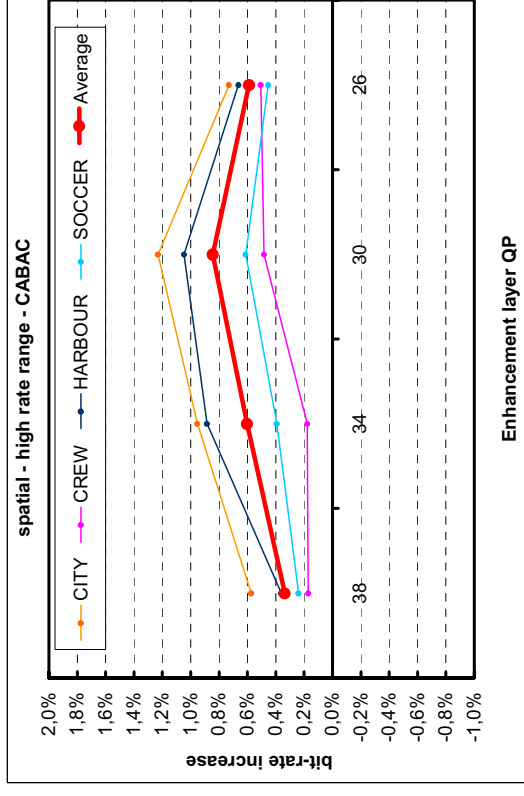
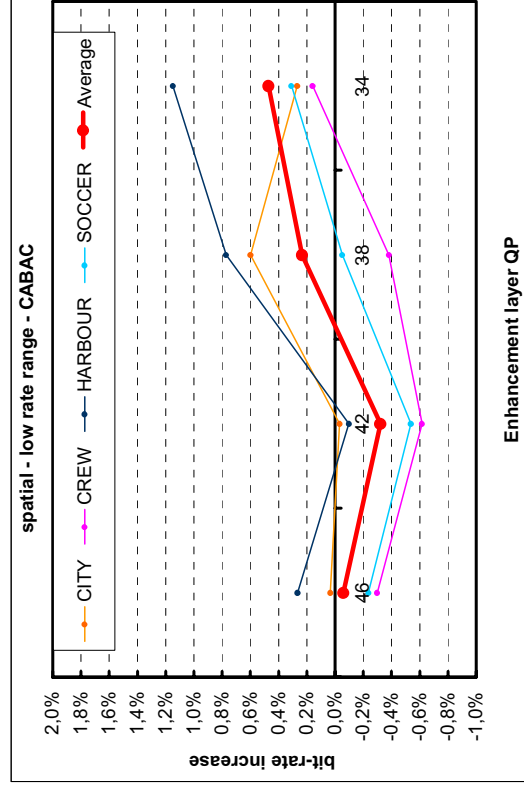


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Spatial scalability test – Summary (QCIF-CIF)



Spatial scalability test – Summary (CIF-4CIF)



Average Results

	CABAC		VLC	
	rate increase	delta PSNR	rate increase	delta PSNR
CGS	0.19 %	-0.01 dB	0.68 %	-0.03 %
Spatial: QCIF15 – CIF15	0.37 %	-0.02 dB	0.45 %	-0.03 %
Spatial: CIF30 – 4CIF30	0.34 %	-0.01 dB	0.55 %	-0.02 %

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Conclusion

§ Proposed modification

- Modify SVC slice data syntax for enabling independent parsing
- Remove conditions on base layer syntax elements and derived variables

§ Advantages

- Allows decoder implementation with reduced complexity
- Allows parallel parsing of NAL units inside an access unit

§ Influence on coding efficiency

- Tested for a large set of CGS and spatial scalability scenarios
- Measured average rate increase for all scenarios is less than 1%
- Equivalent average PSNR loss is not greater than 0.03 dB

§ We believe that the mentioned advantages justify the slight coding efficiency loss

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