# Software Usage Description

The software implements the single-loop decoding scheme by InterDigital, based on SHM3.0.1.

To cross-check the experimental results, cross-checkers only needs to change the following macros highlighted in yellow, while all the other macros are set to the default values and need not to be changes for all the tests.

REF\_EL\_ILMC enables the generation process of hybrid inter-layer reference picture.

ILMC\_BI\_CONSTRAINT enables the EL inter-prediction constraint on the EL bi-prediction between EL temporal and hybrid inter-layer reference picture, which is only used for encoding process.

REF\_BL\_RESIDUE use base-layer residue to enhance hybrid inter-layer reference picture.

ILMC\_BLK\_DEC enables block level decoding implementation.

BL\_MV\_COMP enables using BL compressed motion field to generate hybrid inter-layer reference picture.

REF\_EL\_SINGLE\_LOOP use EL single loop decoding.

TEMP\_SCALABILITY\_INC enables temporal scalability configurations.

SHVC\_COMPLEXITY\_ASSESSMENT enables the code used for the complexity assessment, which should be only enabled when collecting the AHG17 complexity assessment results and only used for the decoder.

RWTH\_COMPLEXITY\_DEC\_STAT enables the code used for the pixel-level complexity assessment, which should be only enabled when collecting the pixel-level complexity assessment results and only used for the decoder.

**Section 1: Macro settings for cross-checking BD-rate results**

**Mandatory Results:**

1. **Results of the proposed single-loop scheme, applied to non-temporal scalability case**

To obtain the encoding and decoding results of the proposed single-loop scheme when applied to non-temporal scalability case, please set the related macros as follows:

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complete BD-rate compared to the SHM3.0.1anchor can be found the spreadsheet “SCE2\_2.2\_SLD-vs-SHM3.0.1.xls” in the package.

1. **Results of the proposed single-loop scheme with EL inter-prediction constraint, applied to non-temporal scalability case**

To obtain the encoding and decoding results of the proposed single-loop scheme with the EL inter-prediction constraint being enabled when applied to non-temporal scalability case, please set the related macros as follows:

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 2

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complete BD-rate compared to the SHM3.0.1 anchor can be found the spreadsheet “SCE2\_2.2\_SLD\_PRED\_COND-vs-SHM3.0.1” in the package.

1. **Results of the proposed single-loop scheme, applied to temporal scalability case**

To obtain the encoding and decoding results of the proposed single-loop scheme when applied to temporal scalability case, please set the related macros as follows:

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 1

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complete BD-rate compared to the SHM3.0.1temporal scalability anchor can be found the spreadsheet “SCE2\_2.2\_SLD\_TEMP-vs-SHM3.0.1\_TEMP.xls” in the package.

1. **Results of the proposed single-loop scheme with EL inter-prediction constraint, applied to temporal scalability case**

To obtain the encoding and decoding results of the proposed single-loop scheme with the EL inter-prediction constraint being enabled when applied to temporal scalability case, please set the related macros as follows:

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 2

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 1

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complete BD-rate compared to the SHM3.0.1 temporal scalability anchor can be found the spreadsheet “SCE2\_2.2\_SLD\_TEMP\_PRED\_COND-vs-SHM3.0.1\_TEMP.xls” in the package.

1. **Results of the BL decoding only**

As the proposed single-loop decoding scheme does not change the encoding/decoding of the BL without involving any drift error to the BL, the corresponding BL bit-stream could be decoded by SHM3.0.1 decoder. To obtain the corresponding SHM3.0.1 decoder, please disable the following macros as follows:

#define REF\_EL\_ILMC 0

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 0

#define ILMC\_BLK\_DEC 0

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 0

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

**Supplemental Results:**

1. **Results of the proposed single-loop scheme using BL compressed motion field and without the BL residue, applied to non-temporal scalability case**

To obtain the encoding and decoding results of the proposed single-loop scheme using BL compressed motion field and without applying the BL residue when applied to non-temporal scalability case, please set the related macros as follows:

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 0

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 1

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complete BD-rate compared to the SHM3.0.1anchor can be found the spreadsheet “SCE2\_SLD\_NORES\_COMPMV-vs-SHM3.0.1” in the package.

1. **Results of the proposed single-loop scheme using BL compressed motion field and without the BL residue, applied to temporal scalability case**

To obtain the encoding and decoding results of the proposed single-loop scheme using BL compressed motion field and without applying the BL residue when applied to temporal scalability case, please set the related macros as follows:

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 0

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 1

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 1

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complete BD-rate compared to the SHM3.0.1 temporal scalability anchor can be found the spreadsheet “SCE2\_SLD\_NORES\_COMPMV\_TEMP-vs-SHM3.0.1\_TEMP” in the package.

1. **Results of the multi-loop based scheme, applied to non-temporal scalability case**

To obtain the encoding and decoding results of the proposed scheme used in the multi-loop based decoding when applied to non-temporal scalability case, please set the related macros as follows. The corresponding introduction of the multi-loop based scheme can be found in JCTVC-N0187.

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 0

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complete BD-rate compared to the SHM3.0.1anchor can be found the spreadsheet “SCE2\_2.2\_MLD-vs-SHM3.0.1.xls” in the package.

1. **Results of the multi-loop based scheme, applied to temporal scalability case**

To obtain the encoding and decoding results of the proposed scheme used in the multi-loop based decoding when applied to temporal scalability case, please set the related macros as follows. The corresponding introduction of the multi-loop based scheme can be found in JCTVC-N0187.

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 0

#define TEMP\_SCALABILITY\_INC 1

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complete BD-rate compared to the SHM3.0.1anchor can be found the spreadsheet “SCE2\_2.2\_MLD\_TEMP-vs-SHM3.0.1\_TEMP.xls” in the package.

**Section 2: Macro settings for cross-checking AHG 17 complexity assessment**

To obtain the complexity assessment data of the methodology from AHG17, cross-checkers need firstly generating the bit-streams after encoding the BL and EL video, using the macro settings as specified in section 1, then use the macros as specified in the following to compile the decoder again and use the executable decoder file to decode the bit-streams in order to collect the corresponding complexity data.

To obtain the Pure memory architecture results, please use the decoding command line:

TAppDecoder –b strFileName –ls 2

To obtain the DDR2 and DDR3 architecture results, please use the decoding command line:

TAppDecoder --LumaMemCompWidth=4 --LumaMemCompHeight=4 --ChromaMemCompWidth=4 --ChromaMemCompHeight=4 –b strFileName –ls 2

**Mandatory Results:**

1. **Complexity data of the proposed single-loop scheme, applied to non-temporal scalability case.**

To obtain the complexity data of the proposed single-loop scheme when applied to non-temporal scalability case, please use the following macros to compile the decoder. It should be noted that the same decoder can be applied to both the case of disabling the EL inter-layer prediction constraint and the case of enabling the EL inter-layer prediction constraint.

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 1

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

“complexity\_analysis\_SCE2.xls” contains the complete complexity data of the proposed single-loop decoding scheme compared to the complexity of the SHM3.0.1 anchor.

“complexity\_analysis\_SCE2\_PredCond.xls” contains the complete complexity data of the proposed single-loop decoding scheme when the EL inter-layer prediction constraint is enabled compared to the complexity of the SHM3.0.1 anchor.

1. **Complexity data of the proposed single-loop scheme, applied to temporal scalability case.**

To obtain the complexity data of the proposed single-loop scheme when applied to temporal scalability case, please use the following macros to compile the decoder. It should be noted that the same decoder can be applied to both the case of disabling the EL inter-layer prediction constraint and the case of enabling the EL inter-layer prediction constraint.

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 1

#define SHVC\_COMPLEXITY\_ASSESSMENT 1

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

“complexity\_analysis\_SCE2\_Temp.xls” contains the complete complexity data of the proposed single-loop decoding scheme when applied to temporal scalability compared to the complexity of the SHM3.0.1 scalability anchor.

“complexity\_analysis\_SCE2\_Temp\_PredCond.xls” contains the complete complexity data of the proposed single-loop decoding scheme with the EL inter-layer prediction constraint enabled when applied to the temporal scalability compared to the complexity of the SHM3.0.1 temporal scalability anchor.

**Supplemental Results:**

1. **Complexity of the proposed single-loop scheme using BL compressed motion field and without the BL residue, applied to non-temporal scalability case**

To obtain the complexity data of the proposed single-loop scheme using BL compressed motion field and without applying the BL residue when applied to non-temporal scalability case, please set the related macros as follows:

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 0

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 1

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 1

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complexity data with the comparison to the complexity of the SHM3.0.1 anchor can be found in the Excel file “complexity\_analysis\_SCE2\_SLD\_NORESI\_COMPMV”.

1. **Complexity of the proposed single-loop scheme using BL compressed motion field and without the BL residue, applied to temporal scalability case**

To obtain the complexity data of the proposed single-loop scheme using BL compressed motion field and without applying the BL residue when applied to temporal scalability case, please set the related macros as follows:

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 0

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 1

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 1

#define SHVC\_COMPLEXITY\_ASSESSMENT 1

#define RWTH\_COMPLEXITY\_DEC\_STAT 0

The corresponding complexity data with the comparison to the complexity of the SHM3.0.1 temporal scalability anchor can be found in the Excel file “complexity\_analysis\_SCE2\_SLD\_NORESI\_COMPMV\_Temp”.

**Section 3: Macro settings for cross-checking the pixel-level complexity results**

To obtain the pixel-level complexity assessment data, cross-checkers need firstly generating the bit-streams after encoding the BL and EL video, using the macro settings as specified in section 1, then use the macros as specified in the following to compile the decoder again and use the executable decoder file to decode the bit-streams in order to collect the corresponding pixel complexity data.

To obtain the pixel-level complexity of decoding only the BL, please use the decoding command line:

TAppDecoder –b strFileName –ls 1

To obtain the pixel-level compleicty of decoding both the BL and the EL, please use the decoding command line:

TAppDecoder –b strFileName –ls 2

**Mandatory Results:**

1. **Pixel-level complexity data of the proposed single-loop scheme, for the decoding of both the BL and the EL.**

To obtain the pixel-level complexity data of the proposed single-loop scheme when considering both the decoding of the BL and the EL, please use the following macros to compile the decoder. It should be noted that the same decoder can be applied to both the case of disabling the EL inter-layer prediction constraint and the case of enabling the EL inter-layer prediction constraint.

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 1

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 1

1. **Pixel-level complexity data of the proposed single-loop scheme, for the decoding of only the BL.**

As the corresponding BL bit-stream of the proposed single-loop scheme could be decoded by SHM3.0.1 decoder, please use the following macros as follows to collect the pixel-level complexity of decoding the BL only. It should be noted that the same results are applied to both the case of disabling the EL inter-layer prediction constraint and the case of enabling the EL inter-layer prediction constraint, as the BL is unchanged for those two cases.

#define REF\_EL\_ILMC 0

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 0

#define ILMC\_BLK\_DEC 0

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 0

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 1

“pixel\_complexity\_analysis\_SCE2\_SLD.xls” contains the complete pixel-level complexity data of the proposed single-loop decoding scheme compared to the complexity of the SHM3.0.1 and HM11 anchors.

“pixel\_complexity\_analysis\_SCE2\_SLD\_PredCond.xls” contains the complete pixel-level complexity data of the proposed single-loop decoding scheme when the EL inter-layer prediction constraint is enabled compared to the complexity of the SHM3.0.1 and HM11 anchor.

**Supplemental Results:**

1. **Pixel-level complexity of the proposed single-loop scheme using BL compressed motion field and without the BL residue, for the decoding of both the BL and the EL.**

To obtain the pixel-level complexity data of the proposed single-loop scheme using BL compressed motion field and without BL residue, when considering both the decoding of the BL and the EL, please use the following macros to compile the decoder.

#define REF\_EL\_ILMC 1

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 0

#define ILMC\_BLK\_DEC 1

#define BL\_MV\_COMP 1

#define REF\_EL\_SINGLE\_LOOP 1

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 1

1. **Pixel-level complexity of the proposed single-loop scheme using BL compressed motion field and without the BL residue, for the decoding of only the BL.**

To obtain the pixel-level complexity data of the proposed single-loop scheme using BL compressed motion field and without BL residue, when considering only the decoding of the BL, please use the following macros to compile the decoder.

#define REF\_EL\_ILMC 0

#define ILMC\_BI\_CONSTRAINT 0

#define REF\_BL\_RESIDUE 0

#define ILMC\_BLK\_DEC 0

#define BL\_MV\_COMP 0

#define REF\_EL\_SINGLE\_LOOP 0

#define TEMP\_SCALABILITY\_INC 0

#define SHVC\_COMPLEXITY\_ASSESSMENT 0

#define RWTH\_COMPLEXITY\_DEC\_STAT 1

“pixel\_complexity\_analysis\_SCE2\_SLD\_NORESI\_COMPMV” contains the corresponding pixel-level complexity data compared to the complexity of the SHM3.0.1 and HM11 anchors.