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| **Joint Collaborative Team on 3D Video Coding Extension Development**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  3rd Meeting: Geneva, CH, 17–23 Jan. 2013 | Document: JCT3V-C0043  M27777 |

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| *Title:* | **AHG8: Report on Relation of GVD Format with Current 3D Video Standardization Tracks** | | |
| *Status:* | Input Document | | |
| *Purpose:* | report | | |
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# Abstract

This contribution reports the discussions and conclusions done in the AHG8 on the following mandate of AHG8.

•Explore the relation of GVD (Global View and Depth) format with current 3D video standardization tracks (MVC+D, 3D-AVC, 3D-HEVC).

The discussion was done on the feature of GVD format and its relation to current 3D video (3DV) standardization tracks. The feature is its simplicity and fast speed with comparable subjective quality comparing to 3DV tracks. The relation is mutually compensational and easy to harmonize with appropriate signalling method using SEI message. AHG8 recommends to define a SEI message for signaling alternative 3D format in 3DV tracks.

# Introduction and feature

Responding to the 3DV CFP (N12036, March 2011) on efficient coding methods based on AVC, MVC and HEVC, concepts of Global View and Depth (GVD) format were proposed. Through several core experiments and subjective quality evaluations, they were recognized to be a simple, fast and subjectively comparable coding method and merged to the Alternative 3D Format together with warp format.



1. Coding structure



1. Coding speed comparing to ATM (M24984)



1. Coding speed comparing to HTM (M26013/JCT2-A0071)

 

1. Subjective quality comparing to ATM (left, M25242) and HTM (right, M26320/JCT2-A0172)

**Figure 1** Structure and feature of Global View and Depth format

# Relation between GVD and 3DV tracks

As seen in many MPEG standards, GVD is suitable for low complexity profile and 3DV tracks are suitable for high efficiency profiles. They are compensating each other.



**Figure 2** Relation between Global View and Depth format and 3DV tracks (JCT3V-B0058/M26750)

In order to harmonize each other, a well-defined bitstream syntax should be developed. As seen in Figure 1, GVD bitstream consists of base view, global depth, residual depth and residual view streams, they are same as the bitstreams for 3DV tracks. Warp format is also in the same relation. The difference is view synthesis method only. The view synthesis method can be signalled in many ways.

One approach is the definition of a new NAL unit type for entire alternative 3D format bitstreams as proposed in JCT3V-B0059. The merit of this signalling method is its wide applicability to MPEG-4 AVC, MVC, MVC+Depth, 3D-AVC codecs without modifying them. This approach is also applicable to HEVC, MV-HEVC and 3D-HEVC. The demerit is incompatibility of depth stream, residual stream and additionally defined camera parameter file with 3DV tracks.



**Figure 3** Signalling of alternative 3D format in a new NAL unit type (JCT3V-B0059/M26751)

Another approach is the definition of a new VUI parameter for depth type signalling. Merit of this approach is the compatibility of base view, global depth, residual view and camera parameter file with the 3DV tracks (MPEG-4 MVC+Depth, 3D-AVC). This approach is applicable to 3D-HEVC, too. Demerit is the inconsistency of depth type parameter with other VUI parameters. VUI parameters signal display-related parameters such as aspect ratio, over scan info, chroma location info, picture structure flag, etc. Since depth type signals view synthesis method after decoding but before displaying, if depth type is defined in VUI parameter, users might be confused.



**Figure 4** Signalling of Alternative 3D Format in VUI parameter (JCT3V-B0227/M27270)

The third approach is the definition of a new SEI message for the depth type signalling. Merit of this approach is the compatibility of base view, global depth, residual view, camera parameter file and depth type signalling method with 3DV tracks (MPEG-4 MVC=Depth, 3D-AVC). Since SEI message signals view synthesis-related messages such as multiview\_acquisition\_info, depth\_acquisition\_info, depth\_representation\_information, etc., depth type is suitable to be placed in SEI message. Demerit of this approach seems nothing. This approach is also applicable to 3D-HEVC.



**Figure 5** Signalling of Alternative 3D format in SEI message (JCT3V-B0227/M27270)

In both VUI parameter and SEI message approaches, depth\_type is common three bit data as shown in Figure 6.

|  |  |
| --- | --- |
| **depth\_type** | **interpretation** |
| 0 | Global depth for 2 view |
| 1 | Global depth and residual depth for 2 view |
| 2 | Global depth for 3 view |
| 3 | Global depth and residual depth for 3 view |
| 4 | Reserved for Warp |
| 5…6 | Unspecified |
| 7 | Reserved for future extension |

**Figure 5** Depth type

When alternative 3D format method is applied to multi-view codecs which support no depth stream such as MPEG-4 MVC or MV-HEVC, an appropriate flag must be used for the identification of depth stream or residual stream. For such signalling, NAL unit type = 0 can be used in the same manner as proposed in the first approach. By inserting an additional NAL unit type = 0 before the original NAL unit type, which was assigned by the MVC or MV-HEVC codec, the depth stream is uniquely identified without defining new NAL unit types.



In summary, Table 1 shows possible signalling methods to harmonise with 3DV tracks and conventional codecs. Merit of No.1 approach is no codec modification is required. Its demerit is the different approach from current 3DV extensions. Demerit of No.2 approach is user confusion. Merit of No.3 approach is consistency with current 3DV extensions. Merit of No.4 approach is it is applicable now, without waiting for ATM development. Its demerit is inconsistency with current 3DV extensions.

Table 1. Signalling methods for Alternative 3D format

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | core codec | | | | | | |  |  |
| No | signaling method | AVC (H.264) | MVC | MVC +D | 3D- AVC | HEVC | MV- HEVC | 3D- HEVC | merit | demerit |
| 1 | new NAL unit type | ○ | ○ | ○ | ○ | ○ | ○ | ○ | no codec modification | different from 3DV extensions |
| 2 | VUI for depth type |  |  | ○ | ○ |  |  | ○ | \*\*\* | user confusion |
| 3 | SEI for depth type |  |  | ○ | ○ |  |  | ○ | consistent | \*\*\* |
| 4 | SEI + byte0 insertion |  | ○ |  |  |  | ○ |  | now applicable | different from 3DV extensions |

# Conclusion

As discussed above, the feature of GVD is its simplicity and fast speed with comparable subjective quality comparing to 3DV tracks. The relation is mutually compensational and easy to harmonize with appropriate signaling method using SEI message. AHG8 recommends to define a SEI message for signaling alternative 3D format in 3DV tracks.