

**ISO/IEC JTC 1/SC 29/WG 11**

**Coding of moving pictures and audio**

**Convenorship: UNI (Italy)**

**ISO/IEC JTC 1/SC 29/WG 11 N19113**

**Document type: Approved WG 11 document**

**Title: Description of Core Experiment Geometry 13.29 Quantisation QP Control**

**Status: Draft**

**Date of document: 2019-01-31**

**Source: 3DG**

**Expected action:**

**No. of pages:**

**Email of convenor: leonardo@chiariglione.org**

**Committee URL: mpeg.chiariglione.org**

**INTERNATIONAL ORGANISATION FOR STANDARDISATION**

**ORGANISATION INTERNATIONALE DE NORMALISATION**

**ISO/IEC JTC 1/SC 29/WG 11**

**CODING OF MOVING PICTURES AND AUDIO**

**ISO/IEC JTC 1/SC 29/WG 11 N19113**

**Brussels, Belgium – January 2020**

|  |  |
| --- | --- |
| **Source:** | **3DG** |
| **Title:** | **Description of Core Experiment 13.29 for G-PCC: Geometry Quantisation QP control** |

# Abstract

In this document, we provide descriptions for the core experiment 13.29 on geometry quantisation QP control for Geometry-based PCC.

The in-tree geometry quantisation was adopted in October 2019 [6][7] and the set of geometry quantisation step size is specified to be the same as that for attribute coding.

This core experiment is intended to study a new set of geometry quantisation step size as proposed in [4]. The goal of this experiment is to study the rate distortion behaviour of the new set of quantisation step size and its subjective benefit, as compared to the set of quantisation step size defined in [5][6]. Furthermore, the rate distortion behaviour of the geometry quantisation for points coded in IDCM mode as proposed in [5] is also studied in this core experiment.

# CE 13.2 Geometry Quantisation QP Control

## Mandates

* Study rate distortion behaviour of geometry quantisation at Octree-level
* Evaluate the impact of different QP to the subjective quality of reconstructed point cloud
* Study rate distortion behaviour of geometry quantisation for points coded in IDCM mode

Related changes to the G-PCC Specification Text [2] shall be reported.

## Participants, description of tools, and implementation notes

The following people are participating in this CE. Their specific roles are detailed in the next section. Proposals are based on the input contributions

1. m52522, *G-PCC: Integer step sizes for in-tree geometry quantisation*
2. m52523, *G-PCC: An IDCM specific QP for in-tree geometry quantisation*

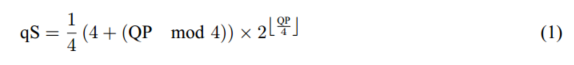
Proponents and cross checkers are

| **Name** | **Company** | **E-mail address** | **Type** |
| --- | --- | --- | --- |
| David Flynn | Apple | davidflynn@apple.com | Proponent m52522, m52523 |
| Wen Gao | Tencent | [wengao@tencent.com](mailto:wengao@tencent.com) | Crosschecker |
|  |  |  |  |

## Information on proposed tools

### Integer step sizes for in-tree geometry quantisation from m52522 [4]

In-tree geometry scaling [6] provides a means to quantize (encoder) and scale (decoder) geometry positions in a non-uniform manner, even while the coding tree is being constructed. In the current draft text scaling is defined to use a quantisation step size as an exponential function of a quantisation parameter, similar as attribute coding. The derivation results in fixed-point step sizes that, when used to reconstruct integer point positions, result in banding of dense objects without further post processing.

It is proposed in [4] to replace the quantisation step size derivation function with the following:  


This results in the step size series of 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 5, 6, 7, 8, 10, 12, 14, 16, 20, 24, 28, 32, 40, 48, 56, 64, 80, 96, 112, 128, 160, 192, 224, 256, 320, 384, 448, 512, 640, 768, 896, 1024, …. Only QPs 1, 2, 3, 5, and 7 result in non-integer step size. This is necessary to maintain the simple derivation. The minimum value of QP is 0 (qS = 1).

### An IDCM specific QP for in-tree geometry quantisation from m52523 [5]

Due to the use of IDCM, some positions may escape quantisation if they occur earlier in the tree than the quantisation tree depth. This contribution suggests signalling an independent quantisation parameter for use with IDCM nodes.

In general, since information conveyed by isolated points is potentially less accurate than more dense regions, it may not be necessary to use the full precision available from the octree. Similarly, in order to match the quantisation behaviour of IDCM nodes with their non-IDCM counterparts, an independent QP, i.e., idcmQP, is proposed for use by IDCM nodes that occur prior to the depth at which per-node scaling QP offsets are signalled.

## Information for conducting tests

### Software

TMC13v9 shall be used for these experiments. The proposed tools shall be implemented on top of TMC13v9.

### Test configurations for m52522

In this experiment, following configuration will be used:

* positionQuantisationOctreeSize=5, 7, 9 for point clouds with geometry precision <= 11 bit
* positionQuantisationOctreeSize=5, 7, 9, 11 for point clouds with geometry precision > 11 bit
* positionBaseQp sweeps from 1 to a QP value such that the corresponding quantisation step size is greater than or equal to the node size (i.e., quantize a node into one point)
* partitionMethod=2 (default partition method used in CTC)

The geometry distortion is measured by D1 and D2 metrics. Besides the objective metric, subjective quality comparison for dense point cloud is also need.

### Test configurations for m52523

In this experiment, following two tests will be conducted:

* Uniform quantisation, ie idcmQP is the same as the in-tree geometry quantisation QP
  1. which sweeps from 5 to a QP value such that the quantisation step size is larger than or equal to the node size
  2. positionQuantisationOctreeSize=5, 7, 9
* idcm-only quantisation: sweep the idcmQP, but keep the sliceqp to 4.

### Test Sequences

To reduce the simulation time, we only run the tests with a subset of test sequences, shown in the following table:

|  |  |
| --- | --- |
| **Category** | **Point Cloud** |
| Cat1A | facade\_00064\_vox11 |
| Cat1A | longdress\_vox10\_1300 |
| Cat1A | loot\_viewdep\_vox12 |
| Cat1A | queen\_0200 |
| Cat1B | facade\_00064\_vox14 |
| Cat1B | facade\_00064\_vox20 |
| Cat1B | stanford\_area\_2\_vox16 |
| Cat1B | ulb\_unicorn\_vox20 |
| Cat3-fused | overpass\_q1mm |
| Cat3-frame | Ford\_01\_q1mm |
| Cat3-frame | qnx-junction-approach |

## CE 13.29 Coordinators

Wen Gao ([wengao@tencent.com](mailto:wengao@tencent.com))

# Timeline:

* **2020-01-31**: Expected date for TMC13v9 release;
* **2020-03-20 [TMC13v9 + 7 weeks]** Deliver source code and results for cross check;
* **2020-04-03 [TMC13v9 + 9 weeks]** Deliver cross check results;
* **2020-04-15**: MPEG document upload deadline.

# References

1. “*G-PCC Test Model v9*”, ISO/IEC JTC1/SC29/WG11 Doc. N19083, Brussels, Belgium, January 2020
2. “*Text of ISO/IEC 23090-9 DIS Geometry-based PCC*”, ISO/IEC JTC1/SC29/WG11 MPEG2019 Doc. w19088, Brussels, Belgium, January 2020
3. “*Common Test Conditions for PCC*” ISO/IEC JTC1/SC29/WG11 N19084, Brussels, Belgium, January 2020
4. “*G-PCC: Integer step sizes for in-tree geometry quantisation*”, ISO/IEC JTC1/SC29/WG11 MPEG2020 Doc. m52522, Brussels, Belgium, January 2020
5. “*G-PCC: An IDCM specific QP for in-tree geometry quantisation”,* ISO/IEC JTC1/SC29/WG11 MPEG2020 Doc. m52523, Brussels, Belgium, January 2020
6. “*EE13.6 report on geometry quantization”,* ISO/IEC JTC1/SC29/WG11 MPEG2019 Doc. m50924, Geneva, Switzerland, October 2019
7. “*Slice based geometry quantization”,* ISO/IEC JTC1/SC29/WG11 MPEG2019 Doc. m50927, Geneva, Switzerland, October 2019