

**INTERNATIONAL ORGANISATION FOR STANDARDISATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC 1/SC 29/WG 4 MPEG VIDEO CODING**

ISO/IEC JTC 1/SC 29/WG 4 m 74616

Geneva, CH – Oct. 2025

Title [GSC][JEE 6.3] Efficiency of temporal smoothing of opacity attribute in video-based GSC
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1. Abstract

This document presents the results of an approach introduced in M73422, allowing for temporal averaging of opacity attribute for stationary splats.

2. Proposed method (description from M73422)

Let GOP contain N frames and S splats per frame. For each splat index s :

2.1. Displacement measurement

Compute per-axis extremes over the GOP:

$$\Delta X_s = \max_{f=1..N} X_{f,s} - \min_{f=1..N} X_{f,s}$$

$$\Delta Y_s = \max_{f=1..N} Y_{f,s} - \min_{f=1..N} Y_{f,s}$$

$$\Delta Z_s = \max_{f=1..N} Z_{f,s} - \min_{f=1..N} Z_{f,s}$$

Normalize by global ranges $R_i = AttrMaxGOP_i - AttrMinGOP_i$, then compute total displacement ratio:

$$R_s = \frac{\Delta X_s}{R_X} + \frac{\Delta Y_s}{R_Y} + \frac{\Delta Z_s}{R_Z}$$

2.2. Static splat selection

If $R_s \leq T$ where T is a threshold (e.g., 0.001) splat s is classified as static, otherwise dynamic.

2.3. Opacity smoothing

For each static splat s , compute the mean opacity:

$$\bar{\alpha}_s = \frac{1}{N} \sum_{f=1}^N \alpha_{f,s}$$

3. Experimental results

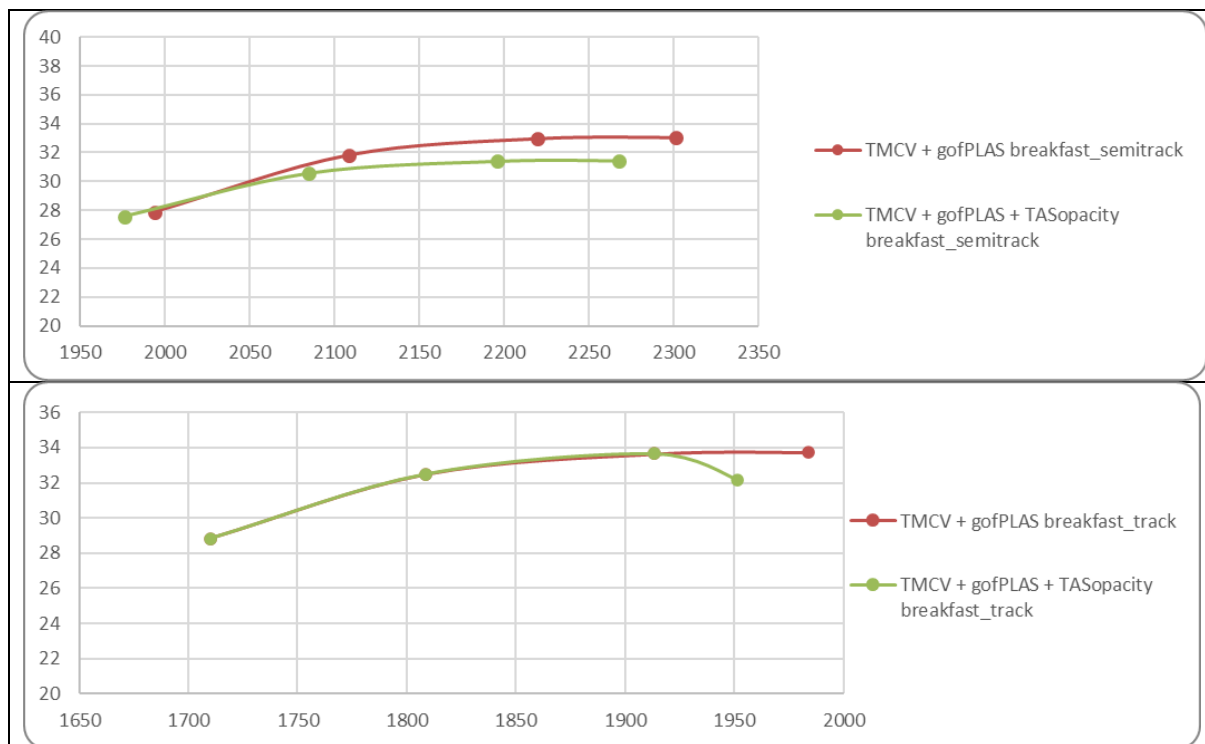
The algorithm has been implemented in MPEG GSC TMCV. It required implementing three major steps:

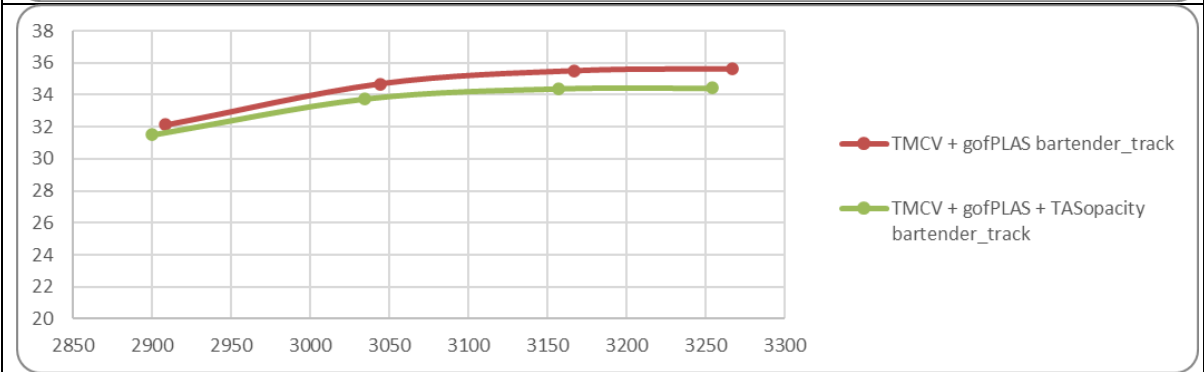
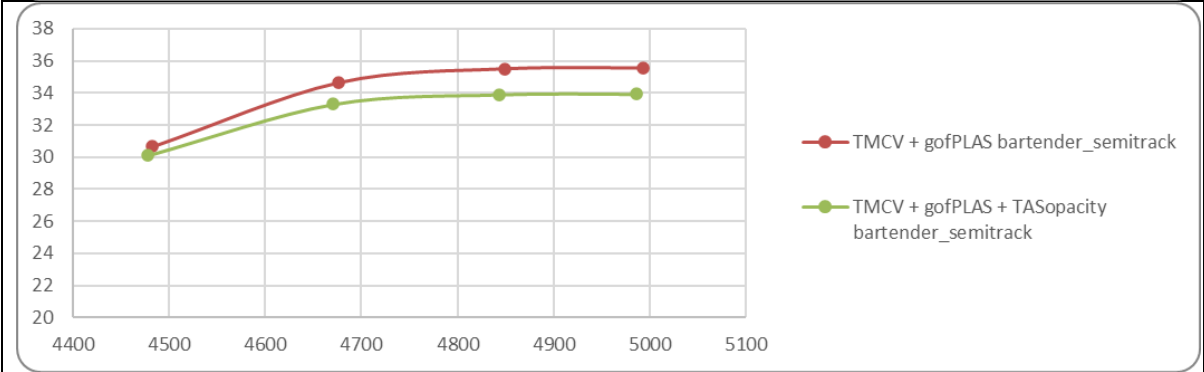
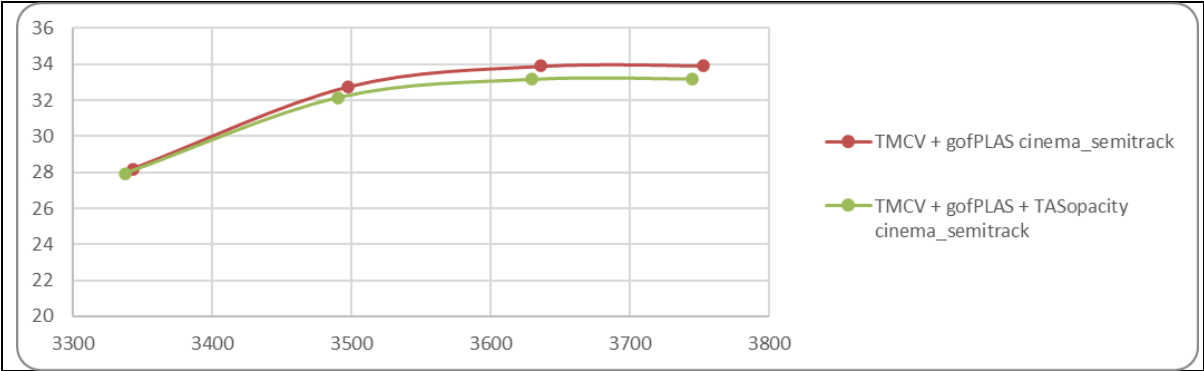
1. Preserving the sorting order from 0th frame for all remaining frames within a GOP,
2. Analysis of splat staticness over entire GOP using **0.005** threshold,
3. Temporal averaging of opacity for static splats.

Anchor **TMCV + gofPLAS**
 Proposal **TMCV + gofPLAS + TASopacity**

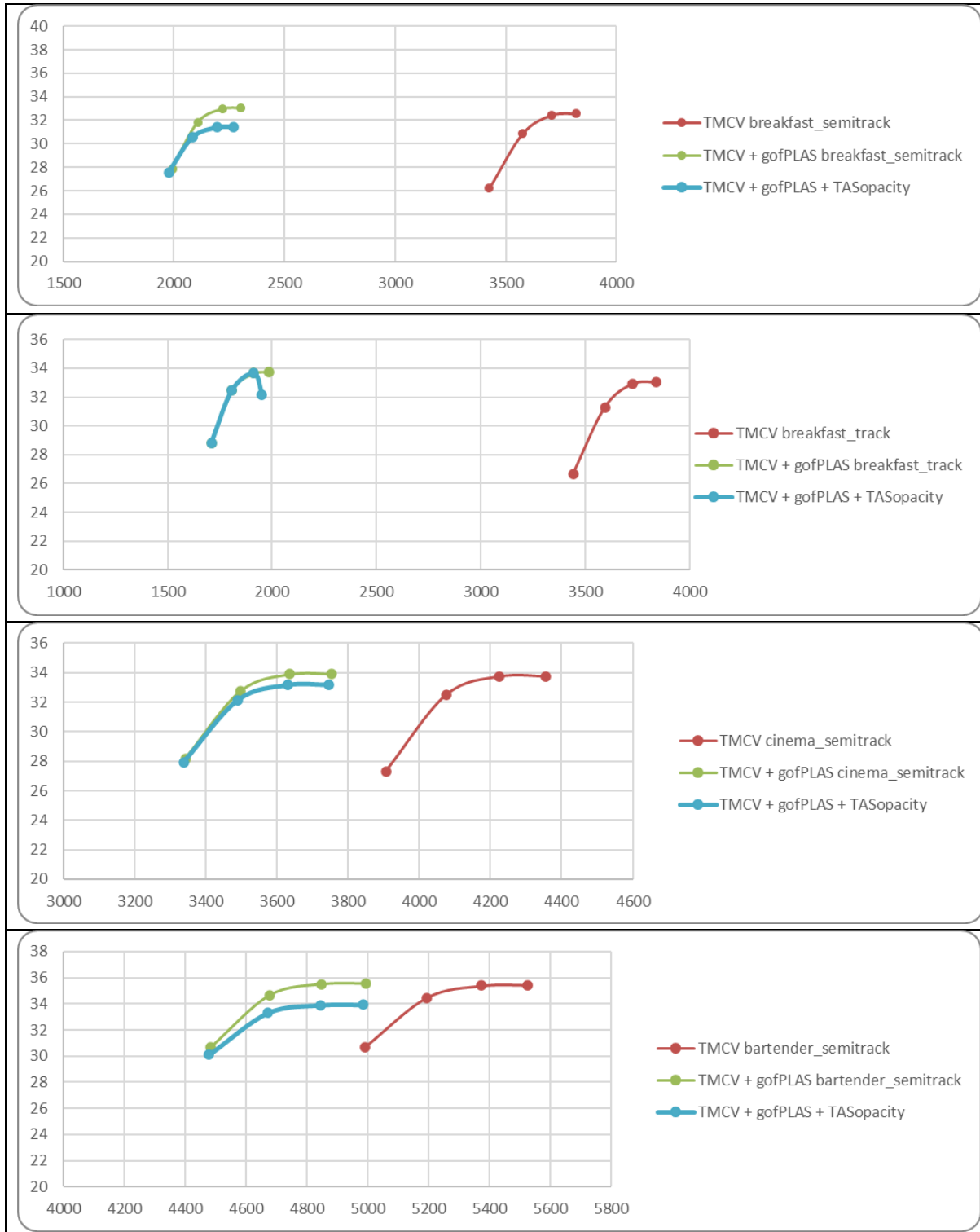
| Sequence | BD-rate RGB-PSNR | BD-rate YUV-PSNR | BD-rate YUV-SSIM |
|---------------------|---------------------|---------------------|---------------------|
| breakfast_untrack | #ARG! | #ARG! | #ARG! |
| breakfast_semitrack | 0,8% | 0,8% | 0,7% |
| breakfast_track | 3,3% | 3,3% | 0,5% |
| cinema_semitrack | 0,5% | 0,5% | 0,9% |
| cinema_track | #ARG! | #ARG! | #ARG! |
| bartender_semitrack | 1,4% | 1,4% | 2,1% |
| bartender_track | 1,6% | 1,6% | 1,8% |

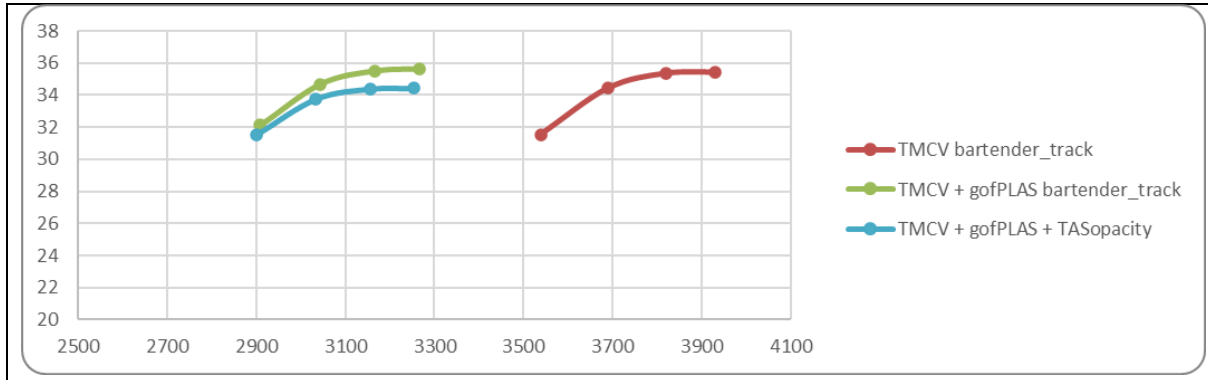
RGB-PSNR results:





RGB-PSNR results:





4. Recommendations

No recommendations so far.

5. Acknowledgment

This work was supported by Institute of Information & Communications Technology Planning & Evaluation (IITP) grant funded by the Korea government (MSIT) (No. 2018-0-00207, Immersive Media Research Laboratory).