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ISO/IEC JTC 1/SC 29/WG 07
MPEG 3DGH**

ISO/IEC JTC 1/SC 29/WG 04 m77041

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Title [Late][GSC][VPCC] Non-deterministic spherical harmonics coding in TMC2?
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Abstract

This late document reports a possible bug in the TMC2 software, which seems to be non-deterministic when coding spherical harmonics.

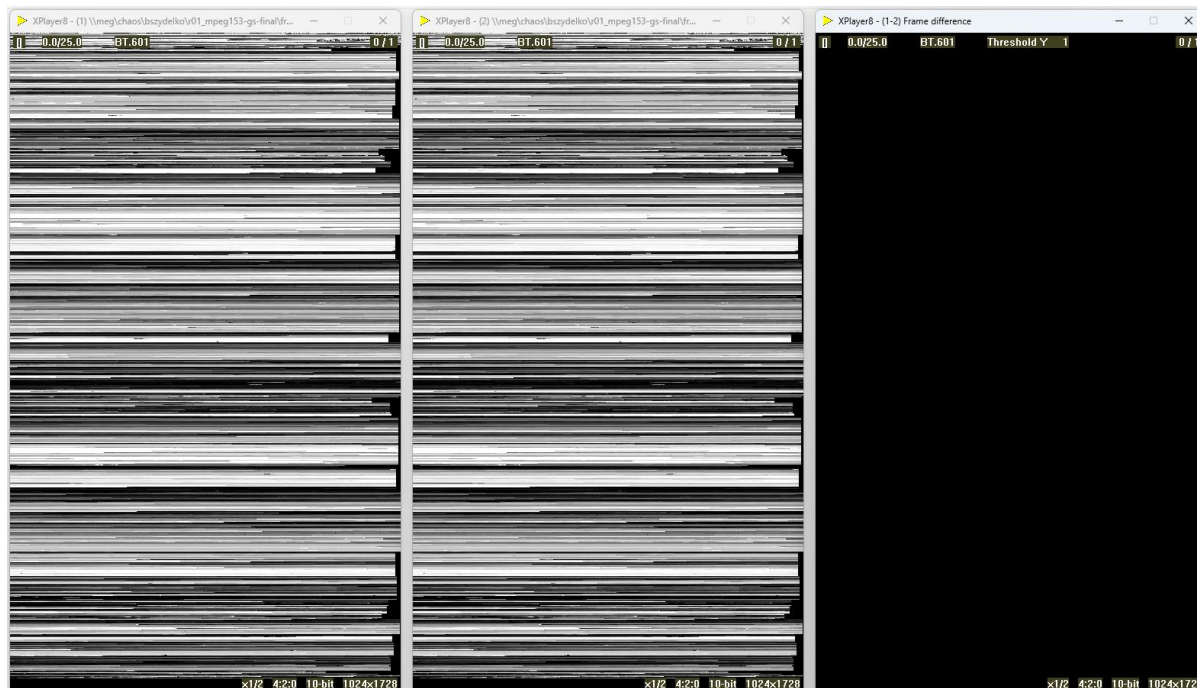
1 Why was the block-based sorting [m76580] non-deterministic?

Two reasons:

- 1) We've used `std::sort` for sorting the raw patches descendingly by size before the packing. It wasn't able to deterministically sort patches with the same number of splats inside.
- 2) The coding of spherical harmonics within the TMC2 software is possibly non-deterministic, both in [m76580] (block-based sorting), and the anchor.

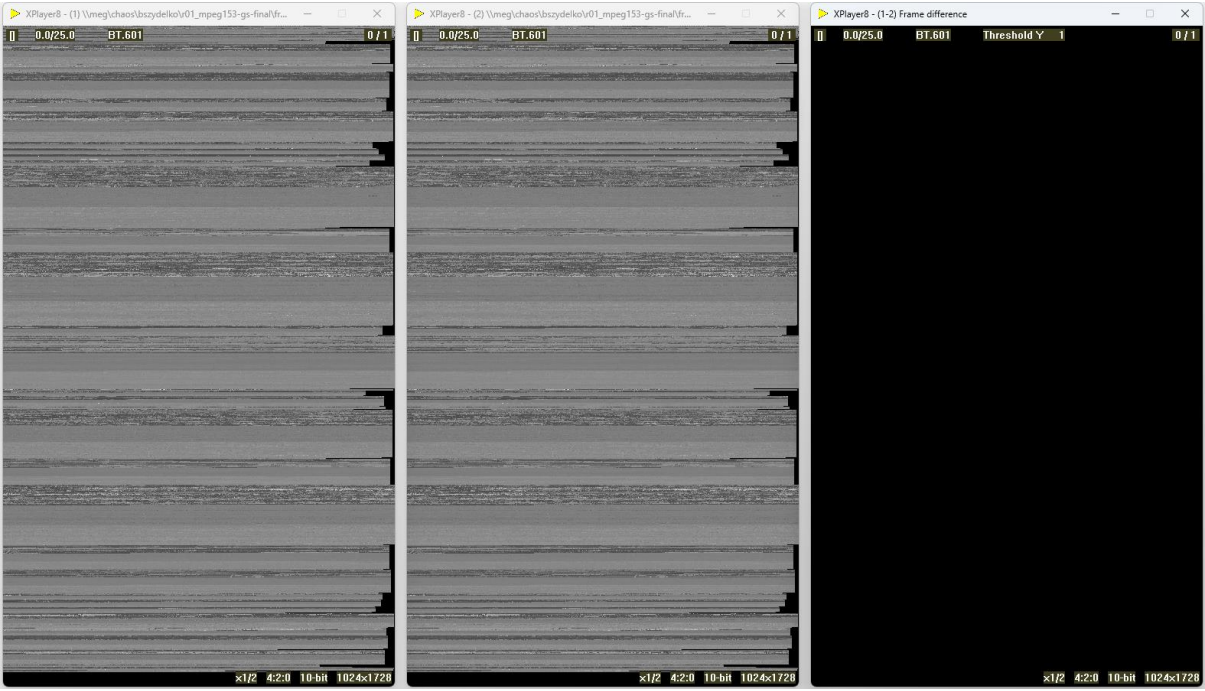
1.1 Anchor

Geometry:

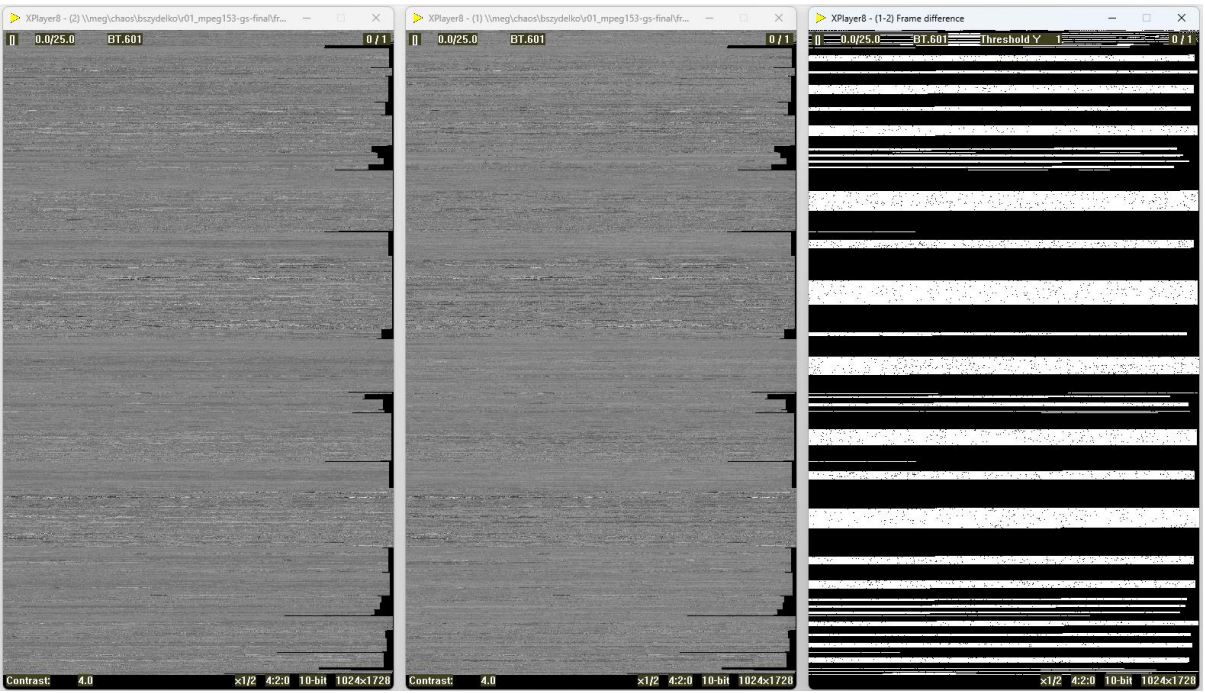


All attributes except for SH are also identical.

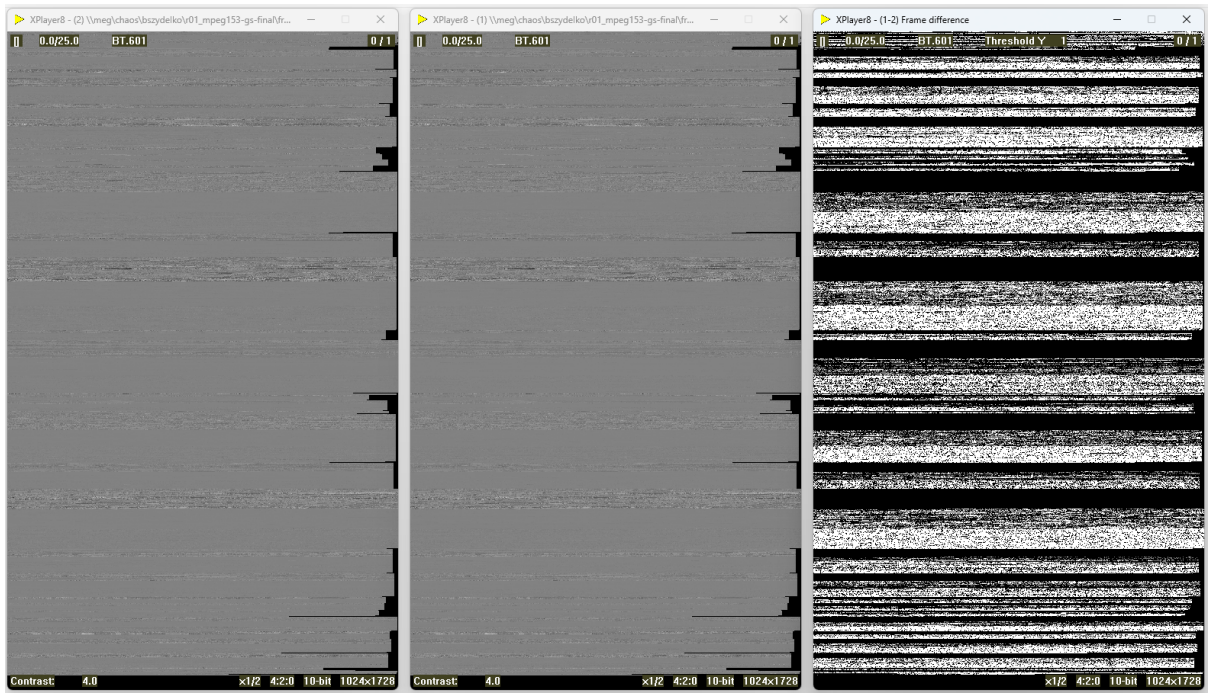
SH attribute, vid 0:



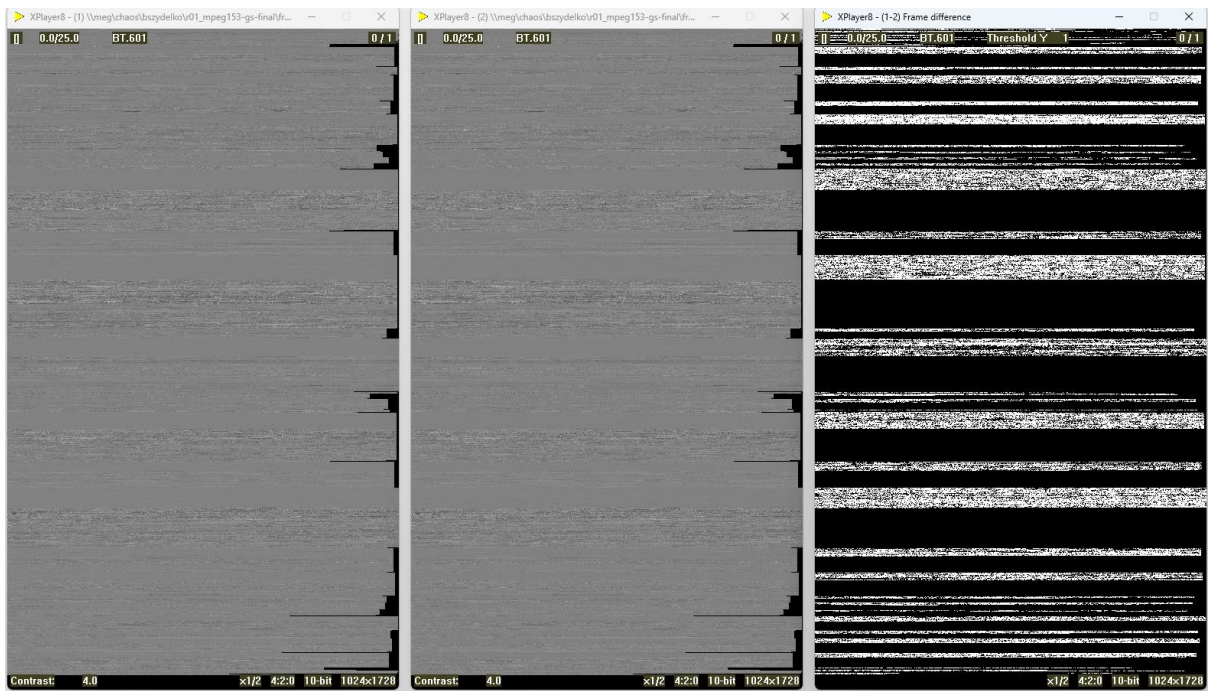
SH attribute, vid 1:



SH attribute, vid 2:

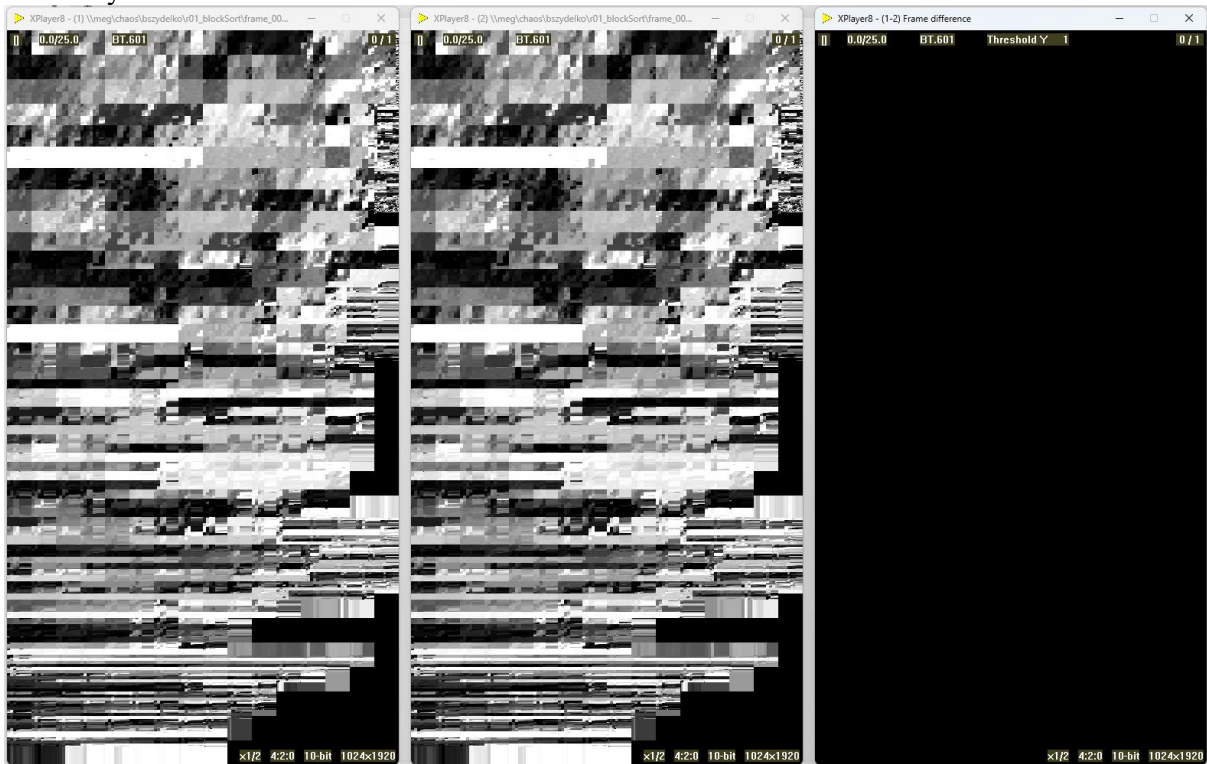


SH attribute, vid 3:



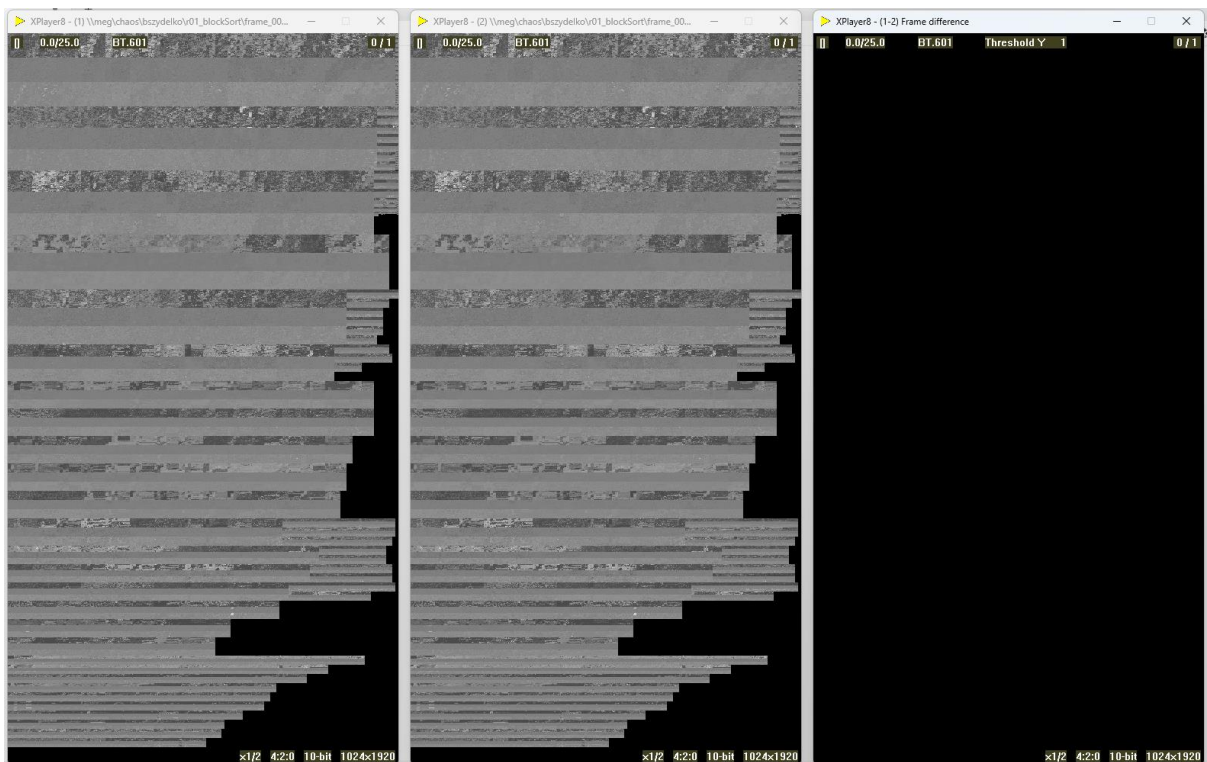
1.2 Block-based sorting [m76580]

Geometry:

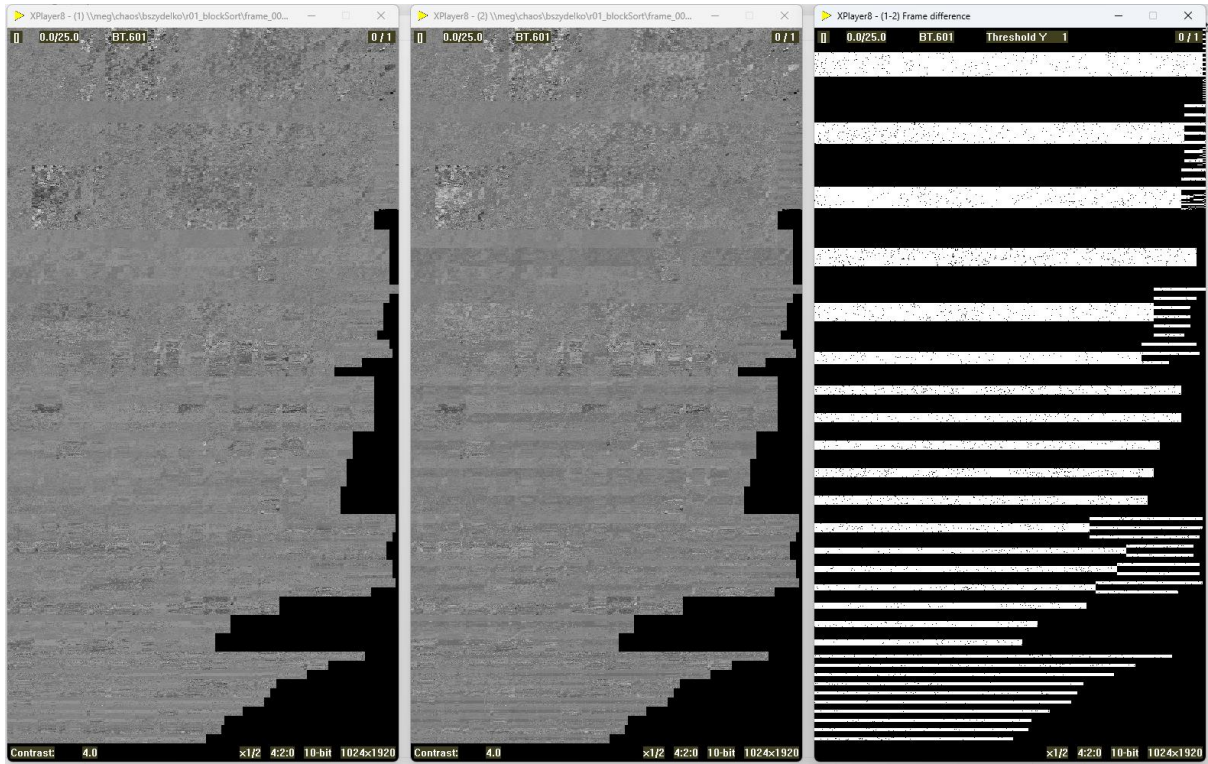


All attributes except for SH are also identical.

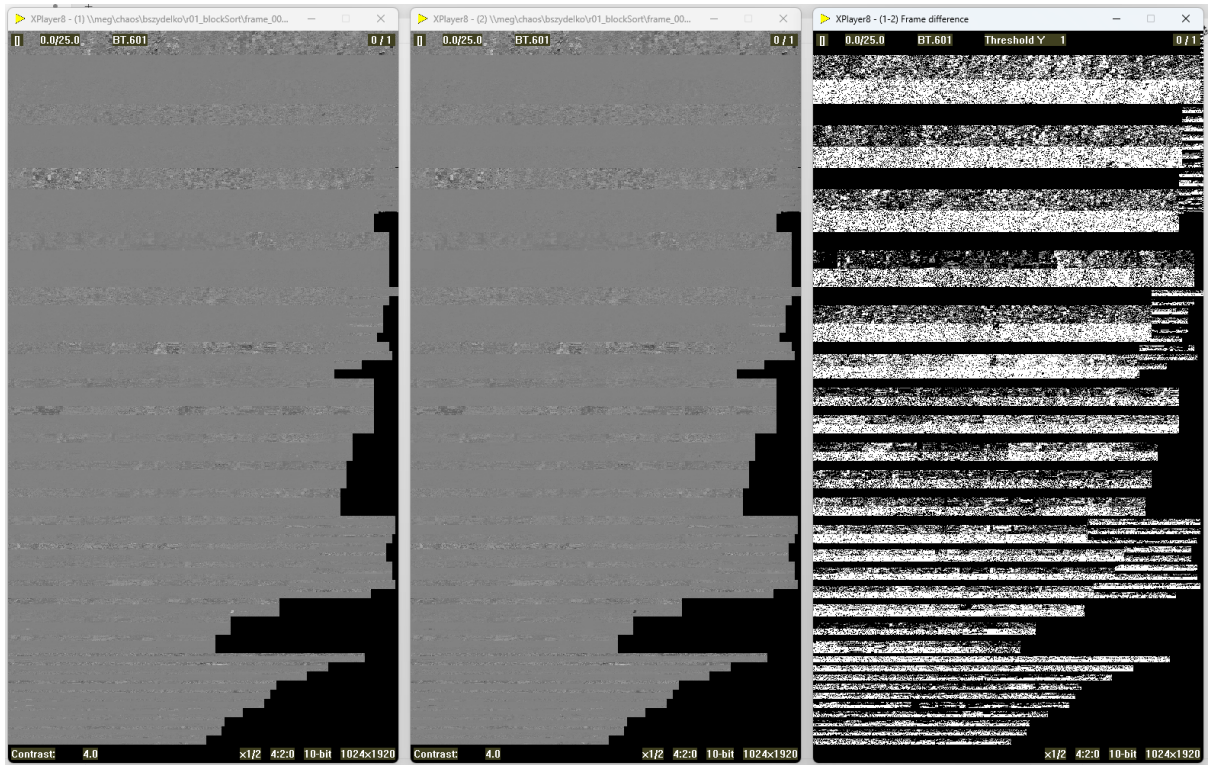
SH attribute, vid 0:



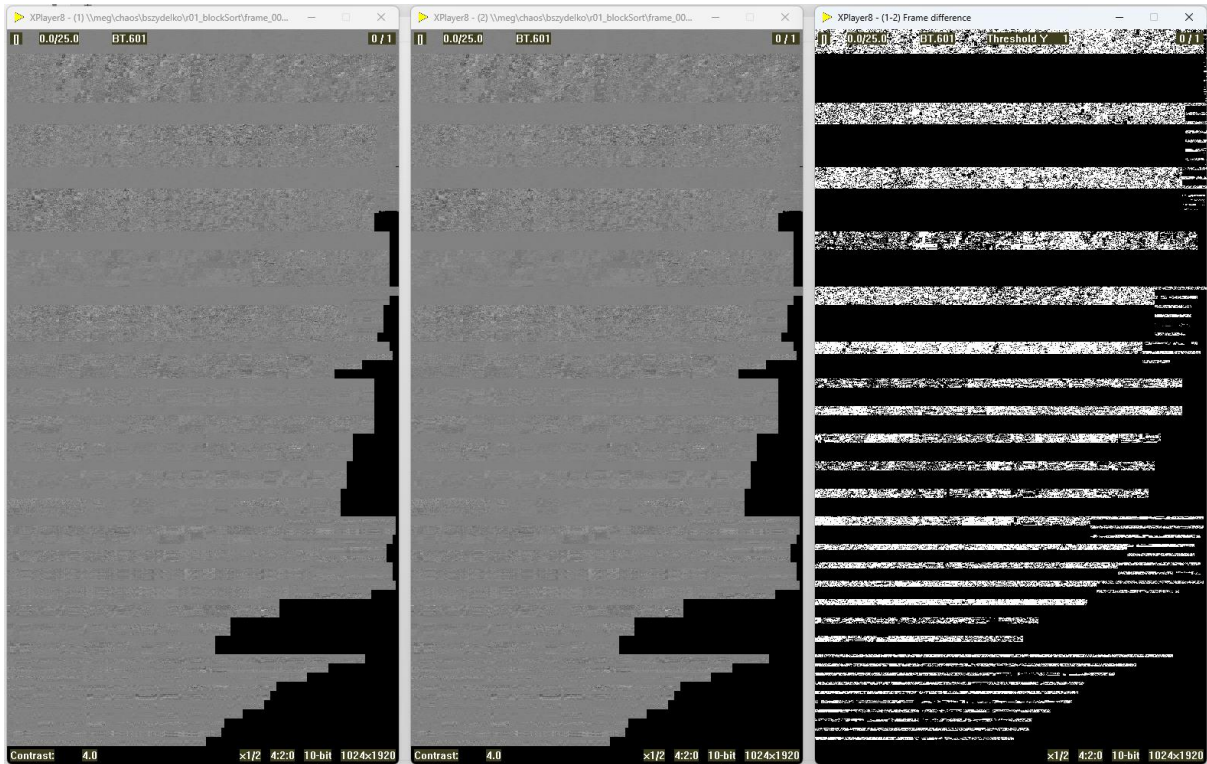
SH attribute, vid1:



SH attribute, vid 2:

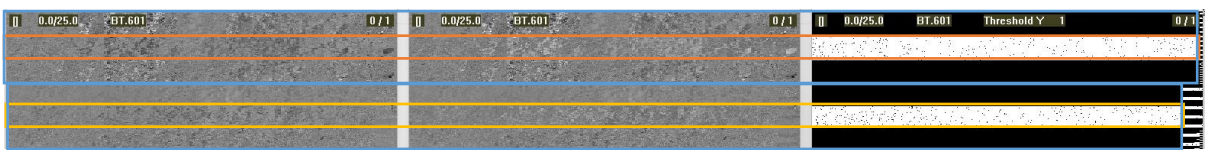


SH attribute, vid 3:

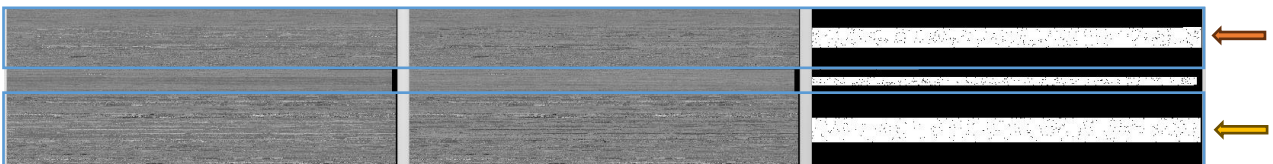


1.3 Analysis

Block-based, SH, vid1 – differences in second subcomponent:

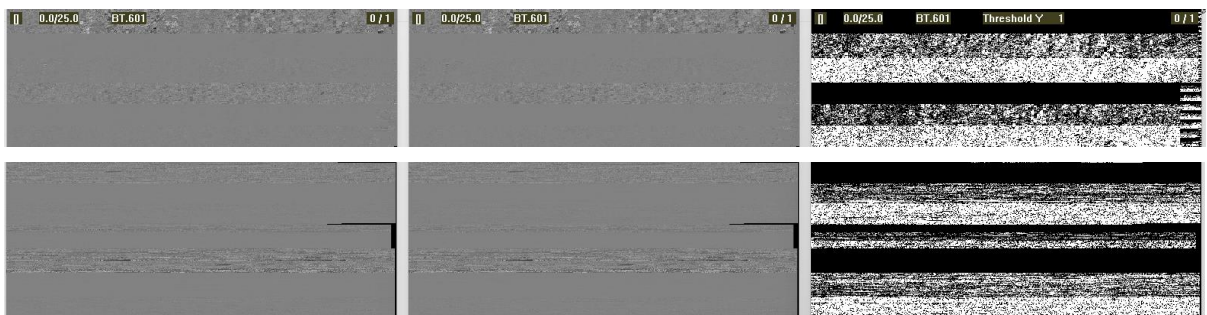


Anchor, SH, vid1 – differences in second subcomponent:



Orange – second subcomponent of 1st patch, yellow – second subcomponent of 2nd patch

SH, vid2 – differences in second and third subcomponent:



SH, vid3 – differences in first subcomponent:



Why only those?

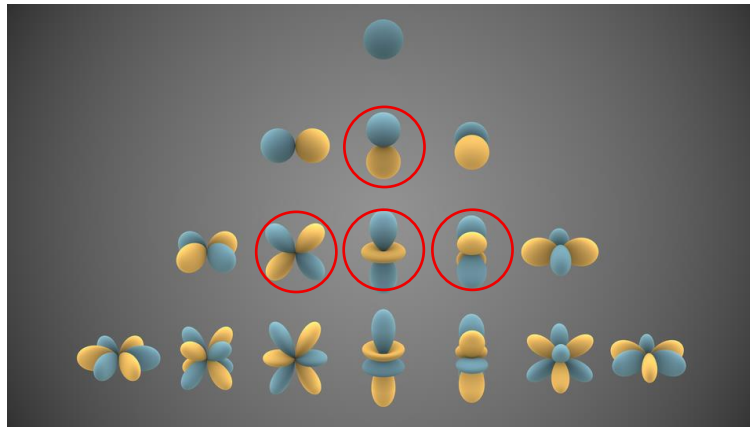


Fig. from Wikipedia. Red circles added.

SH vid 0 contains 0th order harmonics for 3 color components.

No problem.

SH vid 1 contains 1st order harmonics for 1st component.

Problem with 2nd subcomponent.

SH vid 2 contains first three 2nd order harmonics for 1st component.

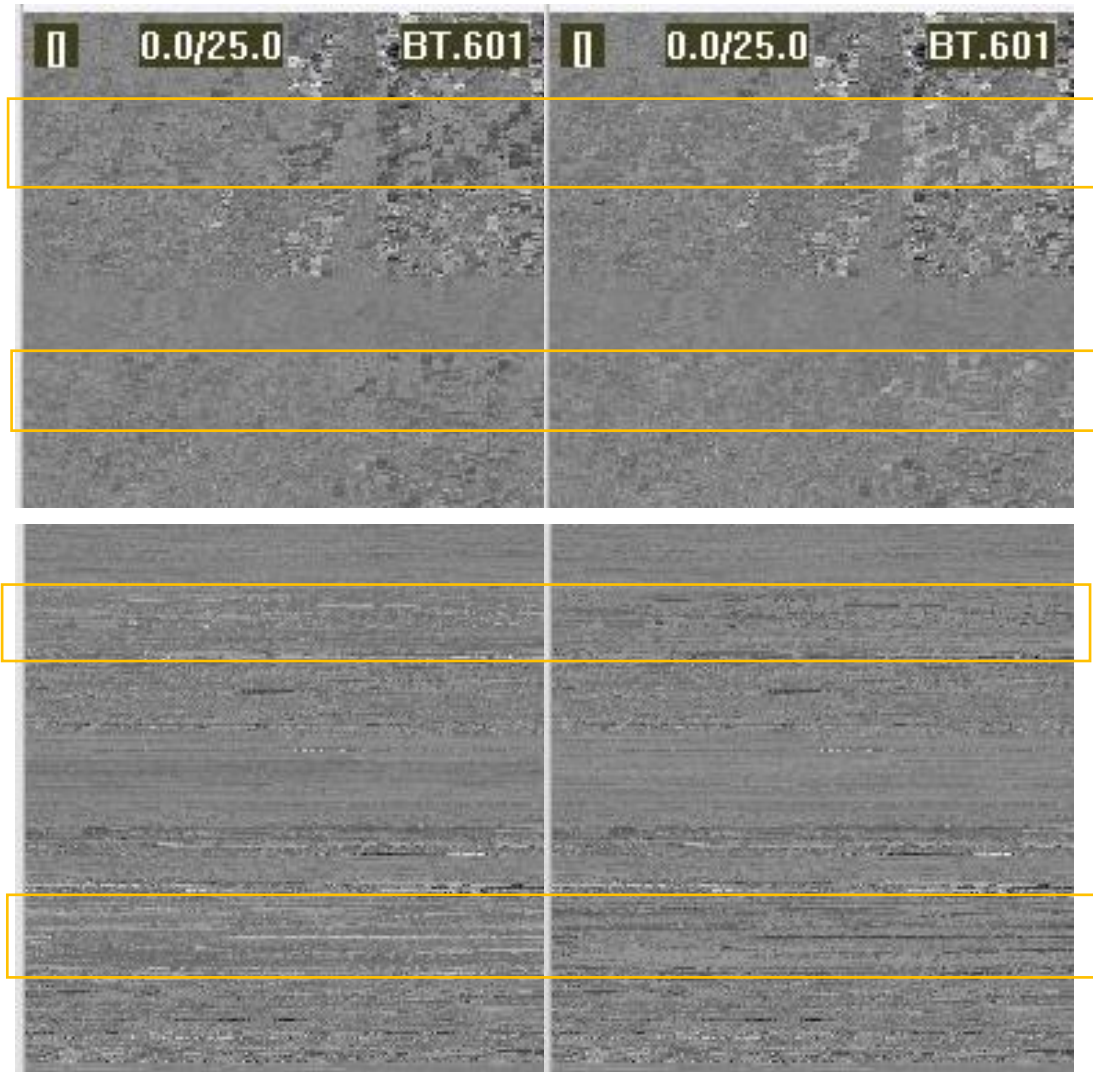
Problem with 2nd and 3rd subcomponent.

SH vid 3 contains last two 2nd order and first one 3rd order harmonics for 1st component.

Problem with 1st subcomponent.

There is a problem with all subcomponents carrying vertically-oriented harmonics. The ones in plane X-Z are correct.

How does the problem look like?



**Is the sign of this particular harmonic direction reversed depending on the platform?
At this moment the answer is unknown.**

1.4 Compared platforms

Compilers:

- WSL: gcc 13.3
- Windows: msvc

Computing platform:

- WSL, Windows: R9 9950X, 64 GB RAM
- Linux Ubuntu 24.04.4 LTS: R9 7950X, 96 GB RAM

2 Recommendations

We recommend to explore the topic further and to resolve the bug eventually.