BothView Multi-device Sync

About this book

SilkyEvCam BothView comes with a Python-based sample code（viewer). This document explains ”multi-device Sync” from among them.

Structure of this document

This document includes the following.

1. Pre-Operation Checklist
2. Sync between BothView and BothView
3. Sync between BothView and SilkyEvCam (VGA/HD)
4. Others

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1. Pre-Operation Checklist

This section describes timestamps and setting files as prerequisites necessary for understanding the content of this document.

1-1. Timestamp Shifting

There are two modes for the timestamp in RAW files.

- **Timestamp Shifting: Enabled**
  The timestamp temporal origin (the zero) is the time when the camera started recording. This is suitable when you want to check the recording time relatively, such as when recording with a single camera.
- **Timestamp Shifting: Disabled**
  The timestamp temporal origin (the zero) is the time when the camera started streaming. This is suitable when you want to achieve absolute time synchronization between cameras with different recording start timing, such as when using multiple event cameras in sync.

For multi-device sync in this document, the timestamp shifting option needs to be **disabled**.

【 Note 】

When timestamp shifting option is set to “Disabled,” the streaming start point becomes the timestamp temporal origin (the zero) , but time is not continuously accumulated. The timestamp cycles within the range of 0 to 16.777215 (4096 μs × 2^{12}) seconds, and any value within this range becomes as the reference value at the start of recording.

Reference
https://docs.prophesee.ai/stable/data/streaming_decoding/timestamp_shifting.html

1-2. Setting files

BothView sample code includes a configuration file for each camera.

- for Event camera: config/Settings.json
- for Fframe camera: config/Settings.xml

In general, it is not a problem if the settings differ between the Master and Slave cameras. However, for the “Exposure Time” and “Acquisition Frame Rate” options in the frame camera setting, the values set on the Master frame camera take precedence. (The settings on the Slave side are ignored.)

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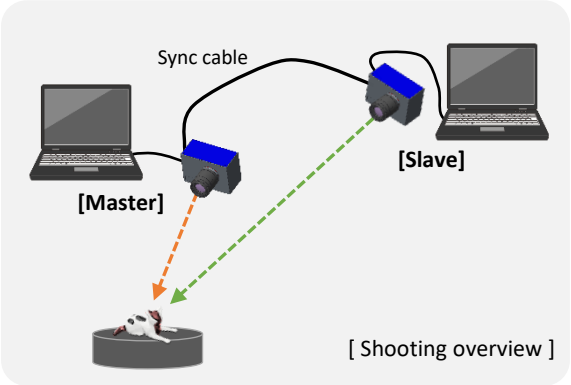
2. Sync between BothView and BothView

This section describes the operating procedures and file handling when synchronizing and recording multiple BothView devices.

2-1. How to Operate



※The following commands are for use on Ubuntu.

1. Launch the Slave from the PC connected to the Slave device.
   ```
   $ python3 bothview_main.py -m slave
   ```
   Execute the command from the console.

2. Launch the Master from the PC connected to the Master device.
   ```
   $ python3 bothview_main.py -m master
   ```
   When the Master viewer starts up, the Slave viewer also starts up.
   (When connecting both the Slave and Master cameras to the same PC, execute commands from separate consoles.)

3. Start multi-device synchronous recording
   Press the R key while the Master viewer is active.
   This will start recording two videos on both the Master and Slave viewers.

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2. Sync between BothView and BothView

2-1. How to Operate (continued)

4. Stop multi-device synchronous recording
   Press the R key again while the Master viewer is active.
   This will stop recording two videos on both the Master and Slave viewers.

5. Quit the Slave viewer
   Press the Q key while the Slave viewer is active.

6. Quit the Master viewer
   Press the Q key while the Master viewer is active.

【 Note 】

- When recording with multi-device sync, we recommend using one PC per BothView device to avoid operational delays caused by concentrated PC load.
- If you need to doing multi-device sync of BothViews on a single PC, specify the serial number of each camera (Master or Slave) in the execution command to identify them (-se、-sf options).
- During multi-device sync, the only key operation synchronized from the Master to the Slave is the R key for simultaneous recording of two videos (start/stop). Other key operations are not synchronized to the Slave.
- Keyboard operations in the Slave viewer are only possible when the Master viewer is running.

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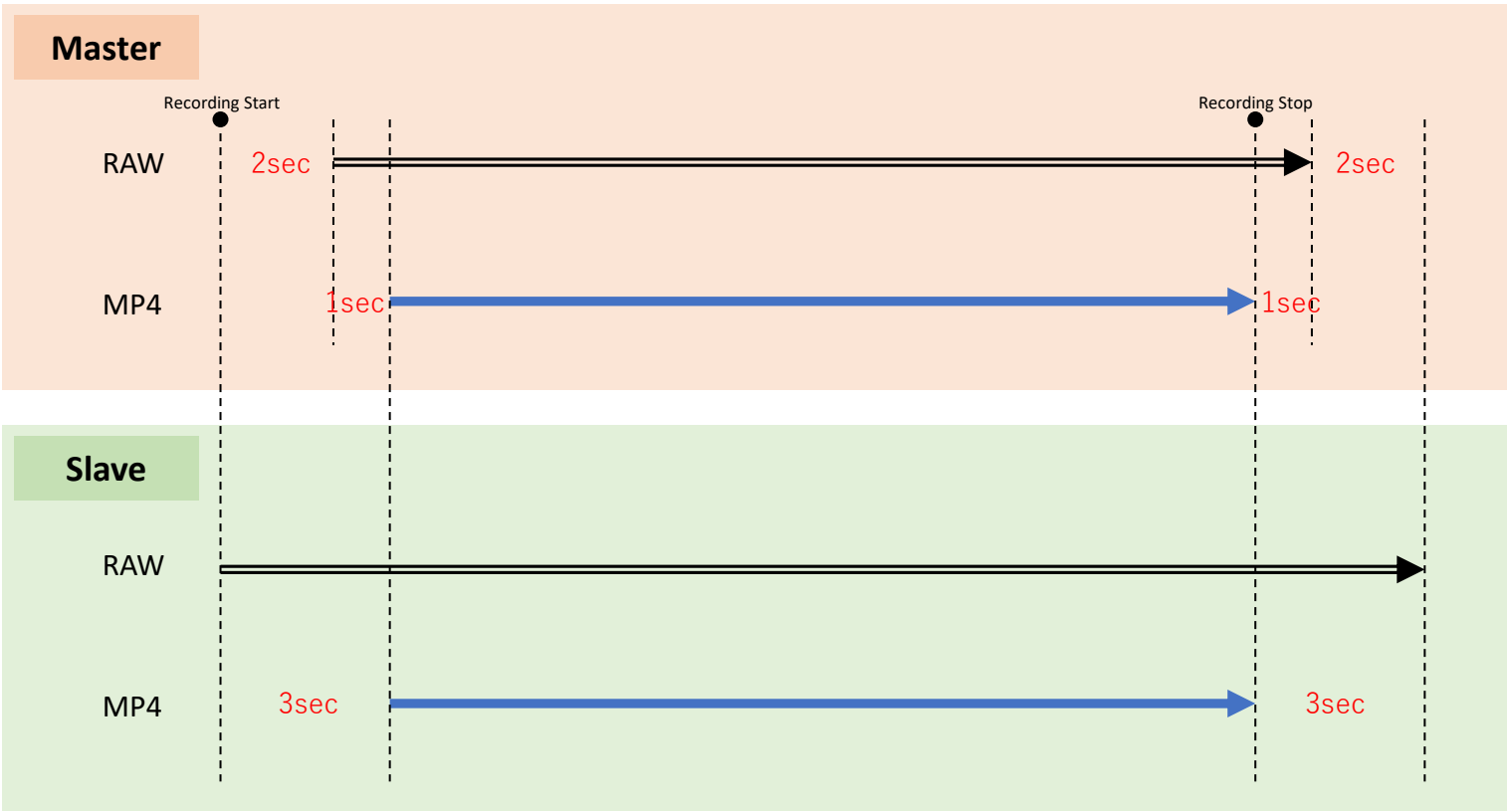
2. Sync between BothView and BothView

2-2. Status of each recorded file

To account for the timing difference that occurs between the Master sending the recording start (or stop) signal and the Slave actually starting (or stopping) recording, a buffer of two seconds before and after is provided for the execution timing of both sides. Additionally, within each camera, the start and end times for recording on the event camera are set approximately one second longer than the recording time on the frame camera to ensure the synchronization signal from the frame camera is reliably acquired.

【 Image of Master/Slave Recording Start/End Timing 】



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2. Sync between BothView and BothView

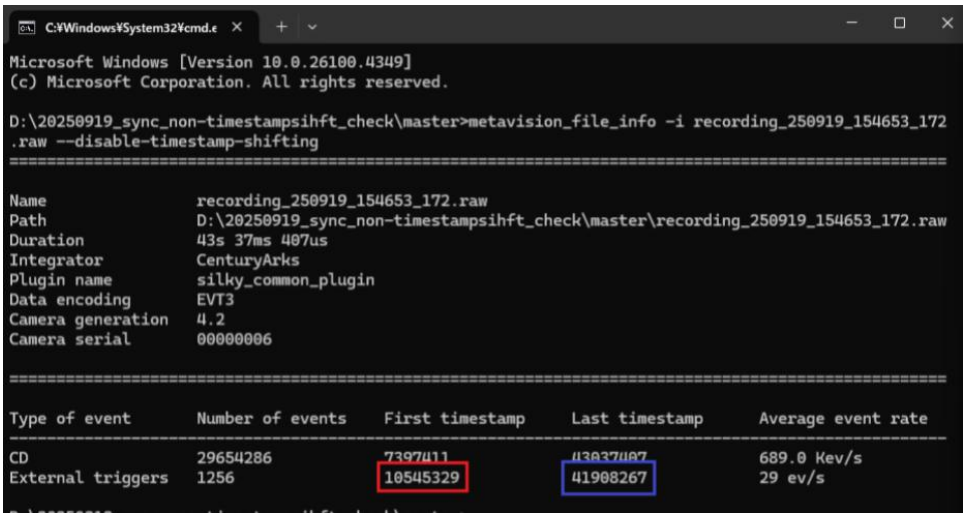
2-3. External Trigger Latency

The timing difference in raw file recording between Master and Slave during external trigger synchronization is measured to be within the range of 20 to 50 µs. (When using our SCBB-3m sync cable product.)

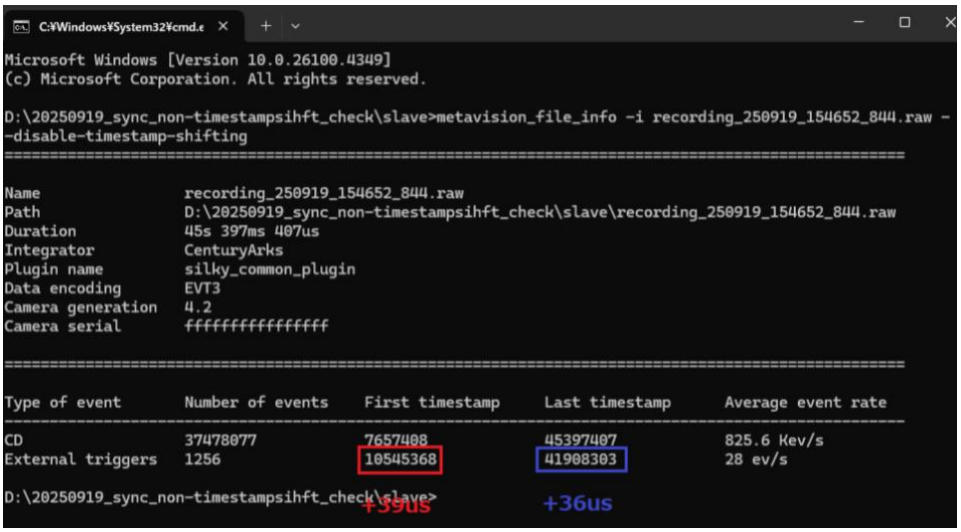
This difference is the latency that occurs in the signal transmission path:

[Master-Frame] ⇒ [Slave-Frame] ⇒ [Slave-Event].

Master Raw (BothView)



Slave Raw (BothView)



【 Note 】

- The metavision_file_info command shown in the figure above is a tool for retrieving information about RAW files recorded using the Metavision SDK. It allows you to check the number of events contained in the file, the average event rate, the timestamp range, camera information, and more.
- The “--disable-timestamp-shifting” option for the metavision_file_info command is a new option added starting with Metavision SDK v5.0.0.

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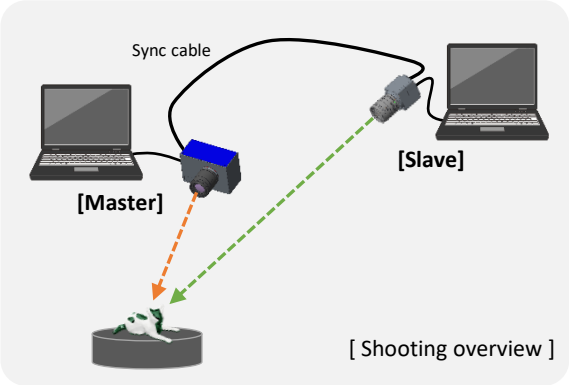
3. Sync between BothView and SilkyEvCam (VGA/HD)

This section describes the operating procedures and file handling when synchronizing and recording between BothView and SilkyEvCam(VGA/HD) devices.

3-1. How to Operate

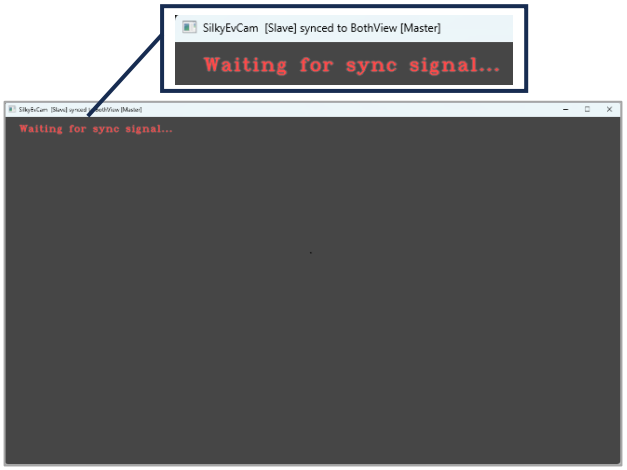


※ The following commands are for use on Ubuntu.

1. Launch the Slave from the PC connected to the Slave device.

   ```
   $ python3 silkyev_slave_sync.py
   ```

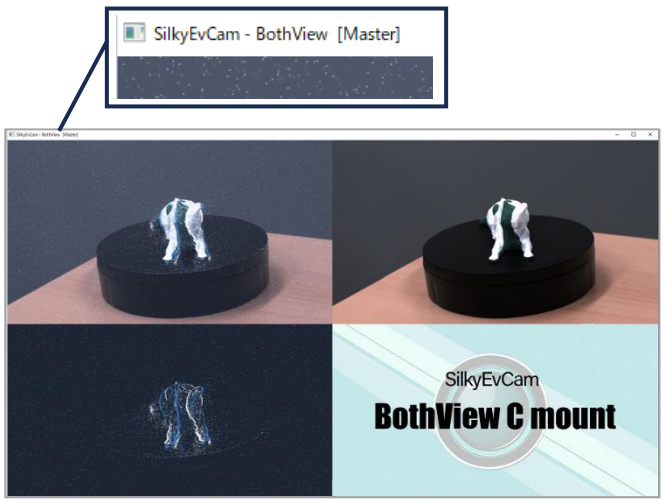
   Execute the command from the console.
   The Slave viewer window starts in standby mode.



2. Launch the Master from the PC connected to the Master device.

   ```
   $ python3 bothview_main.py -m master
   ```

   The Master viewer will start.
   Simultaneously, the Slave viewer will start and recording will begin. (Master recording has not yet begun.)
   (When connecting both the Slave and Master cameras to the same PC, execute commands from separate consoles.)



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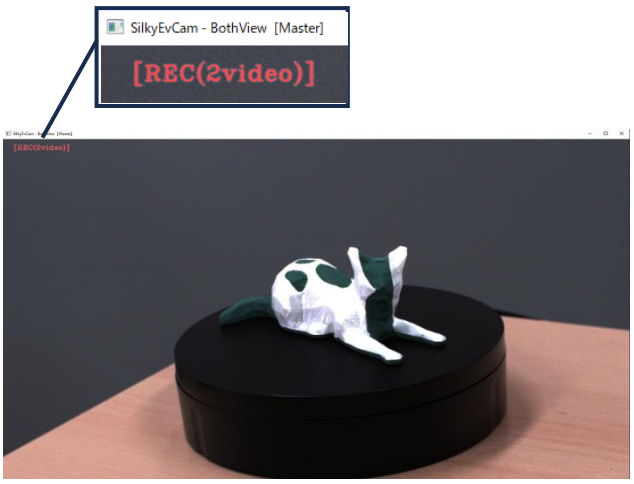
3．BothView と SilkyEvCam の同期（つづき）

3-1. How to Operate (continued)

3. Start multi-device synchronous recording
   Press the R key while the Master viewer is active.
   This will also start Master recording.



4. Stop multi-device synchronous recording
   Press the R key again while the Master viewer is active.
   ※Slave recording does not stop automatically.

5. Stop and quit the Slave recording and viewer
   Press the Q key while the Slave viewer is active.

6. Quit the Master viewer
   Press the Q key while the Master viewer is active.

【 Note 】

- When recording with multi-device sync, we recommend using one PC per camera device to avoid operational delays caused by concentrated PC load.
- If you need to doing multi-device sync of camera devices on a single PC, specify the serial number of each camera (Master or Slave) in the execution command to identify them (-se、-sf options).
- During multi-device sync, keyboard operations on the Master do not synchronize with the Slave in this sample code because there is no GPIO pin for control. Therefore, in this sample code, the Slave is implemented to automatically start and stop Raw recording in sync with the start and end of streaming.
- SilkyEvCam for Slave can be run on either HD or VGA models.

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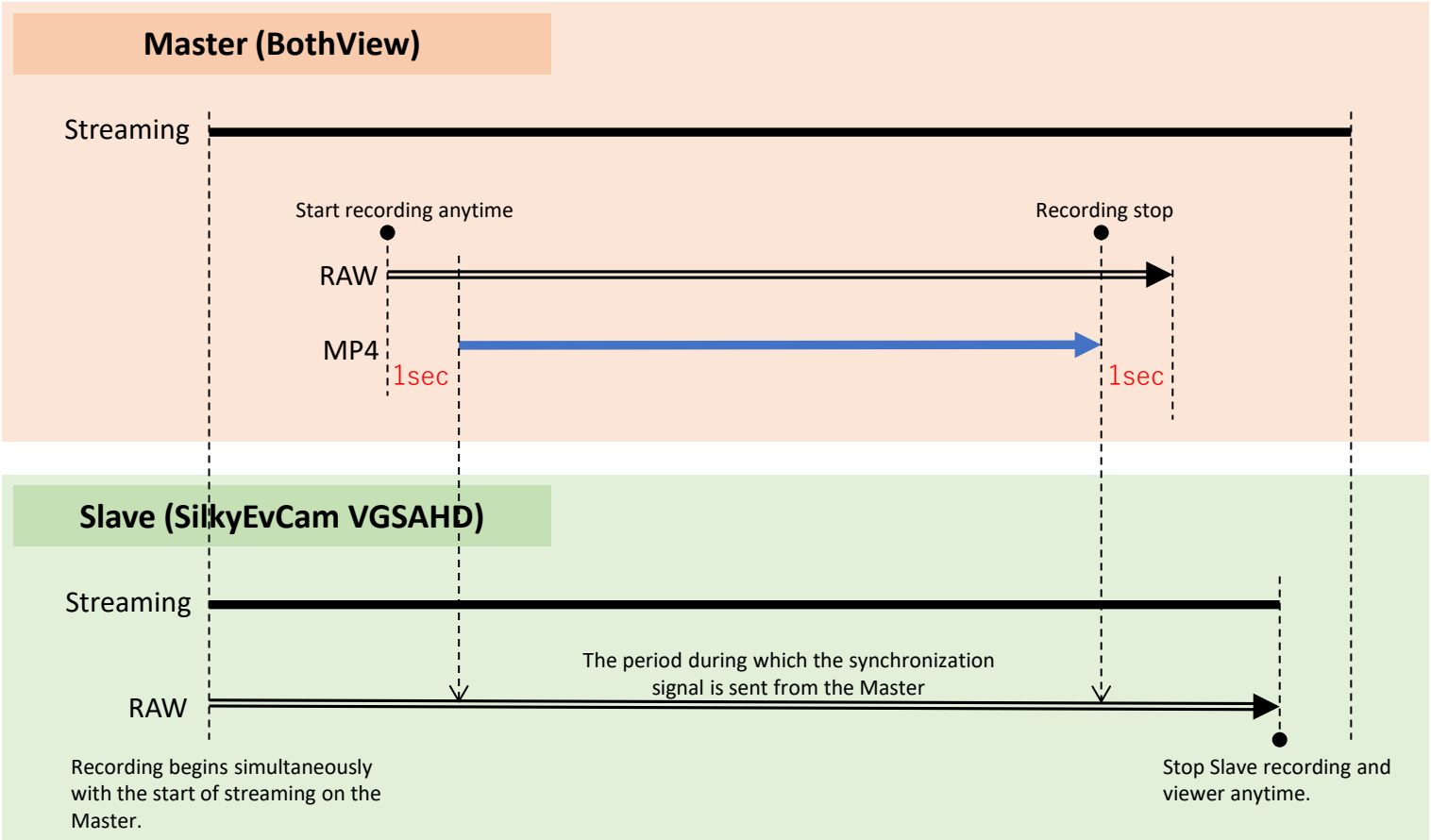
3. Sync between BothView and SilkyEvCam (VGA/HD)

3-2. Status of each recorded file

The Slave is implemented to automatically start recording when streaming begins. Meanwhile, the timing for starting and stopping recording on the Master can be controlled by the user's arbitrary operation.

【 Image of Master/Slave Recording Start/End Timing 】



【 Memo 】

Since the Slave is always in recording mode from the start of streaming, unnecessary external triggers--other than the normal frame camera trigger--may be detected before recording begins on the Master.

This phenomenon occurs due to logical inversion caused by the Master's Invert setting and temporary fluctuations before the circuit or wiring voltage stabilizes. The frequency and number of unwanted triggers detected vary depending on the magnitude and timing of the voltage changes.

As a countermeasure, it is possible to prevent unnecessary event recording by adding software logic to ignore triggers occurring during the brief period immediately after startup, but only when the Slave can detect the Master's recording start timing.

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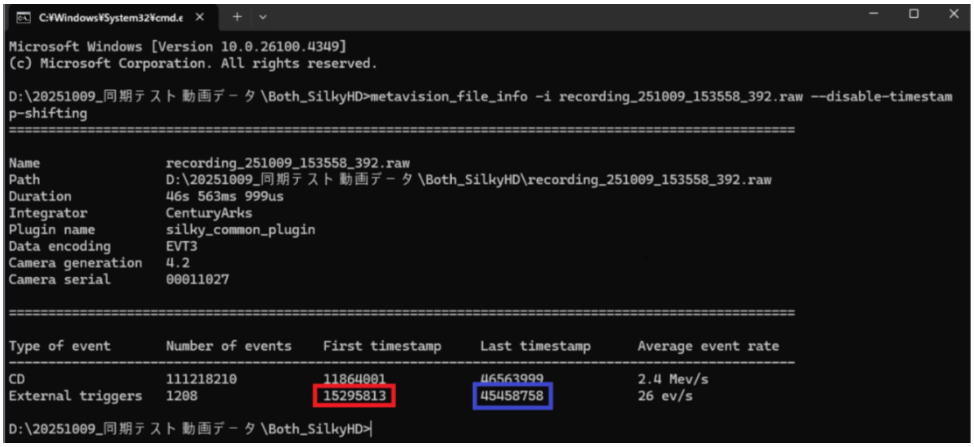
3. Sync between BothView and SilkyEvCam (VGA/HD)

3-3. External Trigger Latency

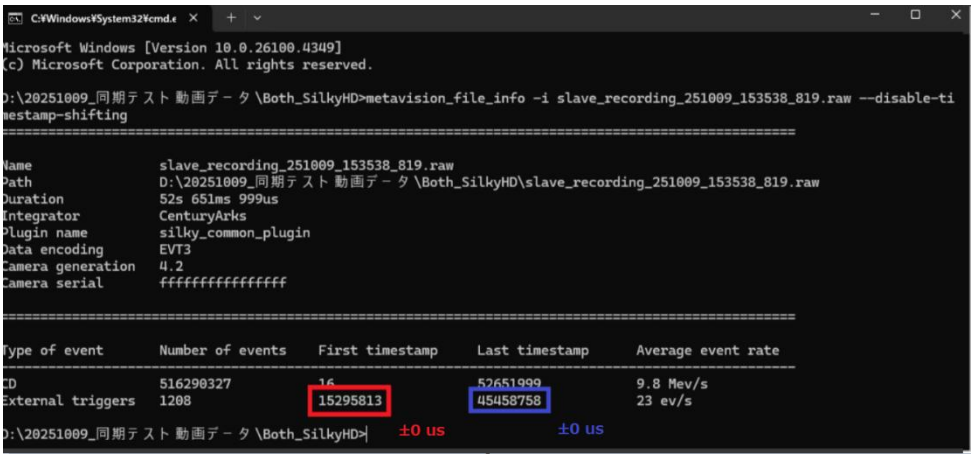
The timing difference in raw file recording between the Master and Slave during external trigger synchronization has not been observed in actual measurements, as the signal is simultaneously split into two separate lines for routing. (When using our SCBB-3m sync cable product.)

Specifically, signals are transmitted simultaneously via both paths: [Master-Frame] ⇒ [Master-Event] and [Master-Frame] ⇒ [Slave-Event].

Master Raw (BothView)



Slave Raw (SilkyEvCam)



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3. Sync between BothView and SilkyEvCam (VGA/HD)

【 Note 】

- The metavision_file_info command shown in the figure above is a tool for retrieving information about RAW files recorded using the Metavision SDK. It allows you to check the number of events contained in the file, the average event rate, the timestamp range, camera information, and more.
- The “--disable-timestamp-shifting” option for the metavision_file_info command is a new option added starting with Metavision SDK v5.0.0.
- If the timing difference between the master and slave for recording start exceeds approximately 16.77 seconds (the timestamp cycle period), simple timestamp comparison becomes impossible due to the effects of timestamp cycling. Therefore, offset correction is necessary through measures such as managing the number of cycles.

4. Others

4-1. Synchronization with External Devices

This document has explained synchronization between BothView and SilkyEvCam(VGA/HD) using sample code, but synchronization with other external devices is also possible. To synchronize with external devices, additional program implementation for your purpose or a dedicated sync cable may be required. Please feel free to contact us if you need.

4-2. Sync Cable Extension Unit

Our standard sync cables are up to 3 meters in length, but we also offer a “Sync Cable Extension Unit” to meet the following requirements. Please feel free to contact us for details.

- When you want to connect synchronization devices more than 3 meters apart.
- When you want to connect multiple slaves (BothView or SilkyEvCam VGA/HD) to one master (BothView).

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