

# OSVP Clip Documentation

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## Introduction

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The OSVP Clip (clip) is a collection of metadata parameters sampled over a specified duration. Each parameter is either:

- static: the parameter has at constant value over the duration of the clip
- dynamic: the parameter is sampled at regular intervals over the duration of the clip

Each parameter is identified by a unique name. It also has a general description as well as a specific set of constraints.

The OSVP Frame (frame) is a collection of metadata parameters that is dynamic and has a synchronous relationship with a video frame. In an OSVP environment this describes live camera position ('tracking') and lens data.

## Clip Parameters

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### **activeSensorPhysicalDimensions**

#### **Description**

Height and width of the active area of the camera sensor in microns

#### **Units**

millimeter

#### **Sampling**

Static

#### **Constraints**

The height and width shall be each be real non-negative numbers.

### **activeSensorResolution**

#### **Description**

Photosite resolution of the active area of the camera sensor in pixels

#### **Units**

pixel

## Sampling

Static

## Constraints

The height and width shall be each be an integer in the range [0..2,147,483,647].

### anamorphicSqueeze

## Description

Nominal ratio of height to width of the image of an axis-aligned square captured by the camera sensor. It can be used to de-squeeze images but is not however an exact number over the entire captured area due to a lens' intrinsic analog nature.

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a rational number whose numerator is in the range [0..2,147,483,647] and denominator in the range (0..4,294,967,295].

### firmwareVersion

## Description

Non-blank string identifying camera firmware version

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

### label

## Description

Non-blank string containing user-determined camera identifier

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

**make**

## Description

Non-blank string naming camera manufacturer

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

**model**

## Description

Non-blank string identifying camera model

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

**serialNumber**

## Description

Non-blank string uniquely identifying the camera

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

### captureFrameRate

## Description

Capture frame rate of the camera

## Units

hertz

## Sampling

Static

## Constraints

The parameter shall be a rational number whose numerator is in the range [0..2,147,483,647] and denominator in the range (0..4,294,967,295].

### duration

## Description

Duration of the clip

## Units

second

## Sampling

Static

## Constraints

The parameter shall be a rational number whose numerator is in the range [0..2,147,483,647] and denominator in the range (0..4,294,967,295].

### fdlLink

### Description

URN identifying the ASC Framing Decision List used by the camera.

### Units

n/a

### Sampling

Static

### Constraints

The parameter shall be a UUID URN as specified in IETF RFC 4122. Only lowercase characters shall be used. Example: `f81d4fae-7dec-11d0-a765-00a0c91e6bf6`

## globalStage

### Description

Position of stage origin in global ENU and geodetic coordinates (E, N, U, lat0, lon0, h0). Note this may be dynamic if the stage is inside a moving vehicle.

### Units

meter

### Sampling

Regular

### Constraints

Each field in the GlobalPosition shall be a real number

## isoSpeed

### Description

Arithmetic ISO scale as defined in ISO 12232

### Units

n/a

### Sampling

Static

### Constraints

The parameter shall be a integer in the range (1..4,294,967,295].

## **custom**

### **Description**

Until the OpenLensIO model is finalised, this list provides custom coefficients for a particular lens model e.g. undistortion, anamorphic etc

### **Units**

n/a

### **Sampling**

Regular

### **Constraints**

The parameter shall be a tuple of items of the class itemClass. The tuple can be empty

## **distortion**

### **Description**

Coefficients for calculating the distortion characteristics of a lens comprising radial distortion coefficients of the spherical distortion (k1-N) and the tangential distortion (p1-N).

### **Units**

n/a

### **Sampling**

Regular

### **Constraints**

The radial and tangential coefficients shall each be real numbers.

## **distortionOverscan**

### **Description**

Overscan factor on lens distortion

### **Units**

n/a

### **Sampling**

Regular

### Constraints

The parameter shall be a non-negative real number.

### distortion0verscanMax

### Description

Static maximum overscan factor on lens distortion

### Units

n/a

### Sampling

Static

### Constraints

The parameter shall be a non-negative real number.

### distortionShift

### Description

Shift in x and y of the centre of distortion of the virtual camera

### Units

millimeter

### Sampling

Regular

### Constraints

X and Y centre shift shall each be real numbers.

### encoders

### Description

Normalised real numbers (0-1) for focus, iris and zoom. Encoders are represented in this way (as opposed to raw integer values) to ensure values remain independent of encoder resolution, minimum and maximum (at an acceptable loss of precision). These values are only relevant in lenses with end-stops that demarcate the 0 and 1 range. Value should be provided in the following directions (if known): Focus: 0=infinite 1=closest Iris: 0=open 1=closed Zoom: 0=wide angle 1=telephoto

## Units

n/a

## Sampling

Regular

## Constraints

The parameter shall contain at least one normalised values (0..1) for the FIZ encoders.

### entrancePupilOffset

## Description

Offset of the entrance pupil relative to the nominal imaging plane (positive if the entrance pupil is located on the side of the nominal imaging plane that is towards the object, and negative otherwise). Measured in meters as in a render engine it is often applied in the virtual camera's transform chain.

## Units

meter

## Sampling

Regular

## Constraints

The parameter shall be a real number.

### exposureFalloff

## Description

Coefficients for calculating the exposure fall-off (vignetting) of a lens

## Units

n/a

## Sampling

Regular

## Constraints

The coefficients shall each be real numbers.

### fStop



## Description

The linear f-number of the lens, equal to the focal length divided by the diameter of the entrance pupil.

## Units

n/a

## Sampling

Regular

## Constraints

The parameter shall be a non-negative real number.

### firmwareVersion

## Description

Non-blank string identifying lens firmware version

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

### focalLength

## Description

Focal length of the lens.

## Units

millimeter

## Sampling

Regular

## Constraints

The parameter shall be a non-negative real number.

### focusDistance

### Description

Focus distance/position of the lens

### Units

meter

### Sampling

Regular

### Constraints

The parameter shall be a non-negative real number.

#### make

### Description

Non-blank string naming lens manufacturer

### Units

n/a

### Sampling

Static

### Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

#### model

### Description

Non-blank string identifying lens model

### Units

n/a

### Sampling

Static

### Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

#### nominalFocalLength

### Description

Nominal focal length of the lens. The number printed on the side of a prime lens, e.g. 50 mm, and undefined in the case of a zoom lens.

### Units

millimeter

### Sampling

Static

### Constraints

The parameter shall be a non-negative real number.

## perspectiveShift

### Description

Shift in x and y of the centre of perspective projection of the virtual camera

### Units

millimeter

### Sampling

Regular

### Constraints

X and Y perspective shift shall each be real numbers.

## rawEncoders

### Description

Raw encoder values for focus, iris and zoom. These values are dependent on encoder resolution and before any homing / ranging has taken place.

### Units

n/a

### Sampling

Regular

### Constraints

The parameter shall contain at least one integer value for the FIZ encoders.

## **serialNumber**

### **Description**

Non-blank string uniquely identifying the lens

### **Units**

n/a

### **Sampling**

Static

### **Constraints**

The parameter shall be a Unicode string between 0 and 1023 codepoints.

## **tStop**

### **Description**

Linear t-number of the lens, equal to the F-number of the lens divided by the square root of the transmittance of the lens.

### **Units**

n/a

### **Sampling**

Regular

### **Constraints**

The parameter shall be a non-negative real number.

## **undistortion**

### **Description**

Coefficients for calculating the undistortion characteristics of a lens comprising radial distortion coefficients of the spherical distortion (k1-N) and the tangential distortion (p1-N).

### **Units**

n/a

### **Sampling**

Regular

### Constraints

The radial and tangential coefficients shall each be real numbers.

## protocol

### Description

Name of the protocol in which the sample is being employed, and version of that protocol

### Units

n/a

### Sampling

Regular

### Constraints

Protocol name is nonblank string; protocol version is basic x.y.z semantic versioning string

## relatedSampleIds

### Description

List of sampleId properties of samples related to this sample. The existence of a sample with a given sampleId is not guaranteed.

### Units

n/a

### Sampling

Regular

### Constraints

The parameter shall be a tuple of items of the class itemClass. The tuple can be empty

## sampleId

### Description

URN serving as unique identifier of the sample in which data is being transported.

### Units

n/a

## Sampling

Regular

## Constraints

The parameter shall be a UUID URN as specified in IETF RFC 4122. Only lowercase characters shall be used. Example: `f81d4fae-7dec-11d0-a765-00a0c91e6bf6`

### shutterAngle

## Description

Shutter speed as a fraction of the capture frame rate. The shutter speed (in units of 1/s) is equal to the value of the parameter divided by 360 times the capture frame rate.

## Units

degree

## Sampling

Static

## Constraints

The parameter shall be a real number in the range (0..360].

### sourceId

## Description

URN serving as unique identifier of the source from which data is being transported.

## Units

n/a

## Sampling

Regular

## Constraints

The parameter shall be a UUID URN as specified in IETF RFC 4122. Only lowercase characters shall be used. Example: `f81d4fae-7dec-11d0-a765-00a0c91e6bf6`

### sourceNumber

## Description

Number that identifies the index of the stream from a source from which data is being transported. This is most important in the case where a source is producing multiple streams of samples.

#### Units

n/a

#### Sampling

Regular

#### Constraints

The parameter shall be a integer in the range (0..4,294,967,295].

### frameRate

#### Description

Sample frame rate as a rational number. Drop frame rates such as 29.97 should be represented as e.g. 30000/1001. In a variable rate system this should is estimated from the last sample delta time.

#### Units

n/a

#### Sampling

Regular

#### Constraints

The parameter shall be a rational number whose numerator is in the range [0..2,147,483,647] and denominator in the range (0..4,294,967,295].

### mode

#### Description

Enumerated value indicating whether the sample transport mechanism provides inherent ('external') timing, or whether the transport mechanism lacks inherent timing and so the sample must contain a PTP timestamp itself ('internal') to carry timing information.

#### Units

n/a

#### Sampling

Regular

#### Constraints

The parameter shall be one of the allowed values.

## **recordedTimestamp**

### **Description**

PTP timestamp of the data recording instant, provided for convenience during playback of e.g. pre-recorded tracking data. The timestamp comprises a 48-bit unsigned integer (seconds), a 32-bit unsigned integer (nanoseconds), and an optional 32-bit unsigned integer (attoseconds)

### **Units**

second

### **Sampling**

Regular

### **Constraints**

The parameter shall contain valid number of seconds, nanoseconds and optionally attoseconds elapsed since the start of the epoch.

## **sampleTimestamp**

### **Description**

PTP timestamp of the data capture instant. Note this may differ from the packet's transmission PTP timestamp. The timestamp comprises a 48-bit unsigned integer (seconds), a 32-bit unsigned integer (nanoseconds), and an optional 32-bit unsigned integer (attoseconds)

### **Units**

second

### **Sampling**

Regular

### **Constraints**

The parameter shall contain valid number of seconds, nanoseconds and optionally attoseconds elapsed since the start of the epoch.

## **sequenceNumber**

### **Description**

Integer incrementing with each sample.

### **Units**



n/a

## Sampling

Regular

## Constraints

The parameter shall be a integer in the range (0..4,294,967,295].

## synchronization

### Description

Object describing how the tracking device is synchronized for this sample.

frequency: The frequency of the synchronisation. This may differ from the sample frame rate for example in a genlocked tracking device. locked: Is the tracking device locked to the synchronization source offsets: Offsets in seconds between sync and sample. Critical for e.g. frame remapping, or when using different data sources for position/rotation and lens encoding present: Is the synchronization source present (a synchronization source can be present but not locked if frame rates differ for example) ptp: If the synchronization source is a PTP master, then this object contains:

- "master": The MAC address of the PTP master
- "offset": The timing offset in seconds from the sample timestamp to the PTP timestamp
- "domain": The PTP domain number source: The source of synchronization must be defined as one of the following:
- "genlock": The tracking device has an external black/burst or tri-level analog sync signal that is triggering the capture of tracking samples
- "videoIn": The tracking device has an external video signal that is triggering the capture of tracking samples
- "ptp": The tracking device is locked to a PTP master
- "ntp": The tracking device is locked to an NTP server

### Units

n/a

## Sampling

Regular

## Constraints

The parameter shall contain the required valid fields.

## timecode

## Description

SMPTE timecode of the sample. Timecode is a standard for labeling individual frames of data in media systems and is useful for inter-frame synchronization.

- `format.dropFrame`: True if the frame rate is a drop-frame format such as 29.97 fps.
- `format.frameRate`: The frame rate as a rational number. Drop frame rates such as 29.97 should be represented as e.g. 30000/1001. Note the timecode frame rate may differ from the sample frequency.

## Units

n/a

## Sampling

Regular

## Constraints

The parameter shall contain a valid format and hours, minutes, seconds and frames with appropriate min/max values.

## firmwareVersion

## Description

Non-blank string identifying tracking device firmware version

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

## make

## Description

Non-blank string naming tracking device manufacturer

## Units

n/a

## Sampling

Static

### Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

### model

### Description

Non-blank string identifying tracking device model

### Units

n/a

### Sampling

Static

### Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

### notes

### Description

Non-blank string containing notes about tracking system

### Units

n/a

### Sampling

Regular

### Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

### recording

### Description

Boolean indicating whether tracking system is recording data

### Units

n/a

## Sampling

Regular

## Constraints

The parameter shall be a boolean.

### serialNumber

## Description

Non-blank string uniquely identifying the tracking device

## Units

n/a

## Sampling

Static

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

### slate

## Description

Non-blank string describing the recording slate

## Units

n/a

## Sampling

Regular

## Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

### status

## Description

Non-blank string describing status of tracking system

## Units

n/a

Sampling

Regular

Constraints

The parameter shall be a Unicode string between 0 and 1023 codepoints.

transforms

Description

A list of transforms. Transforms can have a transformId and parentTransformId that can be used to compose a transform hierarchy. In the case of multiple children their transforms should be processed in their order in the array. X,Y,Z in meters of camera sensor relative to stage origin. The Z axis points upwards and the coordinate system is right-handed. Y points in the forward camera direction (when pan, tilt and roll are zero). For example in an LED volume Y would point towards the centre of the LED wall and so X would point to camera-right. Rotation expressed as euler angles in degrees of the camera sensor relative to stage origin Rotations are intrinsic and are measured around the axes ZXY, commonly referred to as [pan, tilt, roll] Notes on Euler angles: Euler angles are human readable and unlike quarternions, provide the ability for cycles (with angles >360 or <0 degrees). Where a tracking system is providing the pose of a virtual camera, gimbal lock does not present the physical challenges of a robotic system. Conversion to and from quarternions is trivial with an acceptable loss of precision

Units

meter / degree

Sampling

Regular

Constraints

Each component of each transform shall contain Real numbers.

Reader coverage

The following table indicates the camera parameters supported by each of the readers.

Reader	activeSensorPhysicalDimensions	activeSensorResolution	anamorphicSqueeze	
RED	+		+	
ARRI	+		+	
Venice	+		+	
Canon			+	

Clip JSON Schema

```
"$id": "https://opentrackio.org/schema.json",
"$schema": "https://json-schema.org/draft/2020-12/schema",
"type": "object",
"properties": {
  "static": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
      "camera": {
        "type": "object",
        "additionalProperties": false,
        "properties": {
          "activeSensorPhysicalDimensions": {
            "type": "object",
            "additionalProperties": false,
            "required": [
              "height",
              "width"
            ],
            "properties": {
              "height": {
                "type": "number",
                "minimum": 0.0
              },
              "width": {
                "type": "number",
                "minimum": 0.0
              }
            },
            "description": "Height and width of the active area of the camera sensor in micro
            units": "millimeter"
          },
          "activeSensorResolution": {
            "type": "object",
            "additionalProperties": false,
            "required": [
              "height",
              "width"
            ],
            "properties": {
              "height": {
                "type": "integer",
                "minimum": 0,
                "maximum": 2147483647
              },
              "width": {
                "type": "integer",
                "minimum": 0,
                "maximum": 2147483647
              }
            },
            "description": "Photosite resolution of the active area of the camera sensor in p
            units": "pixel"
          },
          "anamorphicSqueeze": {
            "type": "object",
```

```
"properties": {
  "num": {
    "type": "integer",
    "minimum": 0,
    "maximum": 2147483647
  },
  "denom": {
    "type": "integer",
    "minimum": 1,
    "maximum": 4294967295
  }
},
"required": [
  "num",
  "denom"
],
"additionalProperties": false,
"description": "Nominal ratio of height to width of the image of an axis-aligned
},
"firmwareVersion": {
  "type": "string",
  "minLength": 1,
  "maxLength": 1023,
  "description": "Non-blank string identifying camera firmware version"
},
"label": {
  "type": "string",
  "minLength": 1,
  "maxLength": 1023,
  "description": "Non-blank string containing user-determined camera identifier"
},
"make": {
  "type": "string",
  "minLength": 1,
  "maxLength": 1023,
  "description": "Non-blank string naming camera manufacturer"
},
"model": {
  "type": "string",
  "minLength": 1,
  "maxLength": 1023,
  "description": "Non-blank string identifying camera model"
},
"serialNumber": {
  "type": "string",
  "minLength": 1,
  "maxLength": 1023,
  "description": "Non-blank string uniquely identifying the camera"
},
"captureFrameRate": {
  "type": "object",
  "properties": {
    "num": {
      "type": "integer",
      "minimum": 0,
      "maximum": 2147483647
    },
    "denom": {
      "type": "integer",
      "minimum": 1,
      "maximum": 4294967295
    }
  }
},
"required": [
  "make",
  "model",
  "serialNumber",
  "captureFrameRate"
],
"additionalProperties": false,
"description": "A camera device that can capture images and video. The camera is identified by its make, model, and serial number. The captureFrameRate property is an object with a numerator (num) and a denominator (denom) representing the frame rate in frames per second."
}
```

```

        "denom": {
            "type": "integer",
            "minimum": 1,
            "maximum": 4294967295
        }
    },
    "required": [
        "num",
        "denom"
    ],
    "additionalProperties": false,
    "description": "Capture frame rate of the camera",
    "units": "hertz"
},
"fdlLink": {
    "type": "string",
    "pattern": "^urn:uuid:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}$",
    "description": "URN identifying the ASC Framing Decision List used by the camera."
},
"isoSpeed": {
    "type": "integer",
    "minimum": 1,
    "maximum": 4294967295,
    "description": "Arithmetic ISO scale as defined in ISO 12232"
},
"shutterAngle": {
    "type": "number",
    "minimum": 0.0,
    "maximum": 360.0,
    "description": "Shutter speed as a fraction of the capture frame rate. The shutter angle is the angle of the shutter in degrees.",
    "units": "degree"
}
}
},
"duration": {
    "type": "object",
    "properties": {
        "num": {
            "type": "integer",
            "minimum": 0,
            "maximum": 2147483647
        },
        "denom": {
            "type": "integer",
            "minimum": 1,
            "maximum": 4294967295
        }
    },
    "required": [
        "num",
        "denom"
    ],
    "additionalProperties": false,
    "description": "Duration of the clip",
    "units": "second"
},
"lens": {

```



```
"type": "object",
"additionalProperties": false,
"properties": {
  "distortionOverscanMax": {
    "type": "number",
    "minimum": 0.0,
    "description": "Static maximum overscan factor on lens distortion"
  },
  "firmwareVersion": {
    "type": "string",
    "minLength": 1,
    "maxLength": 1023,
    "description": "Non-blank string identifying lens firmware version"
  },
  "make": {
    "type": "string",
    "minLength": 1,
    "maxLength": 1023,
    "description": "Non-blank string naming lens manufacturer"
  },
  "model": {
    "type": "string",
    "minLength": 1,
    "maxLength": 1023,
    "description": "Non-blank string identifying lens model"
  },
  "nominalFocalLength": {
    "type": "number",
    "minimum": 0.0,
    "description": "Nominal focal length of the lens. The number printed on the side",
    "units": "millimeter"
  },
  "serialNumber": {
    "type": "string",
    "minLength": 1,
    "maxLength": 1023,
    "description": "Non-blank string uniquely identifying the lens"
  }
},
"tracker": {
  "type": "object",
  "additionalProperties": false,
  "properties": {
    "firmwareVersion": {
      "type": "string",
      "minLength": 1,
      "maxLength": 1023,
      "description": "Non-blank string identifying tracking device firmware version"
    },
    "make": {
      "type": "string",
      "minLength": 1,
      "maxLength": 1023,
      "description": "Non-blank string naming tracking device manufacturer"
    },
    "model": {
```

```

        "type": "string",
        "minLength": 1,
        "maxLength": 1023,
        "description": "Non-blank string identifying tracking device model"
    },
    "serialNumber": {
        "type": "string",
        "minLength": 1,
        "maxLength": 1023,
        "description": "Non-blank string uniquely identifying the tracking device"
    }
}
}
},
"globalStage": {
    "type": "object",
    "additionalProperties": false,
    "required": [
        "E",
        "N",
        "U",
        "lat0",
        "lon0",
        "h0"
    ],
    "properties": {
        "E": {
            "type": "number"
        },
        "N": {
            "type": "number"
        },
        "U": {
            "type": "number"
        },
        "lat0": {
            "type": "number"
        },
        "lon0": {
            "type": "number"
        },
        "h0": {
            "type": "number"
        }
    },
    "description": "Position of stage origin in global ENU and geodetic coordinates (E, N, U,
    "units": "meter"
},
"lens": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
        "custom": {
            "type": "array",
            "items": {
                "type": "number"
            }
        }
    }
}

```

```

    },
    "description": "Until the OpenLensIO model is finalised, this list provides custom cc
},
"distortion": {
  "type": "object",
  "additionalProperties": false,
  "required": [
    "radial"
  ],
  "properties": {
    "radial": {
      "type": "array",
      "items": {
        "type": "number"
      },
      "minLength": 1
    },
    "tangential": {
      "type": "array",
      "items": {
        "type": "number"
      },
      "minLength": 1
    }
  },
  "description": "Coefficients for calculating the distortion characteristics of a lens
},
"distortionOverscan": {
  "type": "number",
  "minimum": 0.0,
  "description": "Overscan factor on lens distortion"
},
"distortionShift": {
  "type": "object",
  "additionalProperties": false,
  "required": [
    "x",
    "y"
  ],
  "properties": {
    "x": {
      "type": "number"
    },
    "y": {
      "type": "number"
    }
  },
  "description": "Shift in x and y of the centre of distortion of the virtual camera ",
  "units": "millimeter"
},
"encoders": {
  "type": "object",
  "additionalProperties": false,
  "properties": {
    "focus": {
      "type": "number",
      "minimum": 0.0,

```

```

        "maximum": 1.0
    },
    "iris": {
        "type": "number",
        "minimum": 0.0,
        "maximum": 1.0
    },
    "zoom": {
        "type": "number",
        "minimum": 0.0,
        "maximum": 1.0
    }
},
"anyOf": [
    {
        "required": [
            "focus"
        ]
    },
    {
        "required": [
            "iris"
        ]
    },
    {
        "required": [
            "zoom"
        ]
    }
],
"description": " Normalised real numbers (0-1) for focus, iris and zoom. Encoders are
},
"entrancePupilOffset": {
    "type": "number",
    "description": "Offset of the entrance pupil relative to the nominal imaging plane (p
    "units": "meter"
},
"exposureFalloff": {
    "type": "object",
    "additionalProperties": false,
    "required": [
        "a1"
    ],
    "properties": {
        "a1": {
            "type": "number"
        },
        "a2": {
            "type": "number"
        },
        "a3": {
            "type": "number"
        }
    }
},
"description": "Coefficients for calculating the exposure fall-off (vignetting) of a
},
"fStop": {

```

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    "type": "number",
    "minimum": 0.0,
    "description": "The linear f-number of the lens, equal to the focal length divided by
},
"focalLength": {
    "type": "number",
    "minimum": 0.0,
    "description": "Focal length of the lens.",
    "units": "millimeter"
},
"focusDistance": {
    "type": "number",
    "minimum": 0.0,
    "description": "Focus distance/position of the lens",
    "units": "meter"
},
"perspectiveShift": {
    "type": "object",
    "additionalProperties": false,
    "required": [
        "x",
        "y"
    ],
    "properties": {
        "x": {
            "type": "number"
        },
        "y": {
            "type": "number"
        }
    },
    "description": "Shift in x and y of the centre of perspective projection of the virtu
    "units": "millimeter"
},
"rawEncoders": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
        "focus": {
            "type": "integer",
            "minimum": 0
        },
        "iris": {
            "type": "integer",
            "minimum": 0
        },
        "zoom": {
            "type": "integer",
            "minimum": 0
        }
    },
    "anyOf": [
        {
            "required": [
                "focus"
            ]
        }
    ],

```

```

        {
            "required": [
                "iris"
            ]
        },
        {
            "required": [
                "zoom"
            ]
        }
    ],
    "description": " Raw encoder values for focus, iris and zoom. These values are dependant on the camera used.",
},
"tStop": {
    "type": "number",
    "minimum": 0.0,
    "description": "Linear t-number of the lens, equal to the F-number of the lens divided by the aperture.",
},
"undistortion": {
    "type": "object",
    "additionalProperties": false,
    "required": [
        "radial"
    ],
},
"properties": {
    "radial": {
        "type": "array",
        "items": {
            "type": "number"
        },
        "minLength": 1
    },
    "tangential": {
        "type": "array",
        "items": {
            "type": "number"
        },
        "minLength": 1
    }
},
},
"description": "Coefficients for calculating the undistortion characteristics of a lens.",
}
}
},
"protocol": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
        "name": {
            "type": "string",
            "minLength": 1,
            "maxLength": 1023
        },
    },
    "version": {
        "type": "string",
        "pattern": "^[0-9]+.[0-9]+.[0-9]+$"
    }
}

```

```

    },
    "description": "Name of the protocol in which the sample is being employed, and version c
},
"relatedSampleIds": {
  "type": "array",
  "items": {
    "type": "string",
    "pattern": "^urn:uuid:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}$"
  },
  "description": "List of sampleId properties of samples related to this sample. The existe
},
"sampleId": {
  "type": "string",
  "pattern": "^urn:uuid:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}$",
  "description": "URN serving as unique identifier of the sample in which data is being tra
},
"sourceId": {
  "type": "string",
  "pattern": "^urn:uuid:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}$",
  "description": "URN serving as unique identifier of the source from which data is being t
},
"sourceNumber": {
  "type": "integer",
  "minimum": 0,
  "maximum": 4294967295,
  "description": "Number that identifies the index of the stream from a source from which c
},
"timing": {
  "type": "object",
  "additionalProperties": false,
  "properties": {
    "frameRate": {
      "type": "object",
      "properties": {
        "num": {
          "type": "integer",
          "minimum": 0,
          "maximum": 2147483647
        },
        "denom": {
          "type": "integer",
          "minimum": 1,
          "maximum": 4294967295
        }
      }
    },
    "required": [
      "num",
      "denom"
    ],
    "additionalProperties": false,
    "description": "Sample frame rate as a rational number. Drop frame rates such as 29.9
  },
  "mode": {
    "type": "string",
    "enum": [
      "internal",
      "external"
    ]
  }
}

```

```

    ],
    "description": "Enumerated value indicating whether the sample transport mechanism
},
"recordedTimestamp": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
        "seconds": {
            "type": "integer",
            "minimum": 0,
            "maximum": 281474976710655
        },
        "nanoseconds": {
            "type": "integer",
            "minimum": 0,
            "maximum": 4294967295
        },
        "attoseconds": {
            "type": "integer",
            "minimum": 0,
            "maximum": 4294967295
        }
    },
    "required": [
        "seconds",
        "nanoseconds"
    ],
    "description": " PTP timestamp of the data recording instant, provided for convenience
    "units": "second"
},
"sampleTimestamp": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
        "seconds": {
            "type": "integer",
            "minimum": 0,
            "maximum": 281474976710655
        },
        "nanoseconds": {
            "type": "integer",
            "minimum": 0,
            "maximum": 4294967295
        },
        "attoseconds": {
            "type": "integer",
            "minimum": 0,
            "maximum": 4294967295
        }
    },
    "required": [
        "seconds",
        "nanoseconds"
    ],
    "description": "PTP timestamp of the data capture instant. Note this may differ   fr
    "units": "second"
},

```



```
"sequenceNumber": {
  "type": "integer",
  "minimum": 0,
  "maximum": 4294967295,
  "description": "Integer incrementing with each sample."
},
"synchronization": {
  "type": "object",
  "additionalProperties": false,
  "description": "Object describing how the tracking device is synchronized for this sa
  "properties": {
    "frequency": {
      "type": "object",
      "additionalProperties": false,
      "required": [
        "num",
        "denom"
      ],
      "properties": {
        "num": {
          "type": "integer",
          "minimum": 1,
          "maximum": 4294967295
        },
        "denom": {
          "type": "integer",
          "minimum": 1,
          "maximum": 4294967295
        }
      }
    }
  },
  "locked": {
    "type": "boolean"
  },
  "offsets": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
      "translation": {
        "type": "number"
      },
      "rotation": {
        "type": "number"
      },
      "lensEncoders": {
        "type": "number"
      }
    }
  },
  "present": {
    "type": "boolean"
  },
  "ptp": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
      "master": {
```

```
        "type": "string",
        "pattern": "^[A-F0-9]{2:}{5}[A-F0-9]{2}$"
    },
    "offset": {
        "type": "number"
    },
    "domain": {
        "type": "integer",
        "minimum": 0
    }
}
},
"source": {
    "type": "string",
    "enum": [
        "genlock",
        "videoIn",
        "ptp",
        "ntp"
    ]
}
},
"required": [
    "frequency",
    "locked",
    "source"
]
},
"timecode": {
    "type": "object",
    "additionalProperties": false,
    "required": [
        "hours",
        "minutes",
        "seconds",
        "frames",
        "format"
    ],
    "properties": {
        "hours": {
            "type": "integer",
            "minimum": 0,
            "maximum": 23
        },
        "minutes": {
            "type": "integer",
            "minimum": 0,
            "maximum": 59
        },
        "seconds": {
            "type": "integer",
            "minimum": 0,
            "maximum": 59
        },
        "frames": {
            "type": "integer",
            "minimum": 0,
```

```

        "maximum": 29
    },
    "format": {
        "type": "object",
        "description": "The timecode format is defined as a rational frame rate and drop",
        "required": [
            "frameRate",
            "dropFrame"
        ],
        "additionalProperties": false,
        "properties": {
            "frameRate": {
                "type": "object",
                "additionalProperties": false,
                "required": [
                    "num",
                    "denom"
                ],
                "properties": {
                    "num": {
                        "type": "integer",
                        "minimum": 1,
                        "maximum": 4294967295
                    },
                    "denom": {
                        "type": "integer",
                        "minimum": 1,
                        "maximum": 4294967295
                    }
                }
            },
            "dropFrame": {
                "type": "boolean"
            },
            "oddField": {
                "type": "boolean"
            }
        }
    },
    "description": "SMPTE timecode of the sample. Timecode is a standard for labeling inc
}
},
"tracker": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
        "notes": {
            "type": "string",
            "minLength": 1,
            "maxLength": 1023,
            "description": "Non-blank string containing notes about tracking system"
        },
        "recording": {
            "type": "boolean",
            "description": "Boolean indicating whether tracking system is recording data"
        }
    }
}

```

```
    },
    "slate": {
      "type": "string",
      "minLength": 1,
      "maxLength": 1023,
      "description": "Non-blank string describing the recording slate"
    },
    "status": {
      "type": "string",
      "minLength": 1,
      "maxLength": 1023,
      "description": "Non-blank string describing status of tracking system"
    }
  }
},
"transforms": {
  "type": "array",
  "minItems": 1,
  "uniqueItems": false,
  "items": {
    "type": "object",
    "additionalProperties": false,
    "properties": {
      "translation": {
        "type": "object",
        "additionalProperties": false,
        "properties": {
          "x": {
            "type": "number"
          },
          "y": {
            "type": "number"
          },
          "z": {
            "type": "number"
          }
        }
      },
      "units": "meter"
    },
    "rotation": {
      "type": "object",
      "additionalProperties": false,
      "properties": {
        "pan": {
          "type": "number"
        },
        "tilt": {
          "type": "number"
        },
        "roll": {
          "type": "number"
        }
      },
      "units": "degree"
    },
    "scale": {
      "type": "object",
```

```

        "additionalProperties": false,
        "properties": {
            "x": {
                "type": "number"
            },
            "y": {
                "type": "number"
            },
            "z": {
                "type": "number"
            }
        }
    },
    "transformId": {
        "type": "string",
        "minLength": 1,
        "maxLength": 1023
    },
    "parentTransformId": {
        "type": "string",
        "minLength": 1,
        "maxLength": 1023
    }
},
"required": [
    "translation",
    "rotation"
]
},
"description": "A list of transforms. Transforms can have a transformId and parentTransformId",
"units": "meter / degree"
}
}
}

```