Alchemist XF

How to Process Low Frame Rate Files

Version History

Date	Version	Release by	Reason for Changes
21/05/2014	1.0	J. Metcalf	Initial release
22/05/2014	1.1	T. Huns	Minor corrections
09/07/2014	1.2	J Metcalf	Added second interlace example.
20/04/2015	2.0	J Metcalf	Updated for V2.0.0.12
07/07/2015	3.0	J Metcalf	Updated for V2.1.0.8
31/08/2015	3.1	J Metcalf	Updated for V2.1.1.2
08/09/2015	3.2	J Metcalf	Edit for XF Rebrand
19/09/2016	3.3	G Emerson	Completed Rebrand

Table of Contents

1. Frame Rate

Frame rate, also known as **frame frequency** or **frames per second** (**FPS**), is the frequency (rate) at which an imaging device produces unique consecutive images. The term applies equally well to film and video cameras, computer graphics and motion capture systems. Frame rate is most often expressed in frames per second (FPS) but can also be expressed as Hertz (Hz).

1.1 What is considered a Low Temporal Frame Rate?

Any content with a temporal frame rate at or below 30Hz is deemed a **low temporal frame rate**.

23p, 24p, 25p, 29p, 30p, 23psf, 24psf, 25psf, 29psf, 30psf are examples of low temporal frame rates.

1.2 The Potential Issue with Low Temporal Frame Rates

Video files that are formed by ingesting low frame rate baseband video, will be formed with associated metadata that reflects the baseband video transport method that was captured. It is a common practice to transport low frame rate progressive content within an interlaced transport system. Such content is known as **psf** (progressive segmented frame).

Alternatively, the same program content (with the same native rate) could be transported using a purely progressive transport system.

The actual video file formed in each scenario would be identical. However, the metadata would have significant differences. The psf variant can typically contain metadata that indicates the content is normal interlace with a normal video cadence when in actual fact this is not the case. It's actually psf with a 2:2 cadence.

In order to maximise the conversion quality offered with xFile, it is imperative that such files are processed as psf and not as normal interlace**.** If a psf file is processed as normal interlaced video, unwanted artefacts can be introduced, as illustrated in the following example:
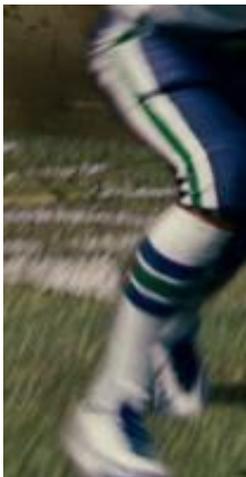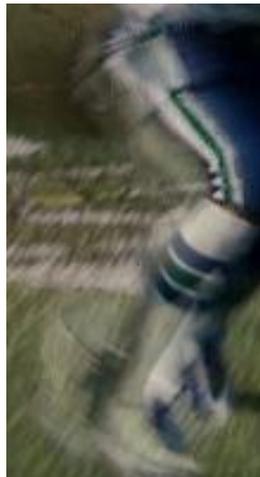
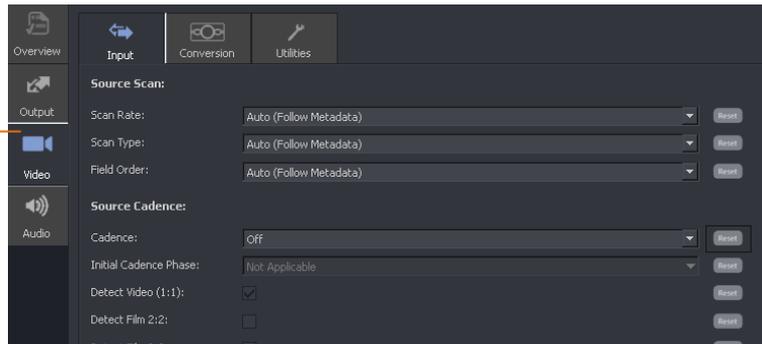| Source	Converted content with **input cadence** set to **Auto** (default)	Converted content with **input cadence** forced to **psf**

To ensure these unwanted artefacts are not introduced the User must manually configure the input **Scan Type** control to **Progressive/psf**.

1.3 xFile Solution

When processing any low frame rate content, it is highly recommended to employ a Conversion Profile where the **Input Source Cadence** is forced to **Progressive/psf.**

1.4 Force the Profile Source Cadence to psf

In the appropriate xFile Client, Select **Profiles**

Select

The Profile Management window should now appear.

Select the appropriate **User Profile** in the **Profile Management** window**.**

Note – Default Profiles are locked and may not be edited. If a Default Profile is to be employed, use the 'copy' feature and edit the copied version. It is recommended that the name of the Profile be modified in such a way that indicates the proposed modification.
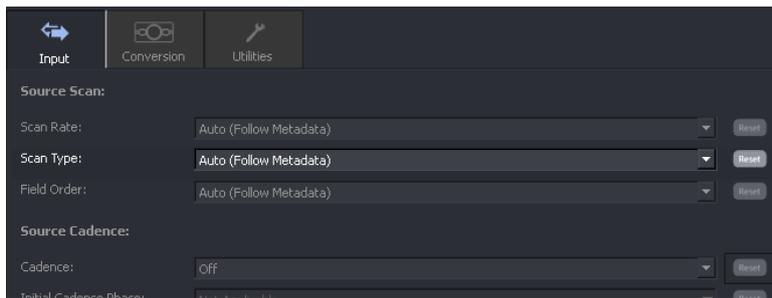

The Profile 'Copy' feature
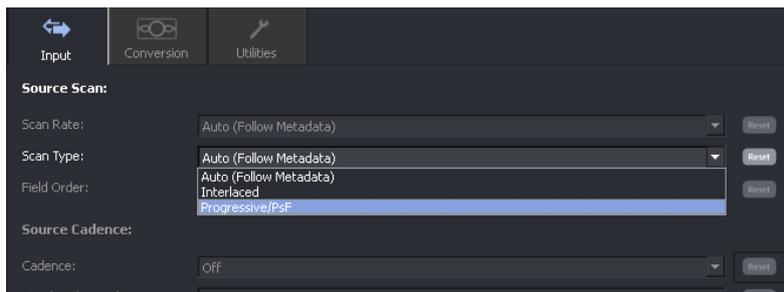
Click on the **Video** tab.

Select ——

The video tab will open displaying the **Input** tab (default).

The scan type control will default to **Auto (follow metadata).**

Set **Scan Type** to **Progressive/psf**:

2. Potential issues due to incorrect metadata

Alchemist XF has the ability to interrogate a source file for itself, so relieving the Operator of the inconvenience of doing this manually. It does this by reading the metadata associated with the source file. This does place reliance on the metadata being correct.

However, it is not uncommon for the metadata to be incorrect, particularly with respect to the scan-type and field-order.

If the metadata associated with a source file, is incorrect, this can result in a less than optimal conversion process. In such circumstances it is imperative that the Alchemist XF includes a control interface to counter this.

With regard to the scan type, it could be a case where the source file contains video essence that has a progressive scan, but the metadata describes the video essence as interlaced. To process a Progressive file, treating it as interlaced video, will result in an inferior conversion. In such a circumstance, the **Scan type** control can be used to ensure that the file is processed as a progressive video file:

Another case may be the opposite of the above scenario. A video source file, containing interlaced video essence, but with metadata describing the video as Progressive may be encountered. If this file is processed with reliance upon the metadata, and sub-optimal conversion will result. In such a circumstance, the **Scan type** control can be used to ensure that the file is processed as an interlaced video file:
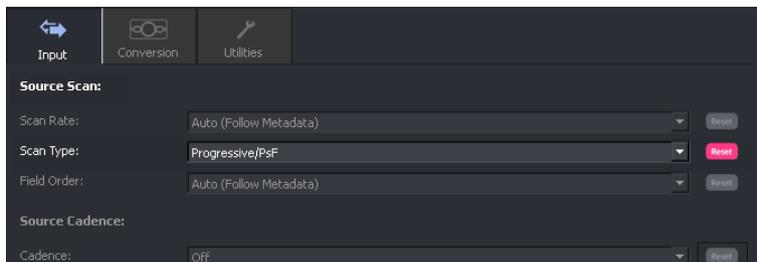
3. How to Identify Cadence

Note – please see document 'Understanding Cadence' for a more detailed explanation of video cadence, available from the website.

For a file to be correctly processed via xFile it is important to consider the frame rate and video cadence of the source. However, when encountering video content in the file-based domain, identifying these parameters can be more complicated than it may first appear.

3.1 What is Cadence?

Cadence is a term generally applied to interlaced video sources and describes the structure of the content.

Usually cadence is used to describe the pattern of video fields that creates a net frame rate lower than the video frame rate (transport rate) that carries them.

3.2 Interlace Cadence

Incoming content is interpreted as interlaced (field by field).

Content shot in 525 59i, 625 50i, 1080 59i, and 1080 50i would all be interpreted as interlaced. Each field in the video stream represents a unique temporal capture point. In the case of 50i, there are 25 frames. Each frame contains two separate fields that are captured at different points in time. A 50i scene is updated 50 times a second.

If a source file is labelled as interlaced and does actually contain interlaced content, the **source cadence** control can be left in **Auto**. Setting manually to **Interlace** would yield the same result. Users should note; artefacts can be introduced if **psf** is selected and the content is actually **interlaced**.

The following example depicts three consecutive frames of interlaced video:
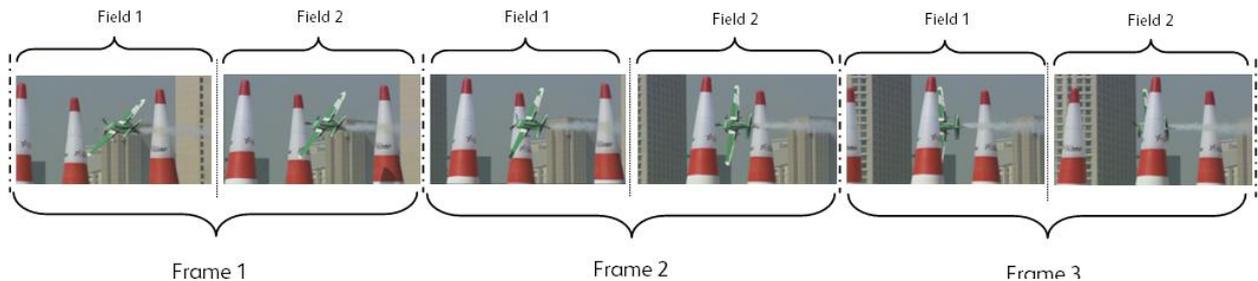
Note: each field in the sequence is unique. The scene updates every **field**.

3.3 psf / 2:2 Cadence

2:2 cadence may also be referred to as psf (progressive segmented frame). However, 2:2 can be associated with purely progressive content which case it is not PsF.

This cadence is usually produced when content has been derived from film stock. This is usually 24 fps but some modern film cameras can shoot true 30 fps. In the case of 24 fps film, a Telecine process is employed where each film frame is scanned into two video fields. It is important to consider that both these fields represent the same temporal event. The result, in the video domain, is 24 psf.

The following example depicts a video stream with a psf cadence:
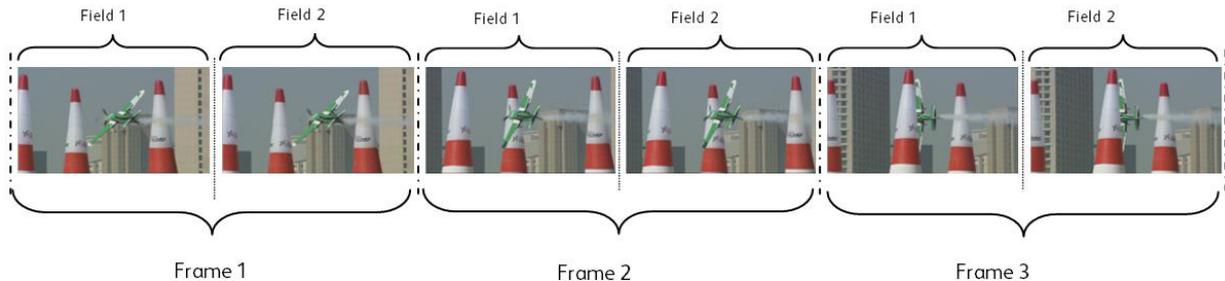
It can be seen that both fields within a video frame represents the same temporal event. The scene updates every **frame** (not every **field**). It would be true to state that the psf sequence has half the temporal resolution compared to an interlaced cadence of the same frame rate.

However, it should be appreciated that the structure of the video transport is identical to that of interlaced cadence of the same frame rate. As discussed, this makes it impossible to differentiate looking at the metadata alone. If we compare say 1080/25psf with 1080/50i, the two streams have the same transport structure (same number of lines, same frequency of fields and frames, etc).

The only way to tell them apart would be to analyse the cadence of the image content.

If in any doubt what the source cadence is, it is recommended that it is manually checked prior to conversion.

Remember it is undesirable to process 1080/25psf source content as 1080/50i and vice versa. In the case of standards conversion, an incorrect configuration can result in sub-optimal picture quality and introduce unwanted artefacts.

The same argument can be made when comparing 1080/59i with 1080/29psf, or 625/50i with 625/25psf, etc

Where an input file is encountered that demonstrates a psf cadence, the **Scan Type** control should be set to:

**Progressive/psf**

   Version Number: 3.3

3.4 2:3 Cadence

2:3 is a pull-down technique used by the Telecine process to convert Film from 24Hz to 59.94Hz videotape. The process is required to allow original film content to be viewed in a 59.94Hz broadcast environment.

For every 4 frames of film there are 5 frames of 59.94Hz video. The telecine alternately places 1 film frame across 2 fields, the next across 3, the next across 2 and so on.

The following diagram depicts the 2:3 pull-down sequences:
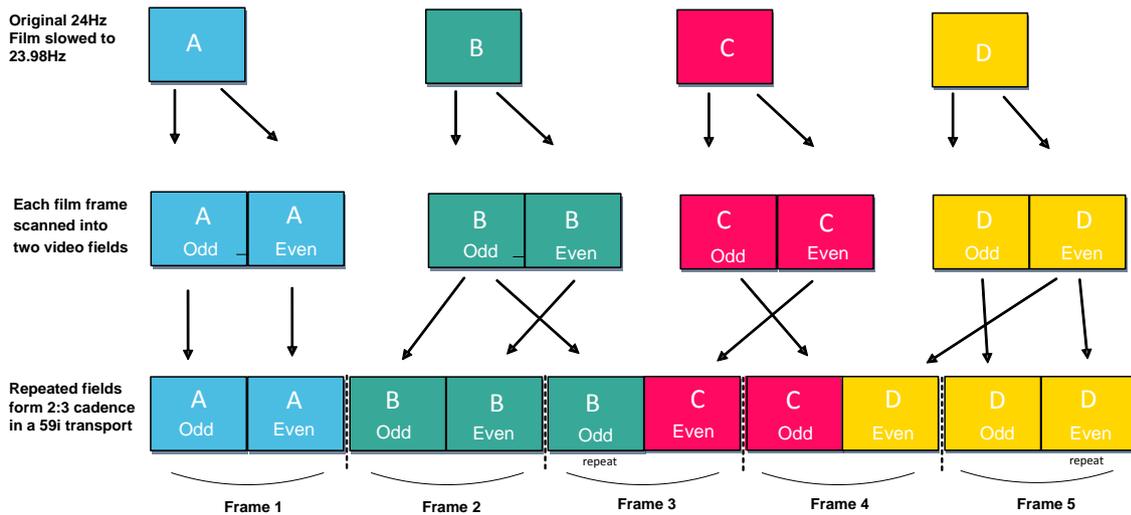
How 24Hz film frames are electronically scanned to create 59i with a 2:3 cadence

It should be understood that such a file is not psf. When converting such a file to another frame rate, it is important that the 2:3 cadence is considered. The Metadata should identify the scan type as interlaced. If this is the case, the **Scan Type** control can be left in **Auto.** If the metadata incorrectly identifies the file as progressive, the **Scan Type should** be forced to **Interlaced:**

To correctly process the file, the Cadence Detector feature should be used. Please refer to the **Alchemist XF User Guide** (section 4.3.3).

For more information regarding Cadence, please refer to the document **Alchemist XF Understanding Cadence**

Both documents are available from the Snell Advanced Media website

www.s-a-m.com

3.5 How to Check File Metadata?

Video files need to carry information that describes the parameters of the file. This information is called 'metadata'. Metadata includes information describing parameters such as:

- Video Standard

- Video Codec

- File Wrapper type

- Frame rate

- Bit-rate

- Video format

- Audio content

- Duration

- Active video lines

- Active pixel width

- Aspect ratio

xFile offers an integrated media view engine which can be used to interrogate the file metadata.
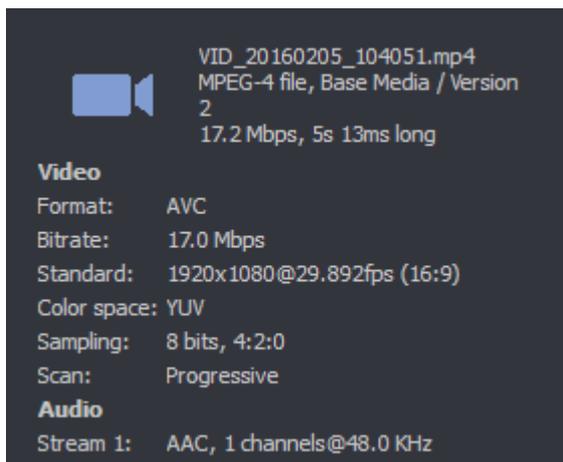
The metadata should be analysed to see whether the content is interlaced or progressive. If interlaced and there is a suspicion the source is film (psf/2:2) it is recommended the file video content is analysed as described in the next section (section 3.6).

For more details on how to access the metadata view feature, in xFile, refer to section 6.2 part 6 of the Alchemist XF User Guide.

3.6 Video Content Analysis

To analyse the video content of a file, we need to play the clip and view it. The easiest way to do this is to open the file using a PC application like VLC Player. Usually just playing the content will allow an experienced Operator to determine the cadence. Psf will appear 'juddery' particularly where fast motion is present. In contrast, interlaced video will look much smoother.

However, for the inexperienced Operator, or on content where it may not be obvious, a different approach can be used.

Play the content and at a point where the content is clearly moving, pause it. Now if we look closely at the frozen picture we should be able to determine whether the content is true interlaced video (1:1) or psf.

The following example shows a paused 1080 50i sequence. In this sequence the camera is panning left to right:

In this example, it can be clearly seen that the picture contains two separate fields that are slightly separated temporally. The vertical content of the two different fields does not line up precisely and so creates jagged edges. This is sometimes referred to as 'mouse-teething'. We can deduce from this that the content is interlaced video.

A similar phenomenon is seen if the video content is tilting vertically. The following example depicts a scene where the camera is tilting in an upward direction:

Again, it can be seen that the frozen frame contains two separate fields that are slightly separated temporally and we can again deduce that the content is interlaced video.

However, if we do a similar procedure with a 1080 25psf sequence, we will see a different result:

Unlike the video examples above, the two fields of a psf frame represent the same temporal event. In this case, the two fields line up precisely and we effectively view a progressive frame. Note the absence of 'mouse-teeth' in the frozen picture.

Note – it is important to appreciate that this analysis method can only be used when the application performs a 'frame freeze'. If the application performed a 'field freeze' both examples would look clean, however simply stepping forward a field at a time would show whether there is movement every field or every other field. If there is motion every field it is true interlaced 1:1. But if there is motion every other field, then the content is psf (2:2).

4. AVC Intra Codec Reader Issue

4.1 Compressing Interlace Content Description

The AVC Intra codec uses some unique compression techniques when compressing interlaced content. A coding technique called 'Macroblock adaptive frame field' (MBAFF) can be employed, or alternatively 'Picture adaptive frame field' (PAFF or PicAFF).

MBAFF is a technique where the picture is split up into 16x16 macroblocks. In simplistic terms, moving content within a block is processed as interlaced and non-moving content is processed as progressive.

PAFF is a similar technique to MBAFF, but in this system the picture isn't split up into macroblocks. In a PAFF system, if a frame contains moving content, the whole frame is processed as interlaced. Frames that contain no movement are processed as progressive.

These techniques enable AVC Intra to offer highly efficient compression performance.

4.2 Reader Issue

There is an issue if a Metadata reader is used to read the metadata of an AVC Intra file that was formed from an interlaced source. The scan-type will be flagged as either MBAFF or PAFF (or maybe PicAFF). Files are not tagged as **interlaced**.

AVC Intra files formed from progressive sources will be tagged as **progressive**.

Where files are encountered that are tagged MBAFF or PAFF, they can be treated as interlaced and the same considerations as explained above will apply.