AMIA 2024
Milwaukee

Thursday, December 5th
4:30 - 5:30 P.M.

Regency D

O.A.R.

To Be Different

Demystifying Aspect Ratio and Forming a Community Consensus

Morgan Oscar Morel

Video Lab Supervisor

Library of Congress

Dave Rice

Archivist

CUNY TV

PRESENTATION OVERVIEW

- What do DAR, PAR, and SAR mean?
- How do these concepts work in practice?
- How do digitization tools implement these concepts?
- Can archivists come up with our own best practices?

ASPECT RATIO BASICS

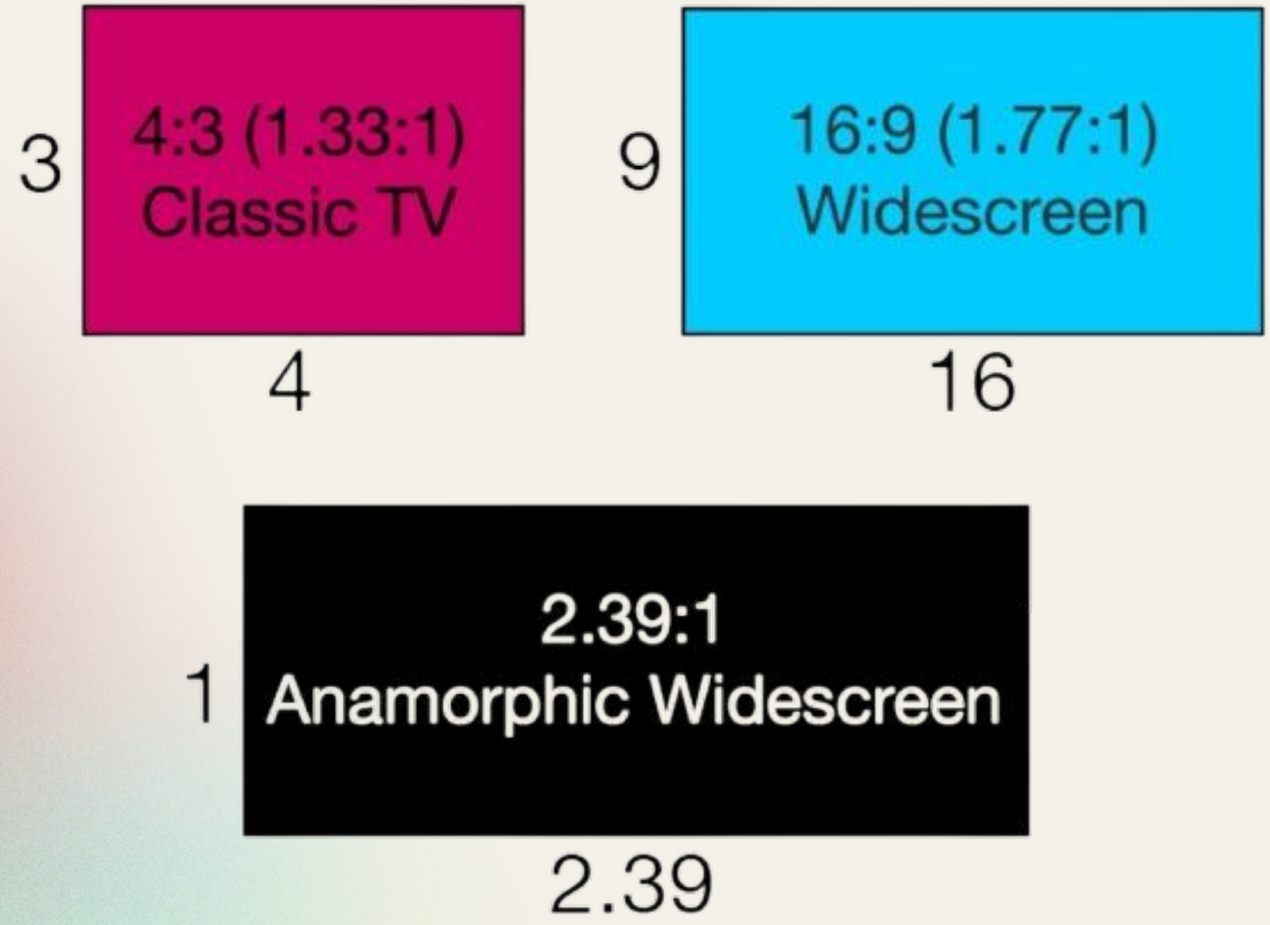
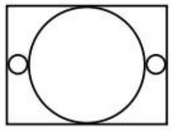
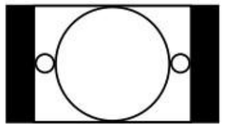
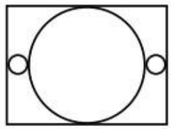
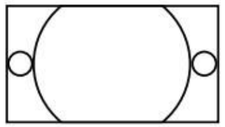
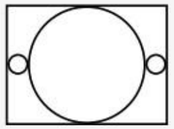
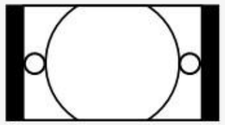
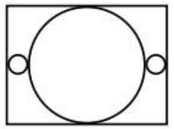
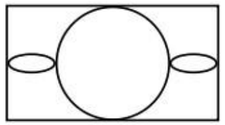
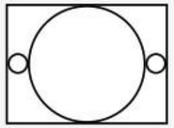
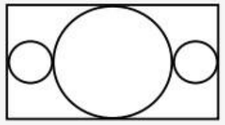


Image Courtesy of Vimeo

ASPECT RATIO BASICS

Up Conversion	Input 4:3	Output 16:9	
PBOX Pillarbox			Displays a 4:3 SD image inside an HD 16:9 frame. Black bars feature on the sides.
ZOOM			Zooms into an SD 4:3 image until it completely fills the HD 16:9 frame. A portion of the top and bottom is lost.
14:9			A compromise between Pillarbox and Zoom. Minimal black bars with a slight crop on the top and bottom.
SMART			Incrementally stretches the sides to fit 16:9 without distorting the main action of the 4:3 image.
ANAM Anamorphic			Horizontally stretches the 4:3 SD image into a 16:9 HD frame.

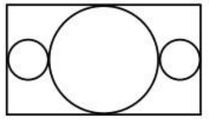
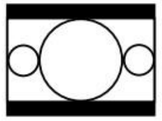
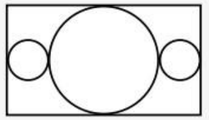
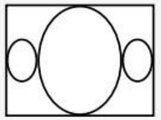
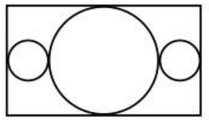
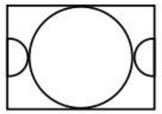
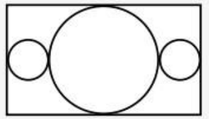
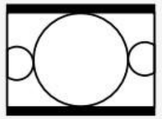
Down Conversion	Input 16:9	Output 4:3	
LBOX Letterbox			Scales the entire 16:9 HD image into a 4:3 SD frame leaving black bars on the top and bottom.
ANAM Anamorphic			Horizontally squeezes the 16:9 HD image into a 4:3 SD frame.
CCUT Center Cut			Cuts a 4:3 SD frame from the 16:9 HD image.
14:9			A compromise between Letterbox and Center Cut. Minimal black bars with a slight edge crop.

Image from BlackMagic Teranex Manual

From FADGI'S

Significant Properties for Digital Video

Display Aspect Ratio (DAR)

DAR is the ratio between the width and height of the frame at the time of playback. DAR is a metadata field present in most audiovisual containers (though absent in some, including AVI) that is used by playback software and platforms to properly render the width and height of the frame proportionally so that the image is not stretched or narrowed.

Pixel Aspect Ratio (PAR)

PAR is the ratio between the width and the height of each individual pixel that makes up a video frame. Pixels within a frame are all of a uniform size, and while they may be square, they often are not. If the pixels are square, the PAR value is 1:1 or 1, since the width and the height of the pixels are equal to one another.

Storage Aspect Ratio (SAR)

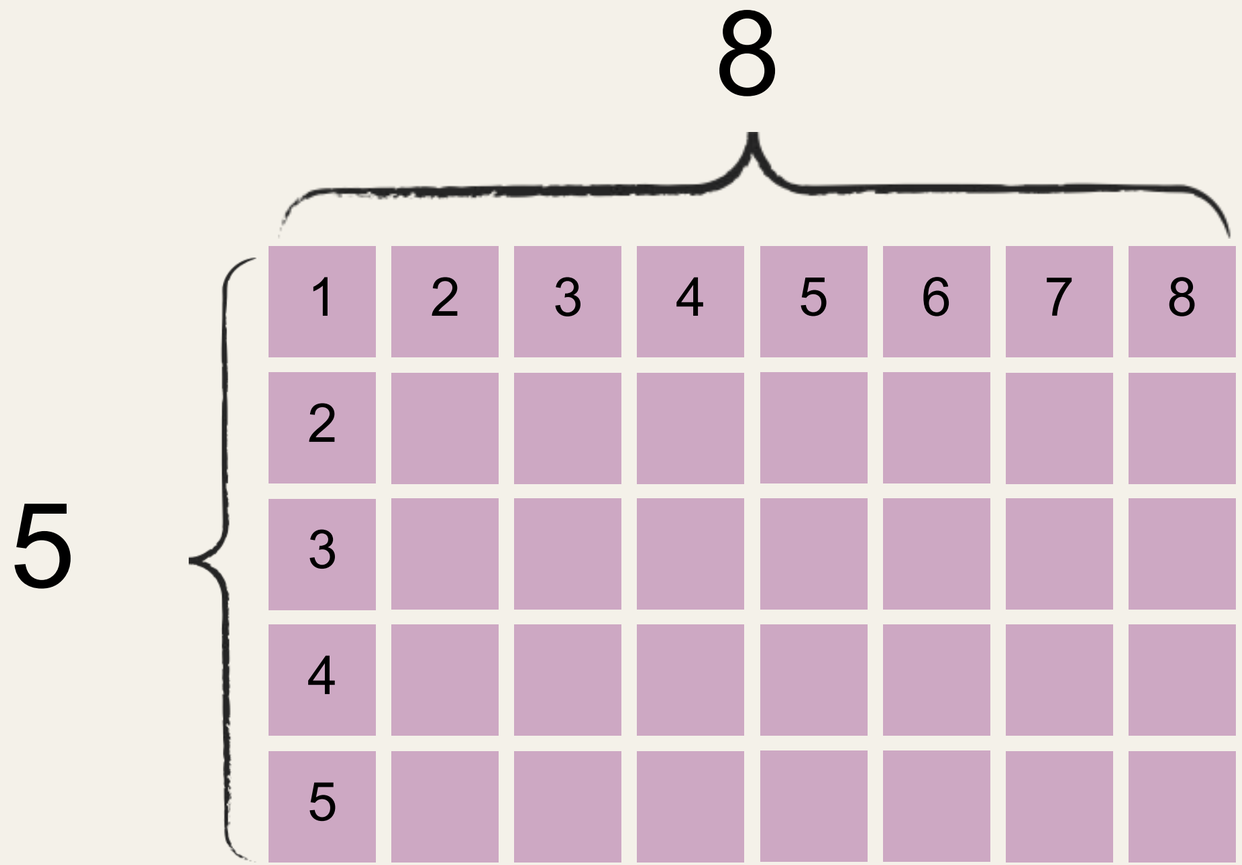
SAR is the width and height of a video frame expressed as a ratio. For example, a video frame with a width of 720 pixels and height of 480 pixels (720x480) would have a SAR of 3:2.

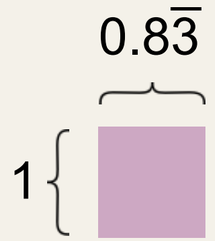
https://www.digitizationguidelines.gov/guidelines/sigpropvideo.html

ONE QUICK CLARIFICATION

FFmpeg uses “Sample Aspect Ratio” in place of “Pixel Aspect Ratio”. Thus, FFmpeg uses SAR to refer to what most people call PAR.

PAR / DAR / SAR VISUALIZED





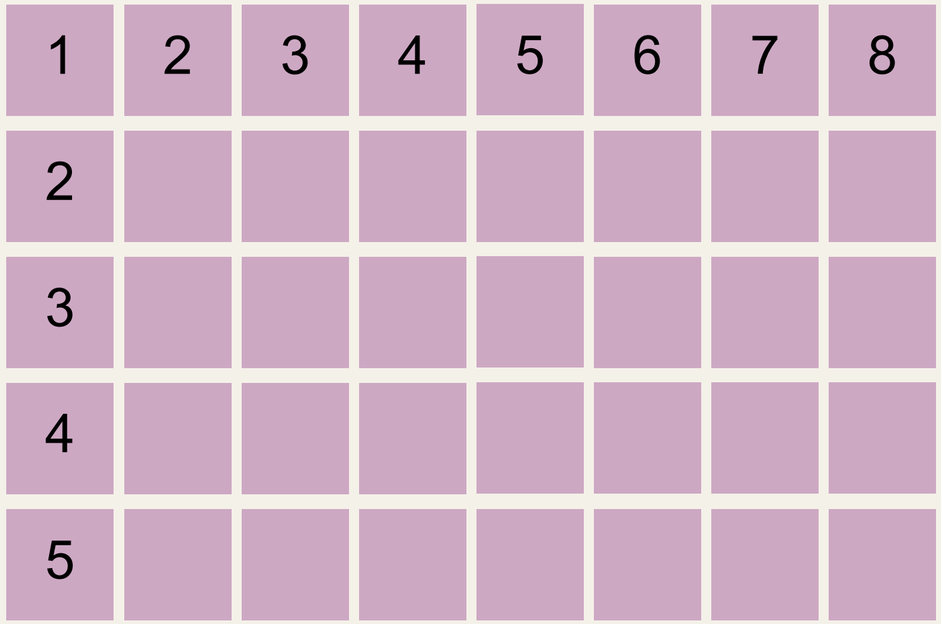
PAR = 0.8$\overline{3}$ / 1
or 5:6

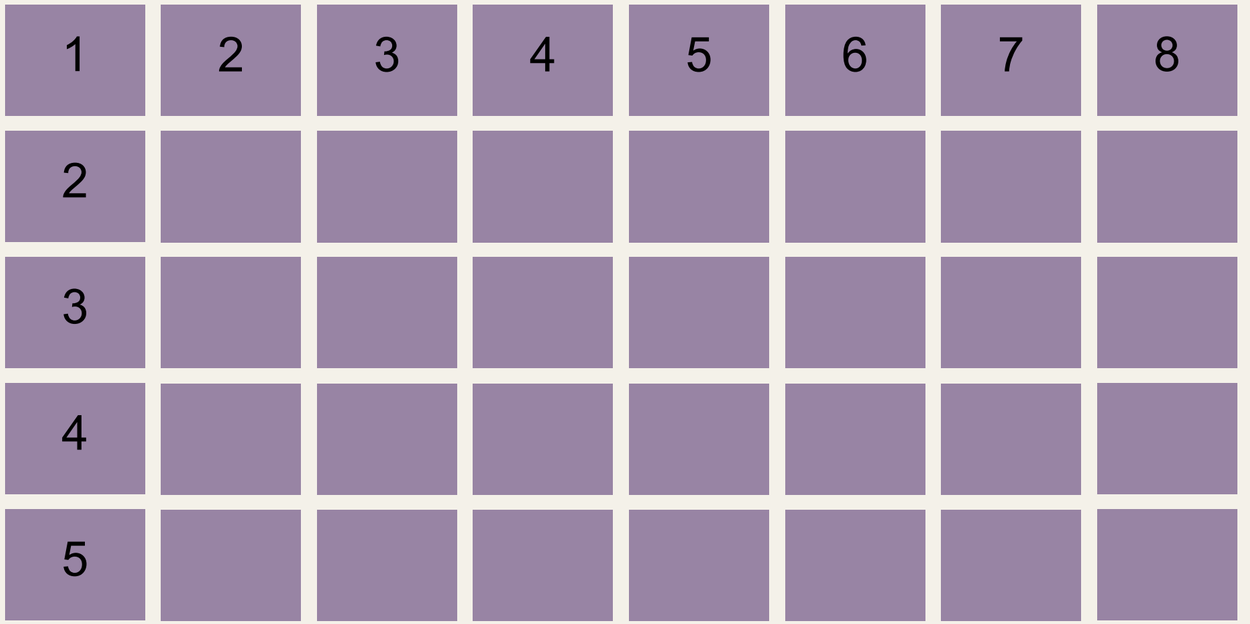
SAR = 8:5

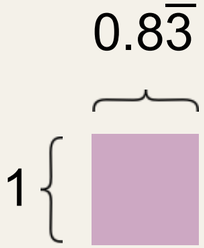
PAR x SAR = DAR

$$\frac{5}{6} \times \frac{8}{5} = \frac{4}{3}$$

PAR / DAR / SAR VISUALIZED







SAR = 8:5

PAR = 5:6

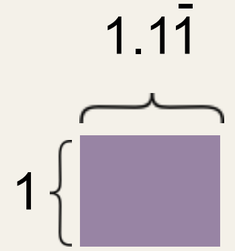
DAR = 4:3

SAR × PAR = DAR

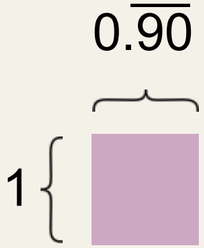
SAR = 8:5

PAR = 10:9

DAR = 16:9



PAR / DAR / SAR VISUALIZED



SAR = 720:486

PAR = 10:11

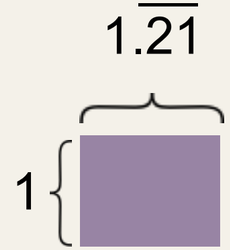
DAR = 4:3

SAR × PAR = DAR

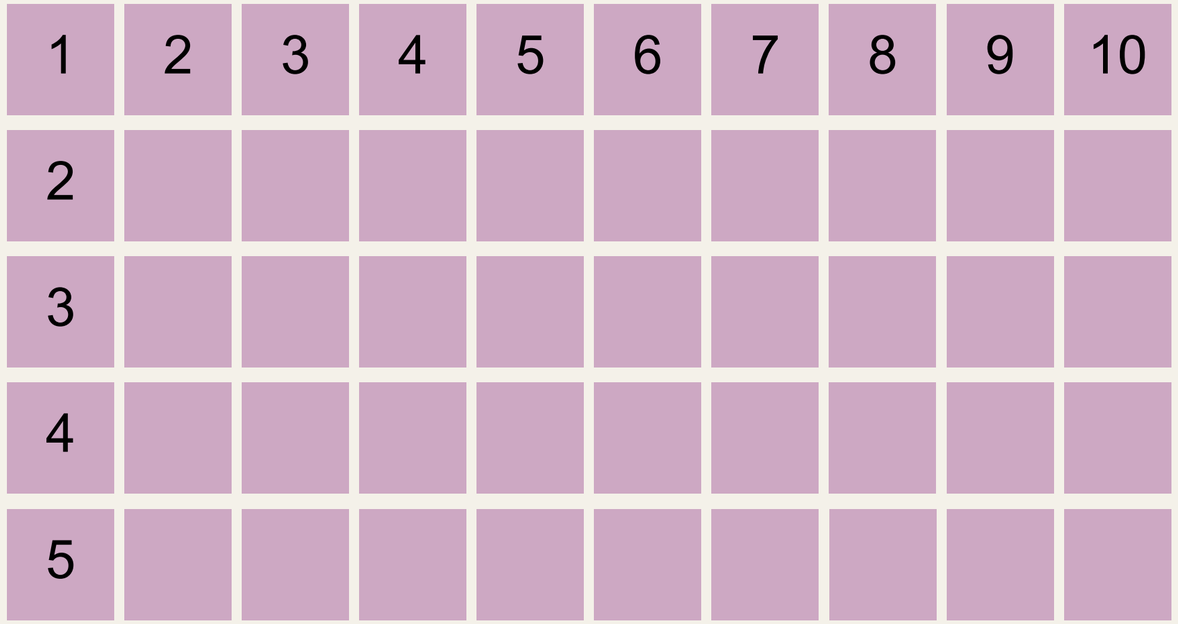
SAR = 720:486

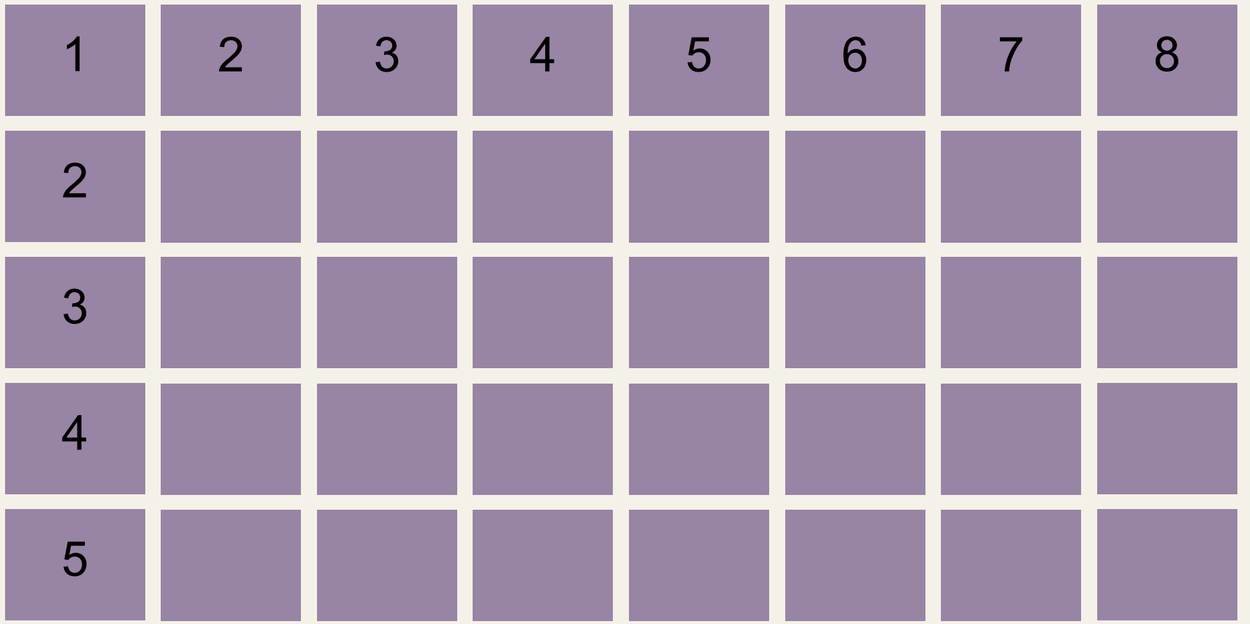
PAR = 40:33

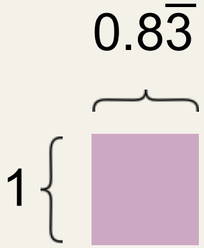
DAR = 16:9



PAR / DAR / SAR VISUALIZED







SAR = 10:5

PAR = 5:6

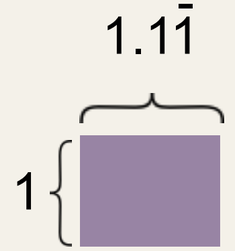
DAR = 16:9

SAR × PAR = DAR

SAR = 8:5

PAR = 10:9

DAR = 16:9



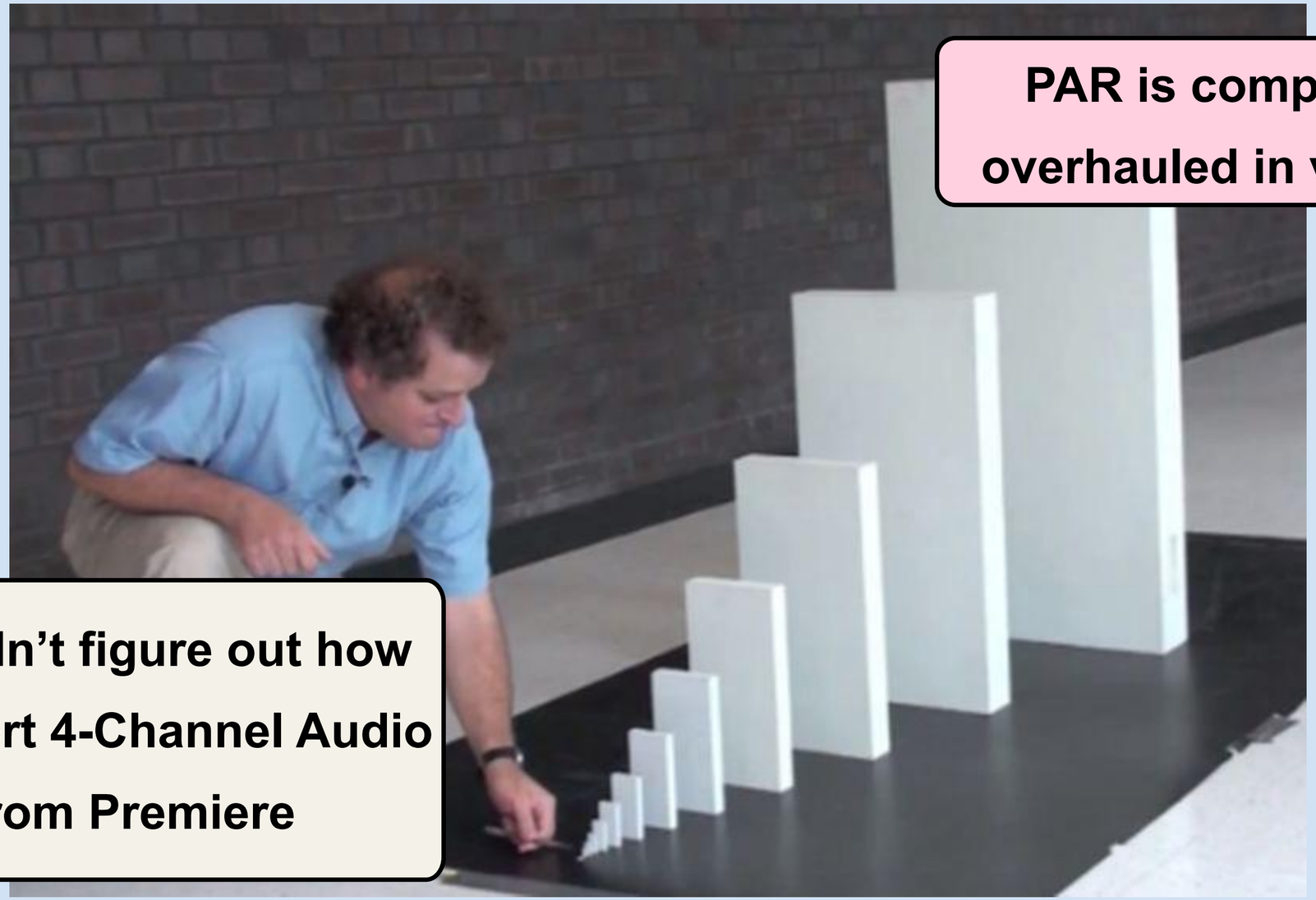
CRITICAL TAKEAWAYS

SAR x PAR = DAR

DAR, SAR, and PAR are technical metadata fields within a file

The Storage Aspect Ratio (SAR) of a file cannot be changed

Pixel Aspect Ratio (PAR) can be adjusted to get your desired Display Aspect Ratio (DAR)



PAR is completely overhauled in vrecord

I couldn’t figure out how to export 4-Channel Audio from Premiere

OFFLINE

Unable to export interlaced NTSC from Resolve

Morgan Morel

Posts: **12**
Joined: **Tue Aug 29, 2017 9:41 pm**
Location: **Culpeper, VA**

Mon Sep 13, 2021 10:17 pm

Hello,

At the moment it is impossible to export interlaced NTSC 29.97 files to MOV from Resolve. This feature would be incredibly useful for archival workflows, where we wish to preserve the interlaced nature of files captured from analog video tapes. Thank you!

👌👌👌

A short and simple request

THE CONVERSATION STARTED TO DRIFT

Why don’t you just use ProRes?

Why are you working with SD?

vrecord files have funky aspect ratio metadata?

OFFLINE

Re: Unable to export interlaced NTSC from Resolve

Andrew Kolakowski

Posts: **9283**
Joined: **Tue Sep 11, 2012 10:20 am**
Location: **Poland**

Thu Sep 16, 2021 9:45 am

I just realised that 40/27 is a NTSC frame aspect ratio (720/486).
Problem is that this **is not what you should use in MOV headers**.
MOV headers need pixel aspect ratio (PAR) which later is applied on top of frame aspect to give final display aspect.
For NTSC 4/3 PAR is either:
10/11 for case when you have active picture using 704 lines (you should see few black pixels on the sides).
8/9 if you treat whole 720 lines as active picture

If you use D1 as source then you use 10/11 and also add 8 pixels sides crop flag for clean aperture.
When you open such a file in QT7 then it will properly crop sides and display image at final aspect of:
704/480x10/11=1.33(3)

OFFLINE

Re: Unable to export interlaced NTSC from Resolve

Andrew Kolakowski

Posts: **9283**
Joined: **Tue Sep 11, 2012 10:20 am**
Location: **Poland**

Mon Sep 20, 2021 8:14 pm

Premiere uses "analog" flagging with 704 active lines and 10/11 PAR. There is no way to change it.
Resolve flagging is messed up (unless fixed).

Even if you use 486 then you should not change PARs as those 6 lines should be "forgotten".
As far as I know there were never introduced separate PARs for 486 lines in any specs.
Your value of 9/10 is made up and doesn't really exist.

Andrew then figured out there is indeed an issue

iamdamosuzuki commented on Sep 20, 2021 • edited ▾ Member ···

Hi, I recently had a convo with somebody on the Black Magic forums about the DAR/PAR/SAR of our files. The dude was a bit curt, but his concern seems to be that we're not using the correct values for these. You can see the post here.

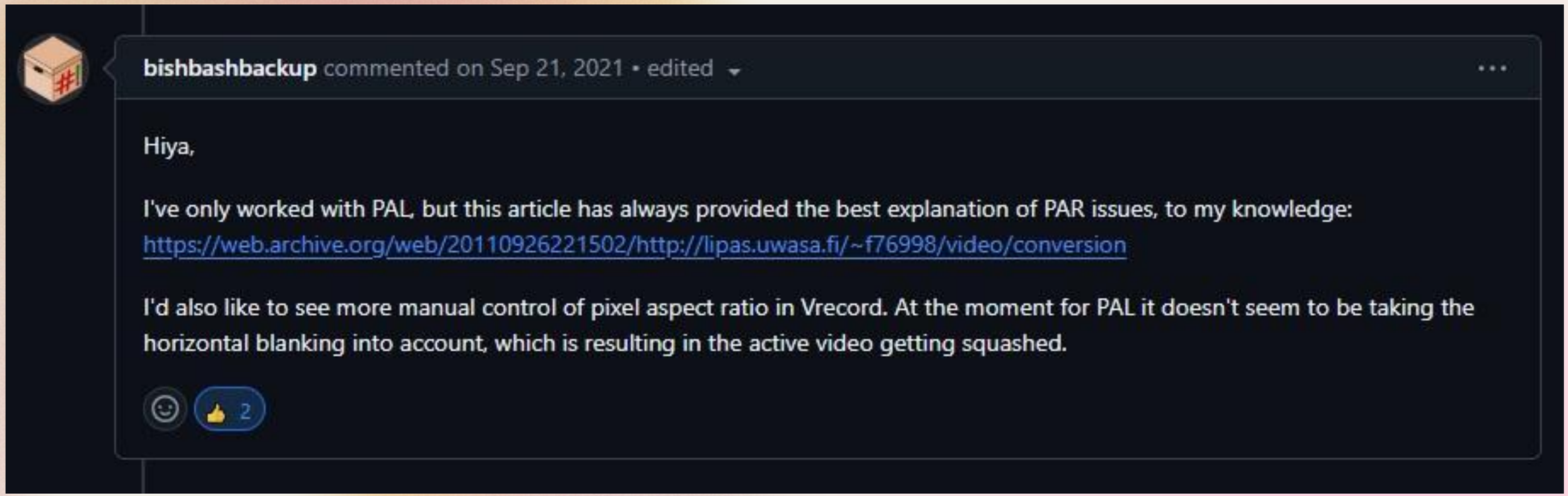
Just to be clear, I'm using PAR to refer to PIxel Aspect Ratio, where a value of 1 would be square pixels. I know that FFmpeg uses SAR (sample aspect ratio) to refer to what others generally called PAR (pixel aspect ratio), but in this post i'm saying PAR is pixel aspect ratio and SAR is (storage aspect ratio)

The argument is that in D1 video files should have the following attributes:

Frame Size: 720x486 / SAR: 720/486
Clean aperture (active video): 704x486
DAR: 4:3
PAR: 10/11

This is what vrecord uses:
Frame Size: 720x486
Clean aperture (active video): 720x486
DAR: 4:3
PAR: 9/10

My understanding is that what we're doing is correct because we got a 4:3 DAR, and we have the entire frame as active video since we don't want to crop and potential content and can't control the size of the frame that's coming in from the tapes. Is this correct? Should we have an option to capture the other way?



Alex Habgood to the rescue

1. Introduction

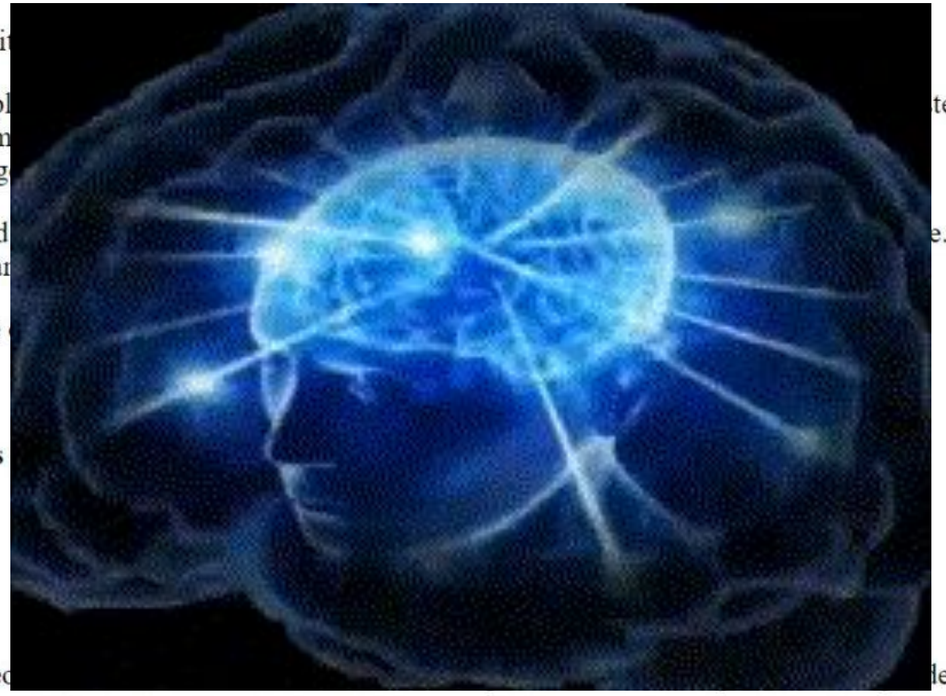
There is a fair number of mind-blowing, scary oddities and secrets in the world of digital video.

One of the very first a beginner will usually encounter is the fact that in digitized video data, pixels are often *not* considered "square" in their form. In most real-world digital video applications pixels have a width/height ratio – or *aspect ratio*, as it is more conveniently called – that can be something completely different from 1/1!

The second great revelation usually comes when one runs into the concept of anamorphic 16:9 video for the very first time. If it was initially hard to grasp the idea of pixels changing their shape when displayed in different environments, this one is even more baffling: the very same pixel resolution you have only just learned to associate with 4:3 displays can now suddenly represent another, totally different image geometry. In other words, the pixels have changed their shape again!

Unfortunately, these two are often the *only* things most ordinary people will ever learn about digital video and aspect ratios.

1.1 The dirty little secret revealed



Tutorials and manuals usually tend to keep very quiet and secretive about the finer technical details of digital video, particularly when i

Even if converting (resampling) video clips to other resolutions *is* discussed, the accompanying explanation is usually troublingly simpl ted methods are just plain wrong. It is not uncommon that the examples only deal with arbitrarily chosen ("x pixels by y pixels") frame dim calculations – not the actual *pixel* aspect ratios – which is usually a good indicator that the writer may not actually take the real image g

It is almost as if the whole aspect ratio issue was considered some sort of dirty little secret of the video industry; black magic you could e. In this case, there is really more to it than meets the eye. Confusing people with incomplete and watered-down explanations does not do a

Now that you have read this far, it is time to reward your effort with The Third Big Revelation about aspect ratios and frame sizes - the

***Not a single one* of the commonly used digital video resolutions *exactly* represents the actual 4:3 or 16:9 image frame.**

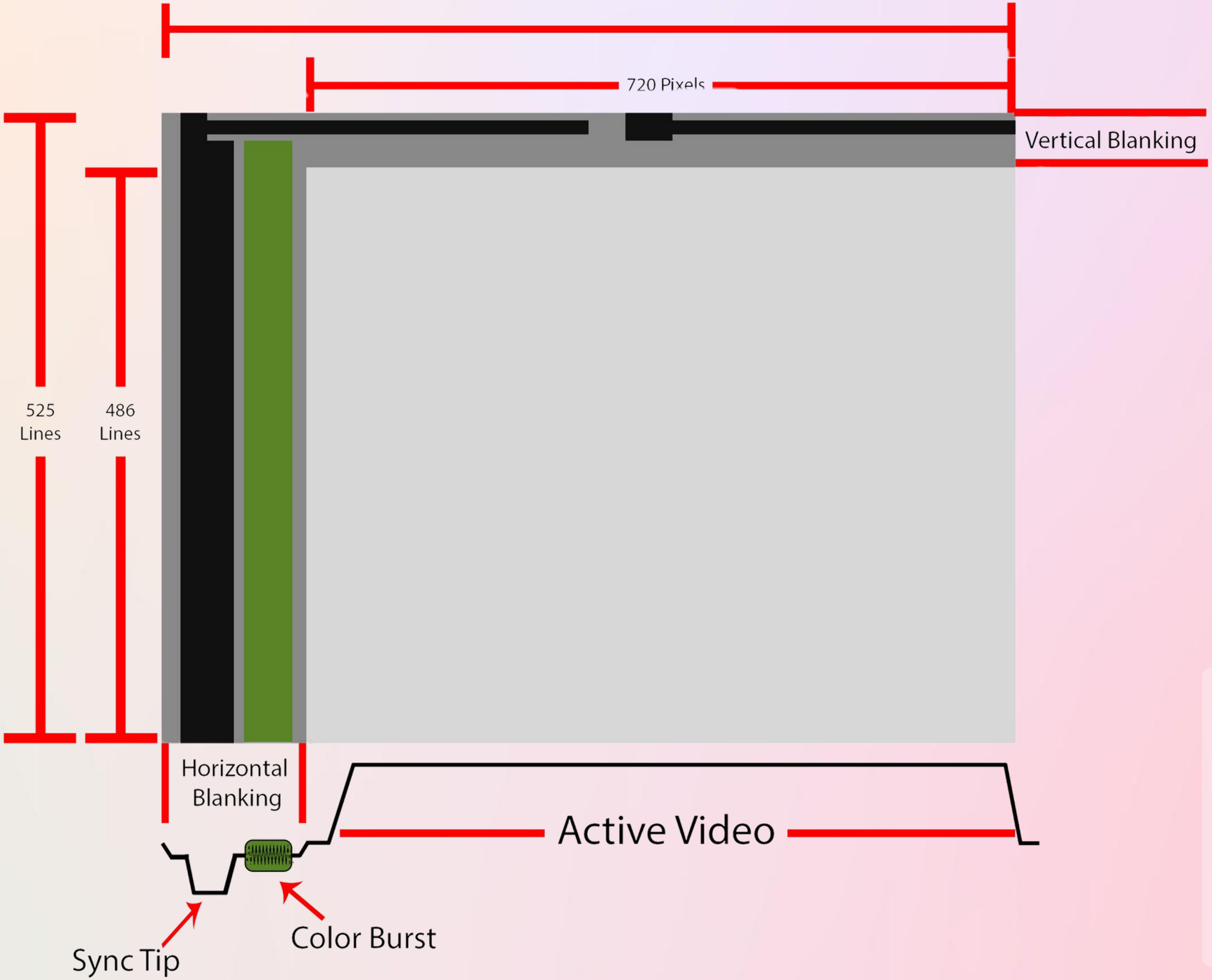
Shocking, isn't it? 768×576, 720×576, 704×576, 720×480, 704×480, 640×480... *none* of them is *exactly* 4:3 or 16:9; **not even the ones**

So there. Now you finally know the truth. Let's find out what it actually means.

2. The Connection Between the Analog and the Digital

Digital video standards do not live outside the realm of analog world. On the contrary, all commonly used modern (SDTV) digital vide leo standards. You could really say they have their *roots* in analog soil.

And now, my friend, we are rapidly closing to The Fourth Big Revelation:



HOW DIGITIZATION WORKS

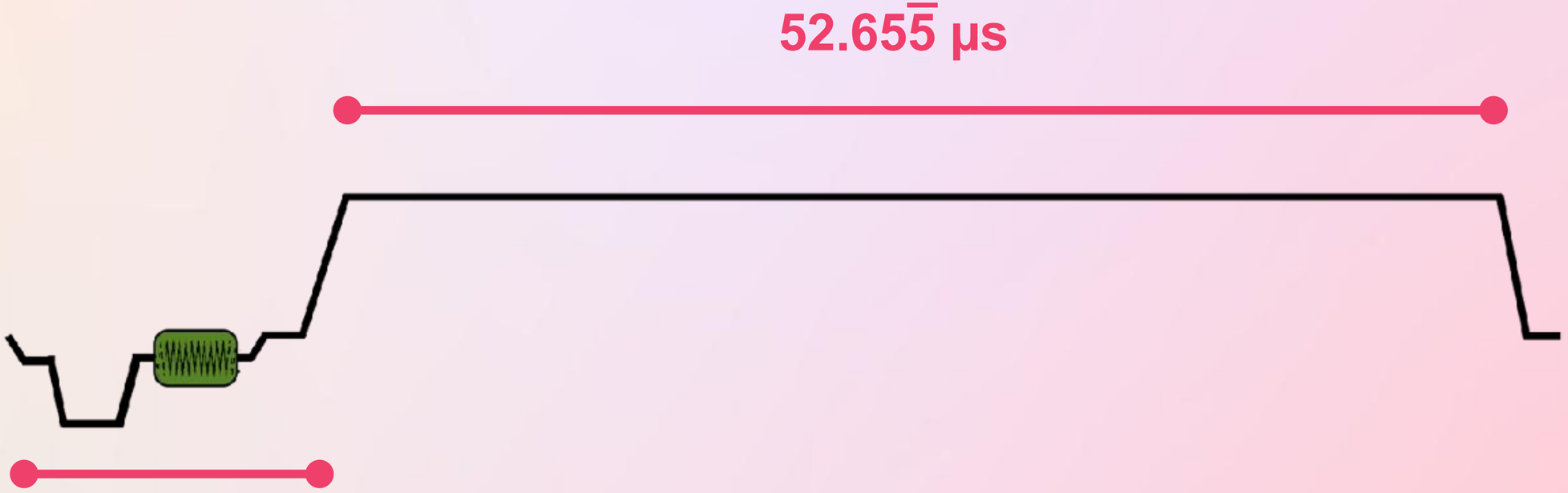
63.5$\overline{5}$ µs

29.97003 fps x 525 lines per frame

$\frac{30000}{1000} \times 525 = 15734.2657$ **lines per second**

$\frac{1}{15734.2657} = 63 + \frac{5}{9}$ **microseconds per line**

HOW DIGITIZATION WORKS

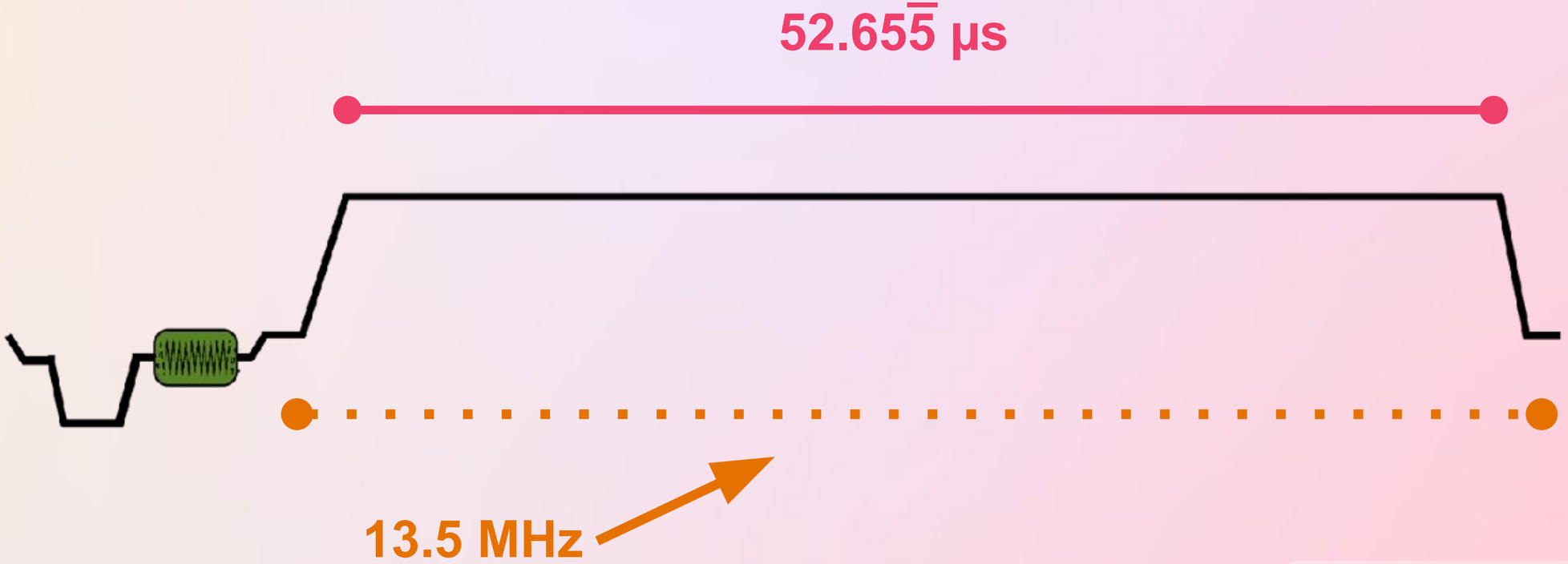


Horizontal Blanking Area is 10.9

Active video is only 52.655 µs

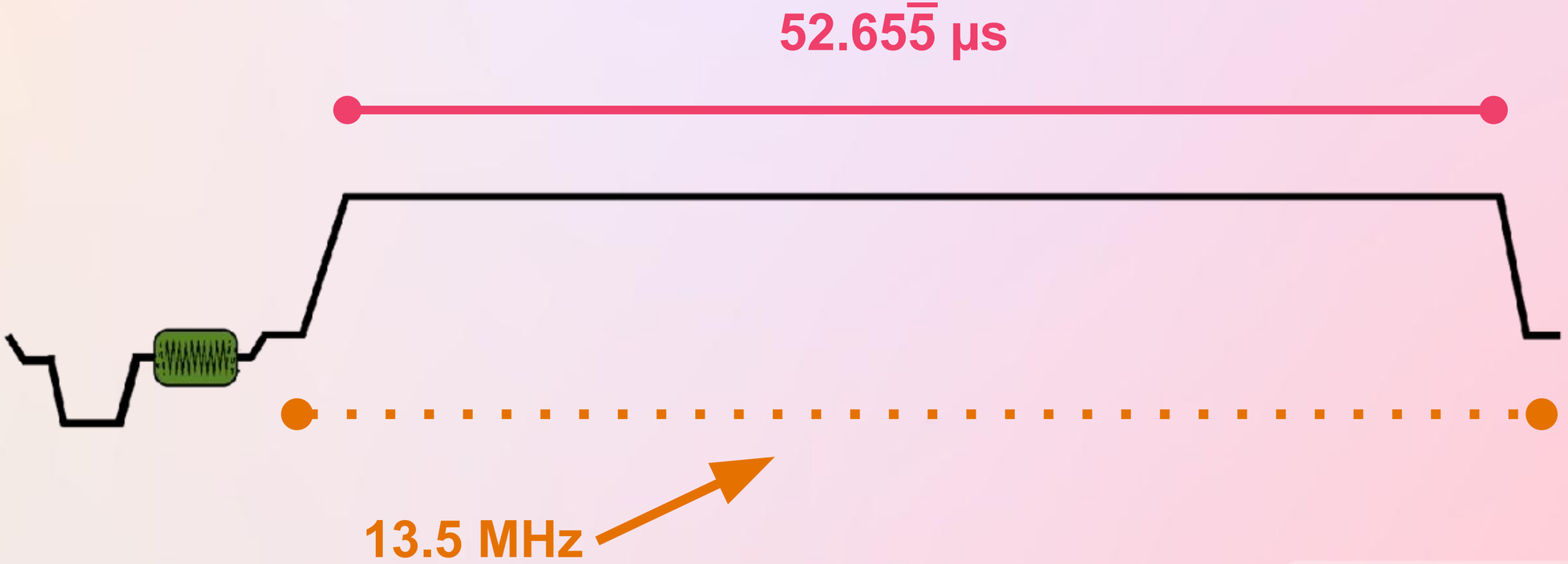
(63.555µs - 10.9µs = 52.655µs

HOW DIGITIZATION WORKS



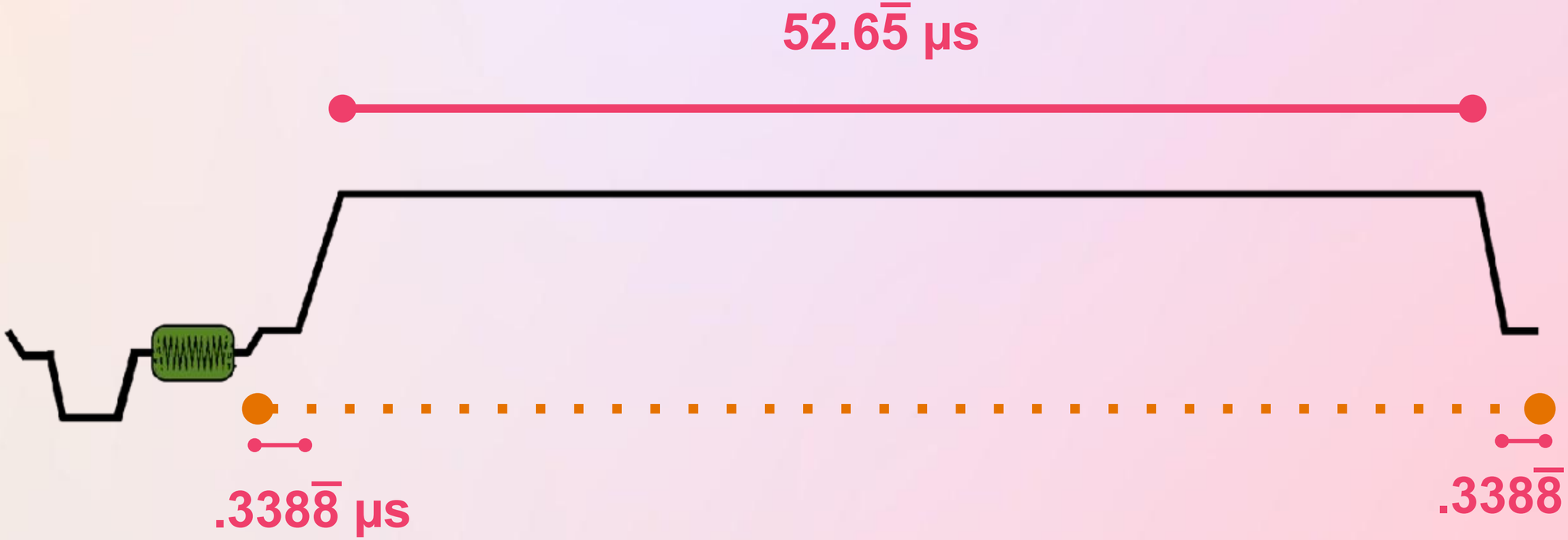
13.5 MHz decided by ITU-R BT.601

HOW DIGITIZATION WORKS



$$\frac{.0000526555}{\left(\frac{1}{(13{,}500{,}000)}\right)}$$ *or* **52.655̄ x 13.5 = 710.85**

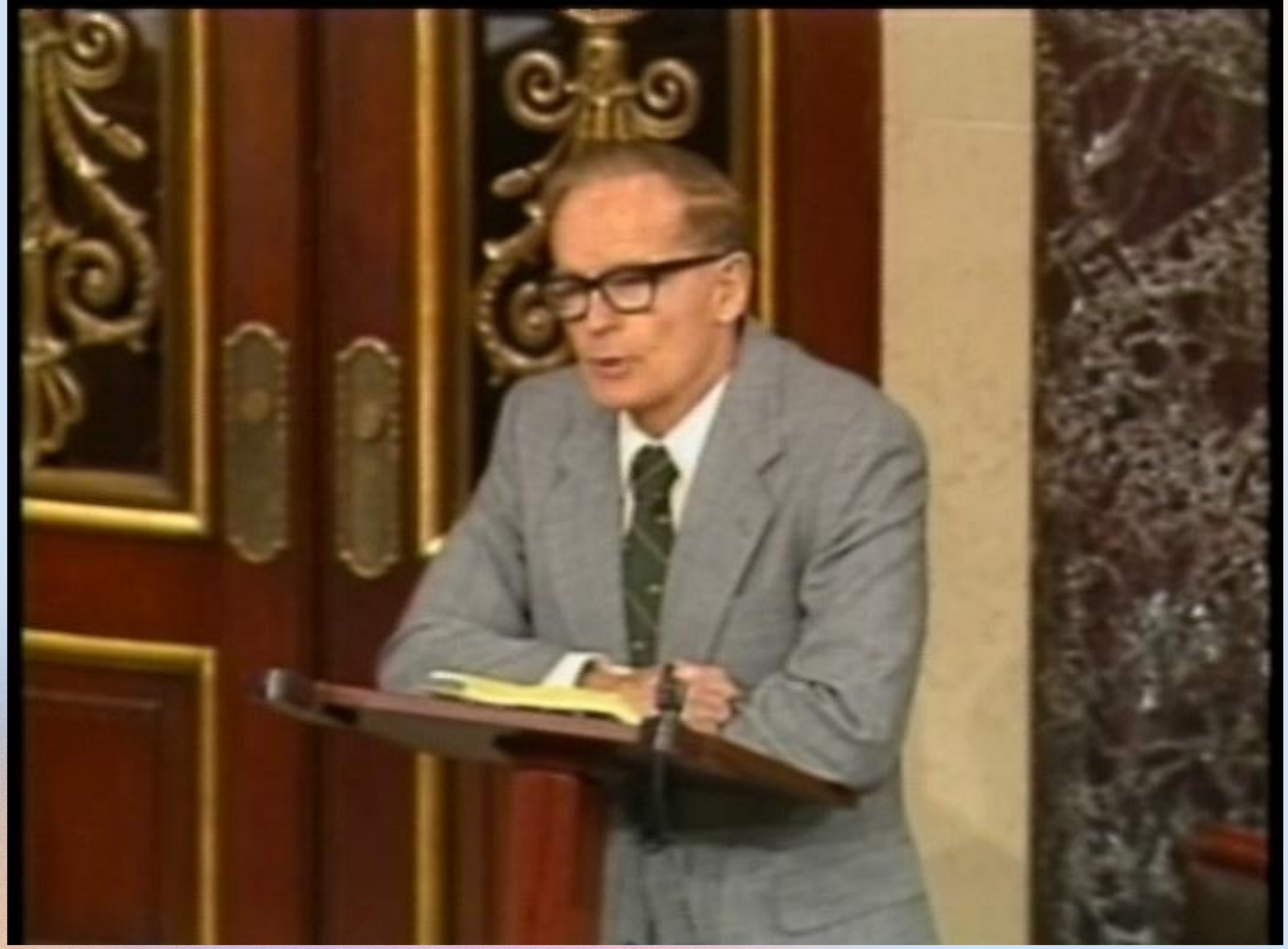
HOW DIGITIZATION WORKS



$$52.65 + .338\overline{8} + .338\overline{8} = 53.3\overline{3}$$

$$53.3\overline{3} \times 13.5 = 720$$

HOW DIGITIZATION WORKS



The formats related to 525-line systems with a 59.94[1] Hz field rate								
sampling matrix		sampling rate (MHz)	pixel aspect ratio (x/y)	sampling matrix width in µs	actual active picture size		supports interlacing	notes
width	height				width	height		
720	540	ambiguous	1/1	ambiguous	720	540	N	Oddball compromise format. Better to avoid unless you really know what you are doing.
720	486	13.5	4320/4739	53.33333	710.85	486	Y	D1
720	480	13.5	4320/4739	53.33333	710.85	486	Y	DV, DVB, DVD, SVCD[3]
711	486	13.5	4320/4739	52.66667	710.85	486	Y	Active picture frame for 525/59.94 systems in ITU-R BT.601-4 pixels.
704	486	13.5	4320/4739	52.14815	710.85	486	Y	
704	480	13.5	4320/4739	52.14815	710.85	486	Y	ATSC, DVD, VCD[3]
648	486	12 + 1452/4739[2]	1/1	52.65556	648	486	Y	"True" computer square-pixel resolution (all 486 active scanlines)
640	480	12 + 3/11	4752/4739	52.14815	646+5/22	486	Y	D2: "industry standard" 525/59.94 square-pixel video
640	480	12 + 1452/4739[2]	1/1	52.00549	648	486	Y	"True" computer square-pixel format (cropped)
480	480	9	6480/4739	53.33333	473.9	486	Y	SVCD (2/3 of BT.601 sampling rate)
352	480	6.75	8640/4739	52.14815	355.425	486	Y	DVD
352	240	6.75	4320/4739	52.14815	355.425	243	N	VCD, DVD
320	240	6 + 3/22	4572/4739	52.14815	324	243	N	1/4 of 640×480

[1] 59.94 Hz is only a conventional approximation; the mathematically exact field rate is 60 Hz * 1000/1001.
[2] A calculated sampling rate, represented here only for completeness. Does not exist in actual 525/625 video equipment.
[3] Only used for still images.

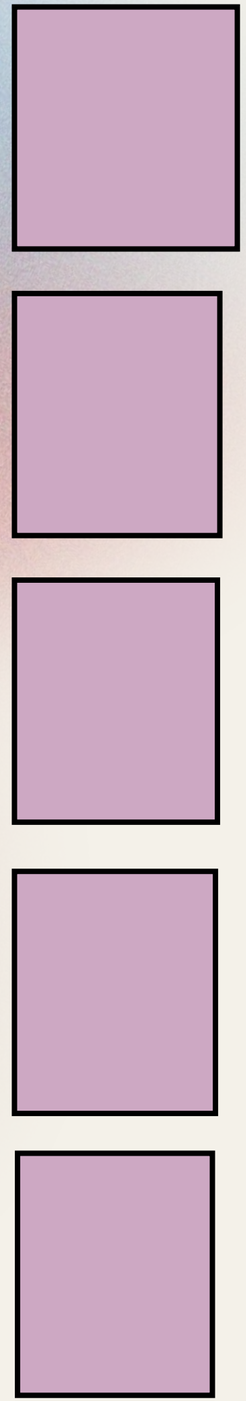
The formats related to 525-line systems with a 59.94[1] Hz field rate								
sampling matrix		sampling rate (MHz)	pixel aspect ratio (x/y)	sampling matrix width in µs	actual active picture size		supports interlacing	notes
width	height				width	height		
720	540	ambiguous	1/1	ambiguous	720	540	N	Oddball compromise format. Better to avoid unless you really know what you are doing.
720	486	13.5	4320/4739	53.33333	710.85	486	Y	D1
720	480	13.5	4320/4739	53.33333	710.85	486	Y	DV, DVB, DVD, SVCD[3]
711	486	13.5	4320/4739	52.66667	710.85	486	Y	Active picture frame for 525/59.94 systems in ITU-R BT.601-4 pixels.
704	486	13.5	4320/4739	52.14815	710.85	486	Y	
704	480	13.5	4320/4739	52.14815	710.85	486	Y	ATSC, DVD, VCD[3]
648	486	12 + 1452/4739[2]	1/1	52.65556	648	486	Y	"True" computer square-pixel resolution
640	480	12 + 3/11	4752/4739	52.14815	646+5/22	486	Y	
640	480	12 + 1452/4739[2]	1/1	52.00549	648	486	Y	
480	480	9	6480/4739	53.33333	473.9	486	Y	
352	480	6.75	8640/4739	52.14815	355.425	486	Y	DVD
352	240	6.75	4320/4739	52.14815	355.425	243	N	VCD, DVD
320	240	6 + 3/22	4572/4739	52.14815	324	243	N	1/4 of 640×480

[1] 59.94 Hz is only a conventional approximation; the mathematically exact field rate is 60 Hz * 1000/1001.
[2] A calculated sampling rate, represented here only for completeness. Does not exist in actual 525/625 video equipment.
[3] Only used for still images.

D1 standardized as part of ITU-R BT.601

Prove it With Math

SAR	x	PAR	=	DAR
$\frac{710.85}{486}$	x	$\frac{4320}{4739}$	=	$\frac{4}{3}$
$\frac{720}{486}$	x	$\frac{4320}{4739}$	=	1.35049589



PAR = 1/1 → OpenCube

PAR = 4320/4739 → True D1

PAR = 10/11 → new vrecord, Black Magic, Premiere

PAR = 9/10 → old vrecord, old SAMMA Solo

PAR = 8/9 → DV, DVCAM, DVCPRO, DVD

NTSC Video

More Math

SAR	x	PAR	=	DAR
$\frac{710.85}{486}$	x	$\frac{9}{10}$	=	1.31638889
$\frac{720}{486}$	x	$\frac{9}{10}$	=	$\frac{4}{3}$

PAR of 9/10 makes the entire 720 frame have a DAR of 4/3, but we know this isn't actually correct!

This is how the SAMMA did it, which we now know is wrong

More Math

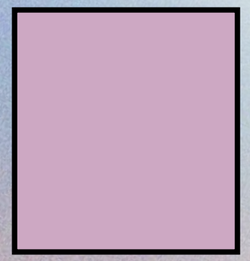
SAR	x	PAR	=	DAR
$\frac{710.85}{486}$	x	$\frac{10}{11}$	=	1.32968575
$\frac{720}{486}$	x	$\frac{10}{11}$	=	1.34680135

PAR of 10/11 makes the 710.85 frame with video have a DAR of very nearly 4/3 (off by 0.003)

More Math

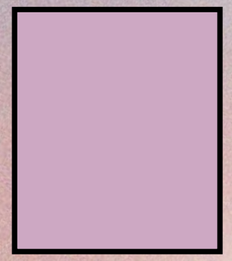
SAR	x	PAR	=	DAR
$\frac{710.85}{486}$	x	$\frac{8}{9}$	=	1.30013717
$\frac{720}{480}$	x	$\frac{8}{9}$	=	$\frac{4}{3}$

8/9 is for DV, which has no blanking on the side and 6 fewer horizontal lines. Thus the full 720x480 frame is 4:3



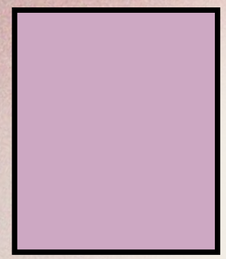
PAR = 1/1

Makes very wide files



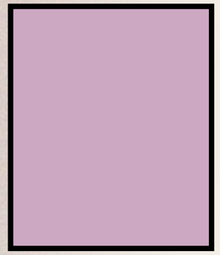
PAR = 4320/4739 → True D1

Technical correct but nobody uses it



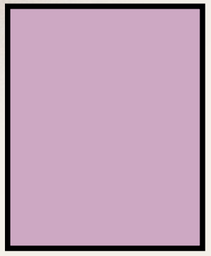
PAR = 10/11 → new vrecord, Black Magic, Premiere

Most commonly used in commercial software



PAR = 9/10 → old vrecord, old SAMMA Solo

This shouldn’t be used!



PAR = 8/9 → DV, DVCAM, DVCPRO, DVD

Used only for 720x480 digital video

Forming a Community Consensus

Storage Aspect Ratio and Display Aspect Ratio are just metadata fields

Changing these fields doesn’t affect the preservation of the content

How do we form a community consensus about these fields?

"..." -- Skip Elsheimer, 2024-12-05

Pixel Aspect Ratio
Crop Aspect Ratio
Video Aspect Ratio
Image Aspect Ratio
Frame Aspect Ratio
Native Aspect Ratio
Picture Aspect Ratio
Display Aspect Ratio
Sample Aspect Ratio
Storage Aspect Ratio
Viewing Aspect Ratio
Encoded Aspect Ratio
Projection Aspect Ratio

Pixel Aspect Ratio
Crop Aspect Ratio
Video Aspect Ratio
Image Aspect Ratio
Frame Aspect Ratio
Native Aspect Ratio
Picture Aspect Ratio
Display Aspect Ratio
Sample Aspect Ratio
Storage Aspect Ratio
Viewing Aspect Ratio
Encoded Aspect Ratio
Projection Aspect Ratio

Pixel Aspect Ratio

Crop Aspect Ratio

Video Aspect Ratio

Image Aspect Ratio

Frame Aspect Ratio

Native Aspect Ratio

Picture Aspect Ratio

Display Aspect Ratio

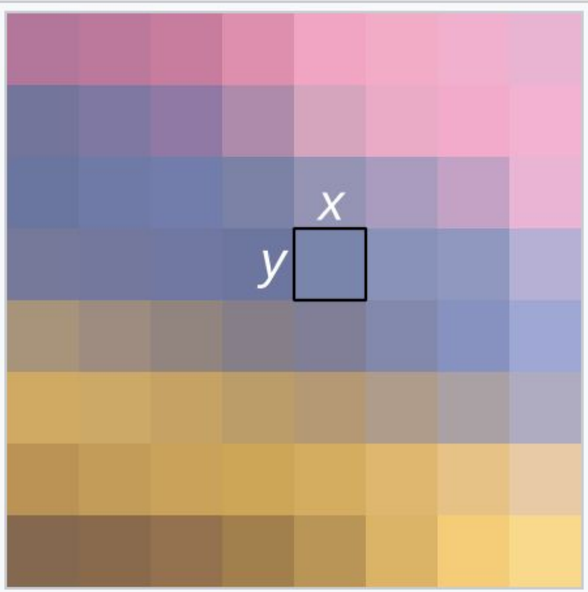
Sample Aspect Ratio

Storage Aspect Ratio

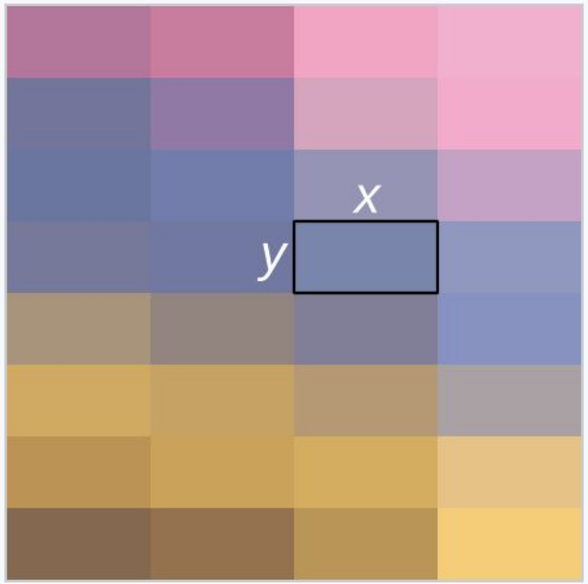
Viewing Aspect Ratio

Encoded Aspect Ratio

Projection Aspect Ratio



Pixel aspect ratio 1:1



Pixel aspect ratio 2:1

Pixel Aspect Ratio -> PAR

Crop Aspect Ratio

Video Aspect Ratio

Image Aspect Ratio

Frame Aspect Ratio

Native Aspect Ratio

Picture Aspect Ratio -> PAR

Display Aspect Ratio

Sample Aspect Ratio

Storage Aspect Ratio

Viewing Aspect Ratio

Encoded Aspect Ratio

Projection Aspect Ratio

Pixel Aspect Ratio
Crop Aspect Ratio
Video Aspect Ratio
Image Aspect Ratio
Frame Aspect Ratio
Native Aspect Ratio
Picture Aspect Ratio
Display Aspect Ratio
Sample Aspect Ratio -> SAR
Storage Aspect Ratio -> SAR
Viewing Aspect Ratio
Encoded Aspect Ratio
Projection Aspect Ratio

Picture Aspect Ratio
aka
Storage Aspect Ratio

Pixel Aspect Ratio
aka
Sample Aspect Ratio

SAR * PAR = DAR

SAR?

*

PAR?

=

DAR?


From FADGI'S
Significant Properties for Digital Video
Display Aspect Ratio (DAR)
DAR is the ratio between the width and height of the frame at the time of playback. DAR is a metadata field present in most audiovisual containers (though absent in some, including AVI) that is used by playback software and platforms to properly render the width and height of the frame proportionally so that the image is not stretched or narrowed.
Pixel Aspect Ratio (PAR)
PAR is the ratio between the width and the height of each individual pixel that makes up a video frame. Pixels within a frame are all of a uniform size, and while they may be square, they often are not. If the pixels are square, the PAR value is 1:1 or 1, since the width and the height of the pixels are equal to one another.
Storage Aspect Ratio (SAR)
SAR is the width and height of a video frame expressed as a ratio. For example, a video frame with a width of 720 pixels and height of 480 pixels (720x480) would have a SAR of 3:2.
https://www.digitizationguidelines.gov/guidelines/sigpropvideo.html
HYATT
REGENCY
MILWAUKEE

SAR * PAR = DAR

Storage Aspect Ratio *
Pixel Aspect Ratio =
Display Aspect Ratio

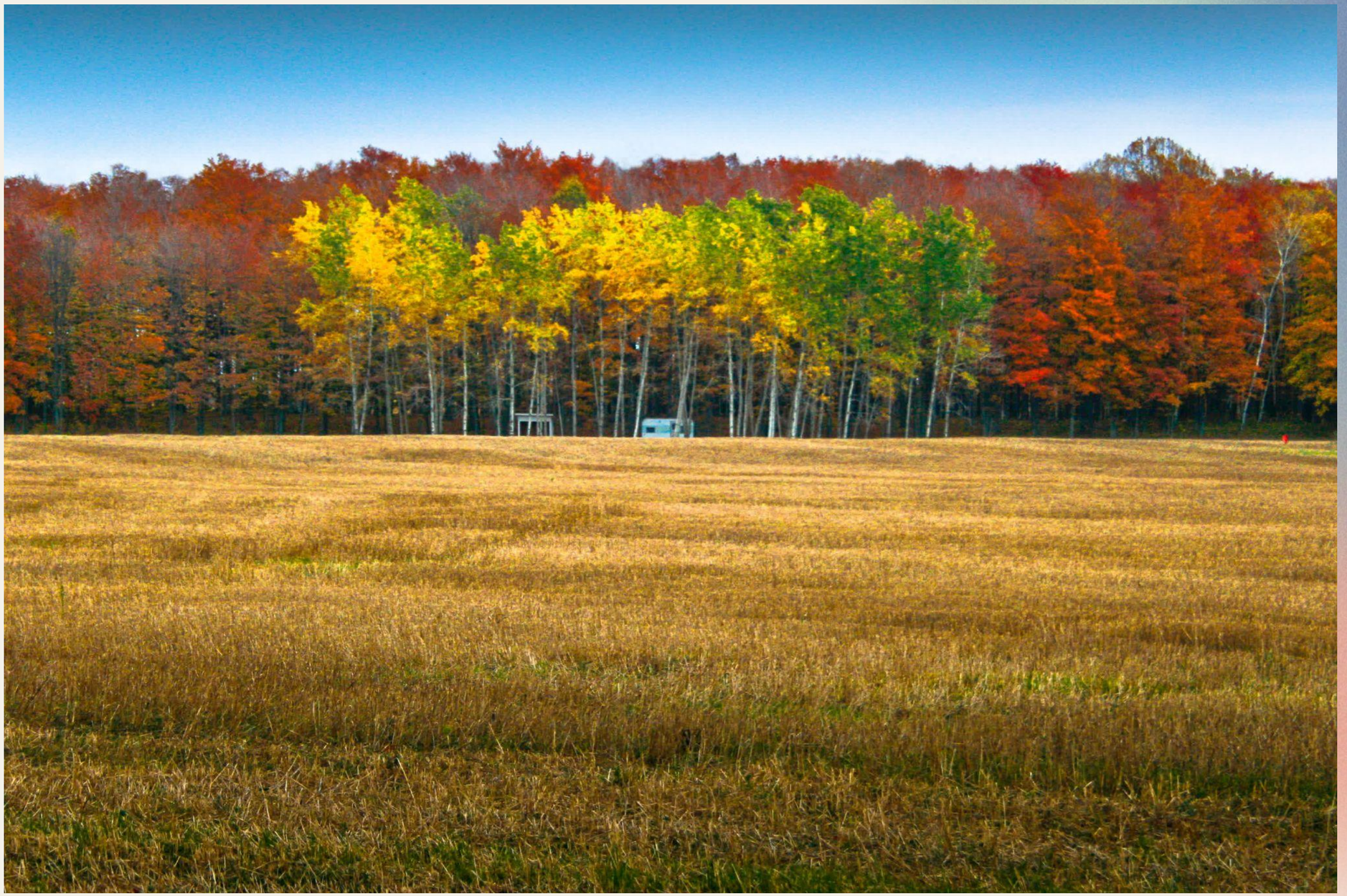
(W/H) * SAR = DAR
(W/H) / DAR = SAR

(Width / Height) *
Sample Aspect Ratio =
Display Aspect Ratio

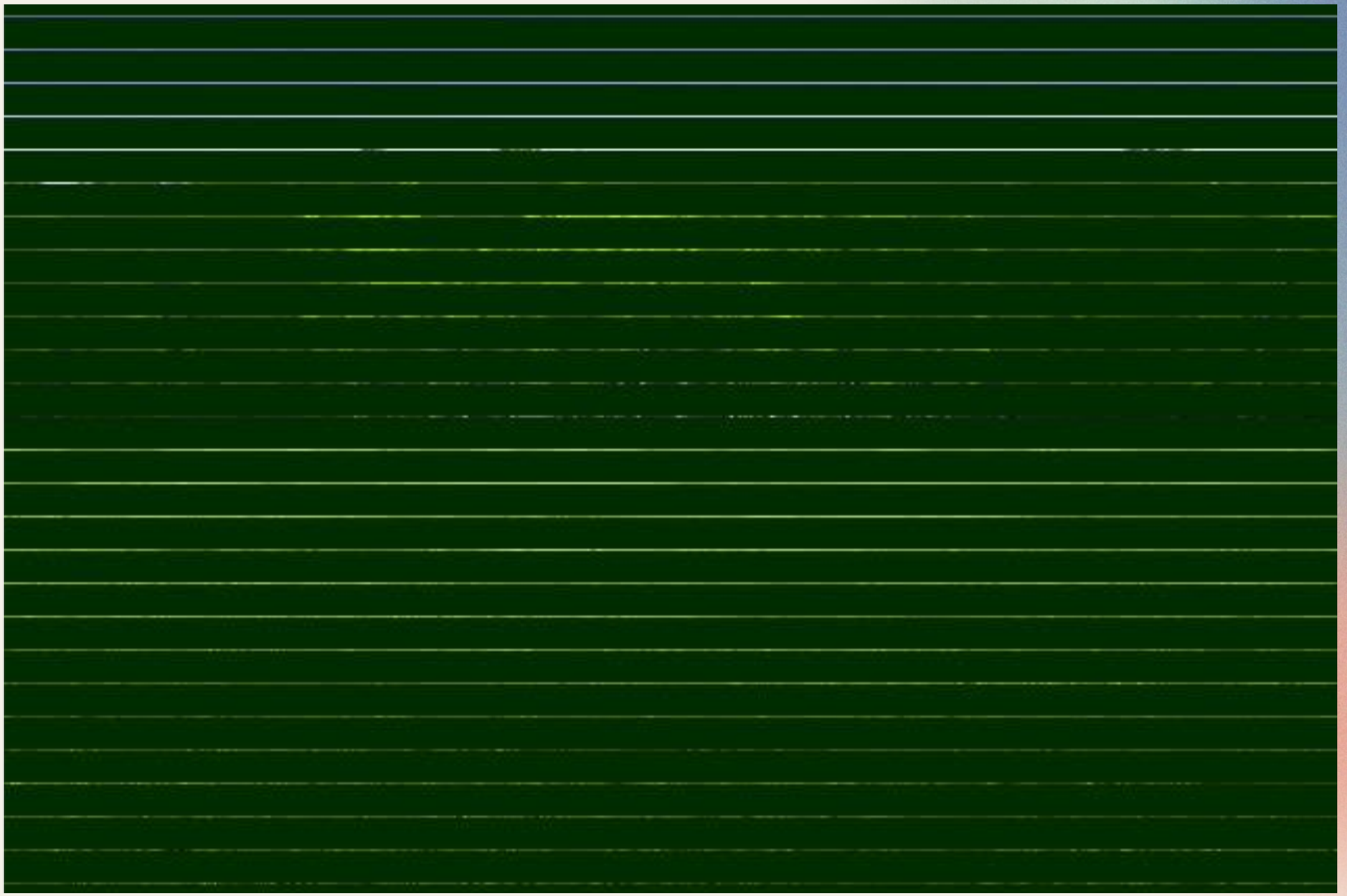
(Width / Height) /
Display Aspect Ratio =
Sample Aspect Ratio

Pixel Aspect Ratio
Crop Aspect Ratio
Video Aspect Ratio
Image Aspect Ratio
Frame Aspect Ratio
Native Aspect Ratio
Picture Aspect Ratio
Display Aspect Ratio
Sample Aspect Ratio
Storage Aspect Ratio
Viewing Aspect Ratio
Encoded Aspect Ratio
Projection Aspect Ratio

Samples :D



30 scan lines sampled



30 scan lines sampled

480 scan lines sampled

Samples :D

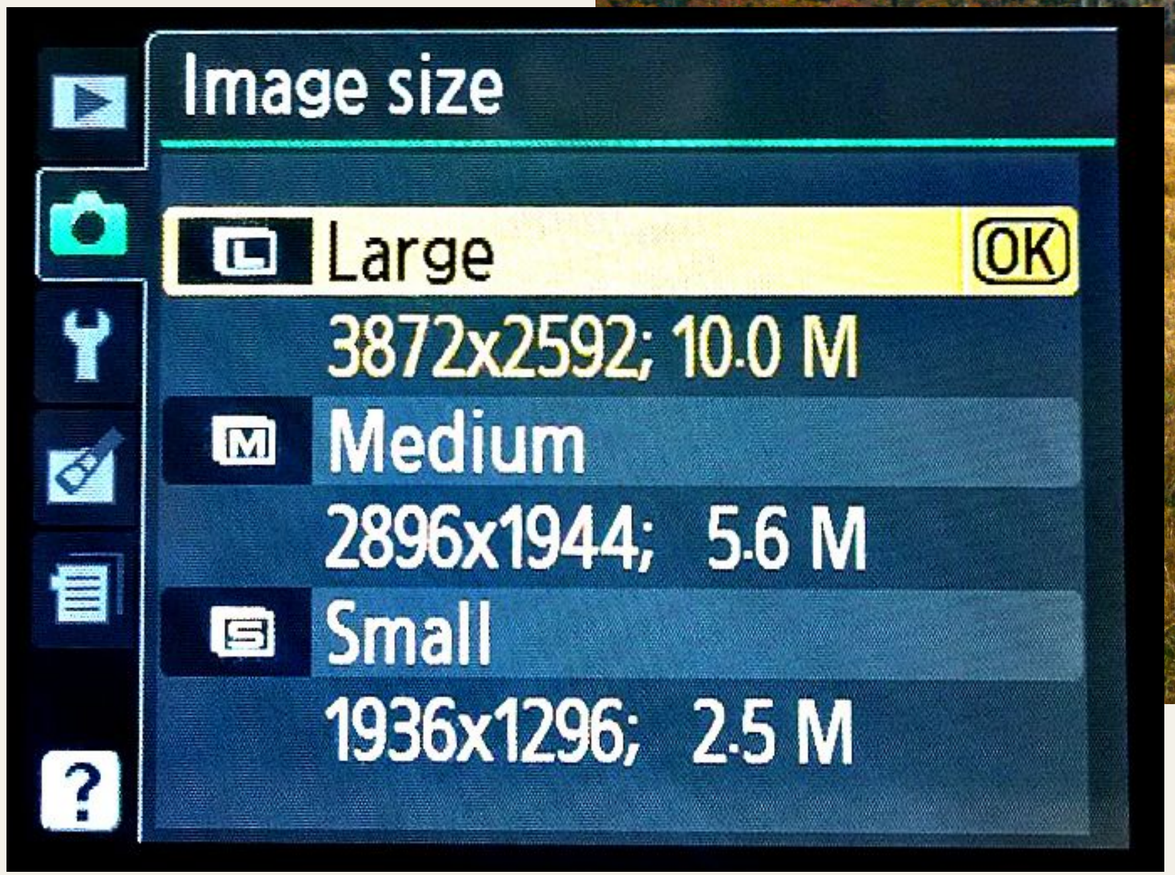
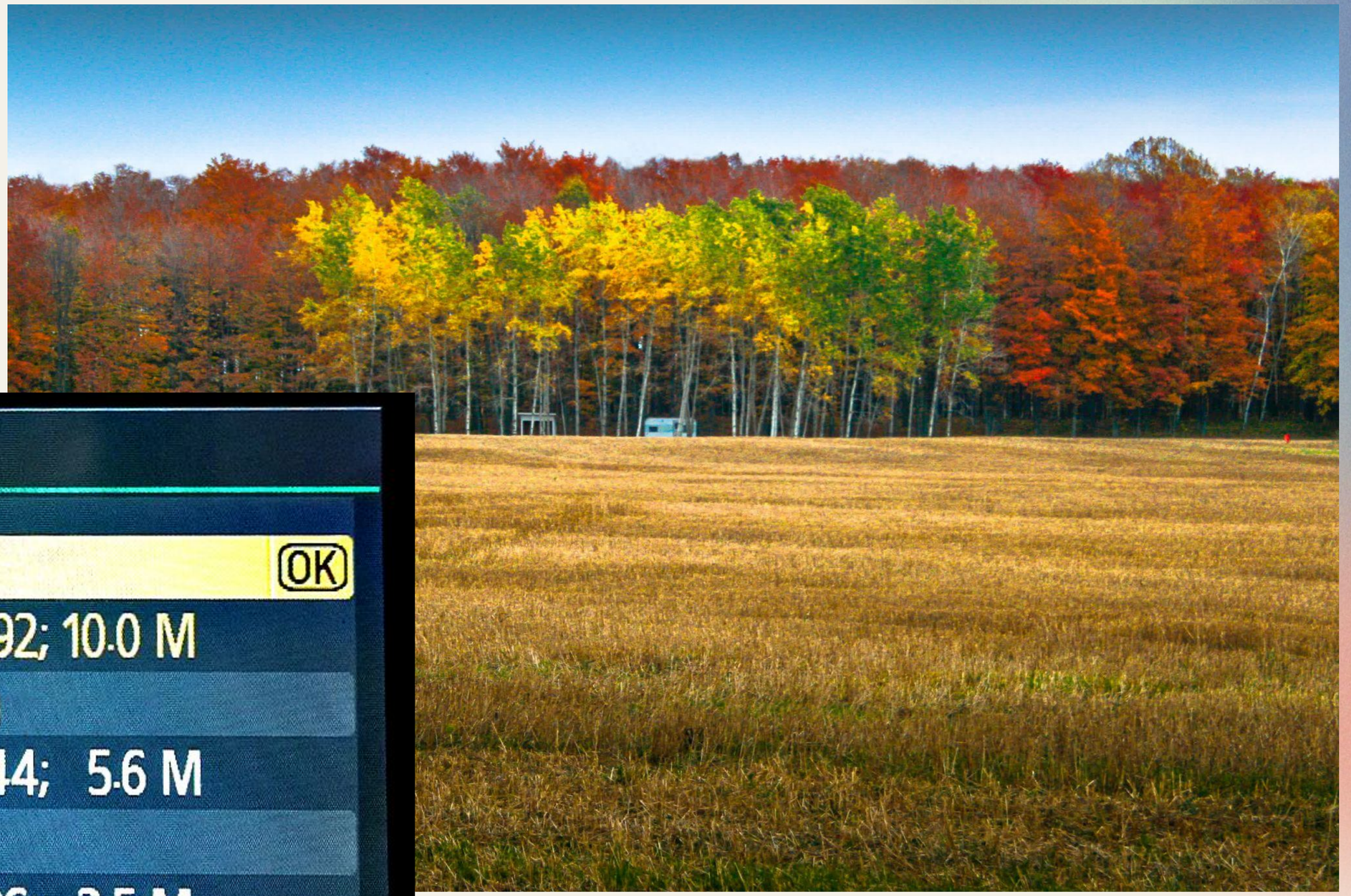


Image size
Large
OK
3872x2592; 10.0 M
Medium
2896x1944; 5.6 M
Small
1936x1296; 2.5 M




30 samples
40x30 samples
40 samples

30 samples

40 samples

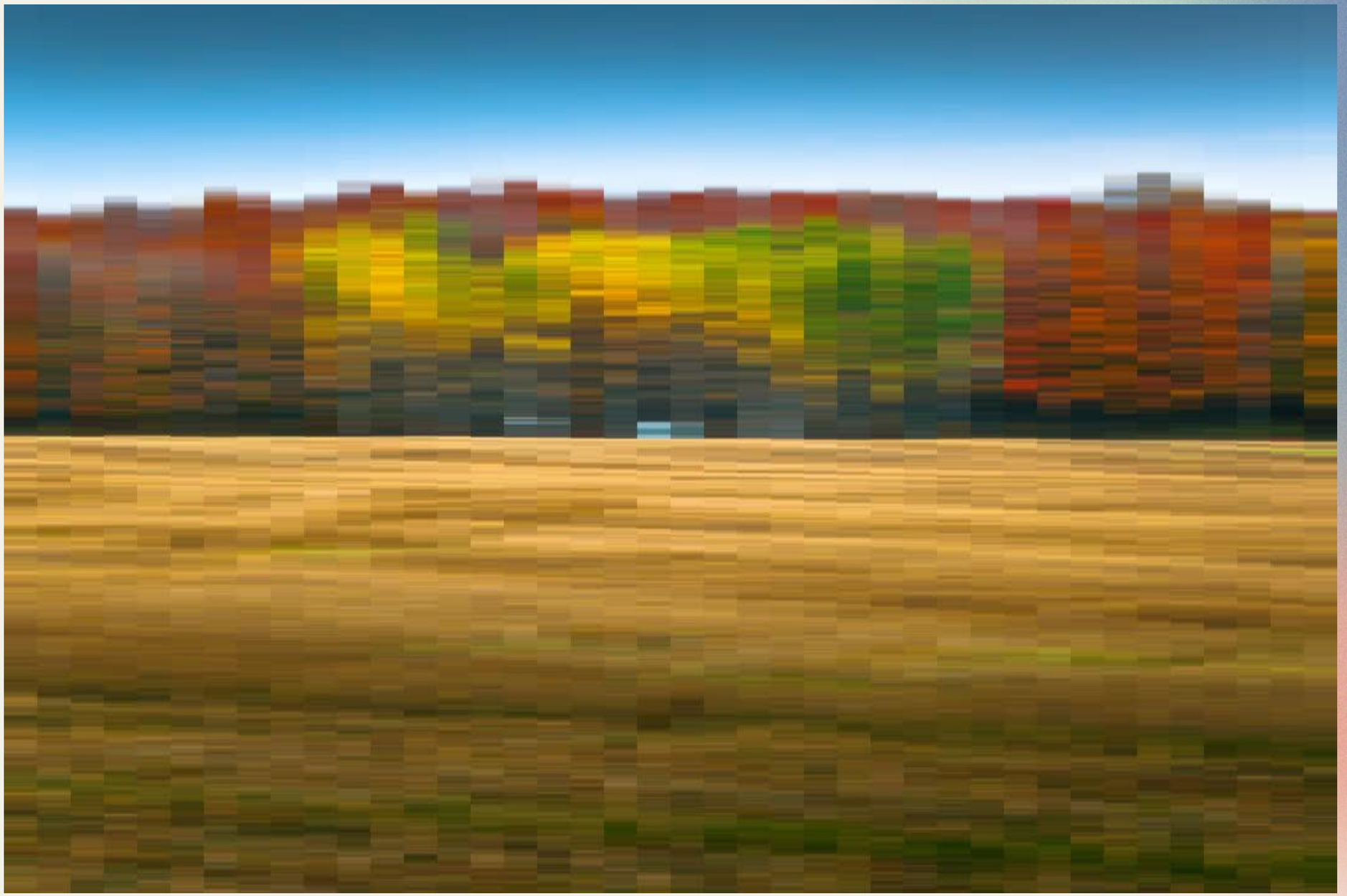
40x30 samples
Scaled to 1080x720
Sample aspect ratio of 1/1

30 samples

1080x30 samples
Scaled to 1080x720
Sample aspect ratio of 1/27

1080 samples

720 samples



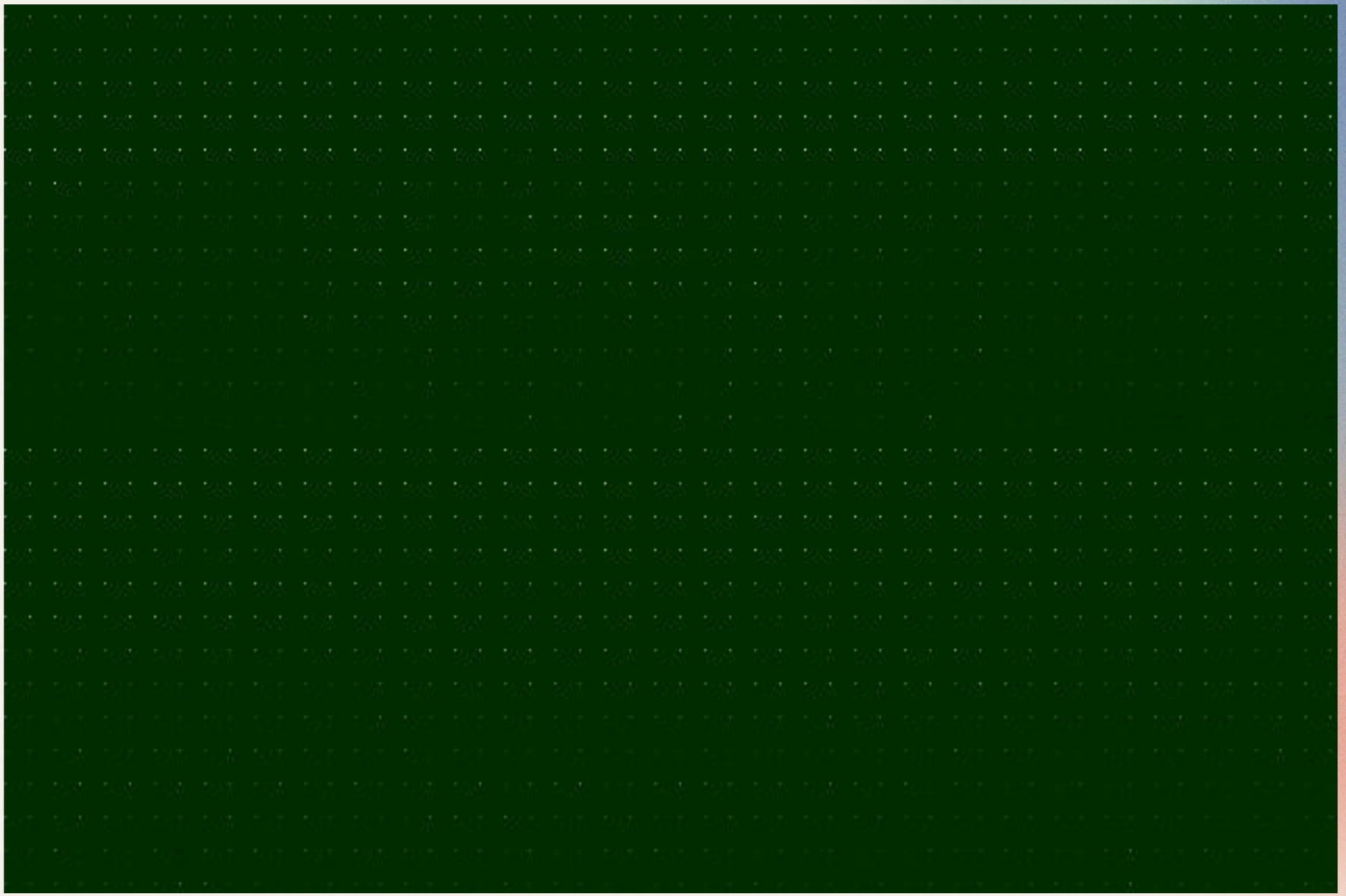
40x720 samples
Scaled to 1080x720
Sample aspect ratio of 24/1

40 samples

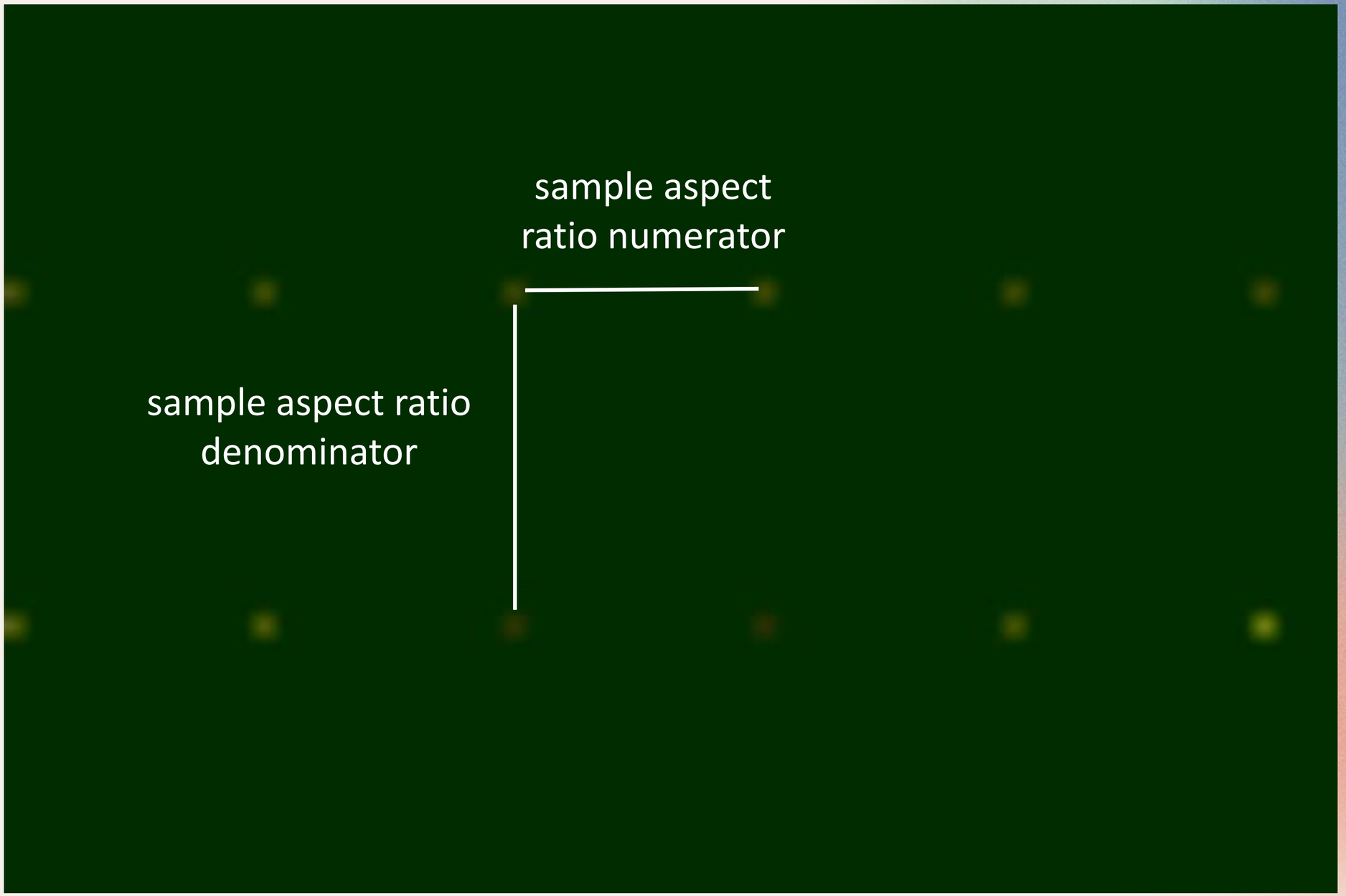
Sample Aspect Ratio?

30 samples

40x30 samples



40 samples



30 samples

40x30 samples

40 samples

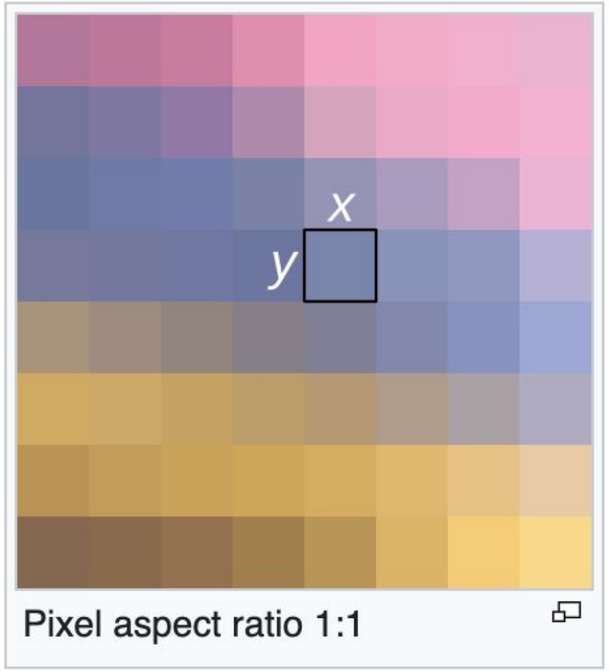
sample aspect ratio numerator

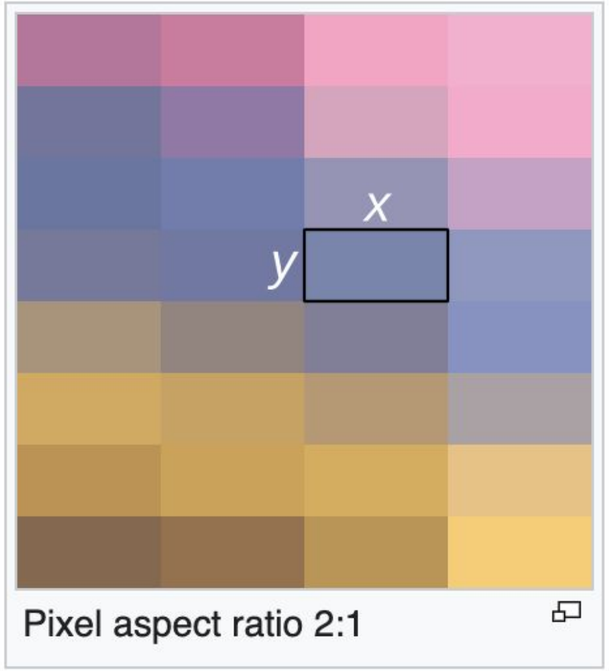
sample aspect ratio denominator

30 samples

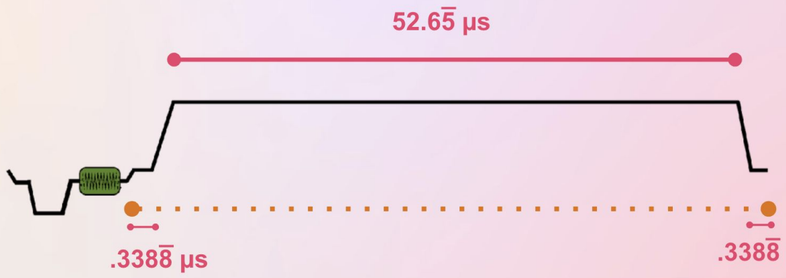
40x30 samples

40 samples





30 scan lines sampled



$52.65 + .338\overline{8} + .338\overline{8} = 53.3\overline{3}$

$53.3\overline{3} \times 13.5 = 720$

HOW DIGITIZATION WORKS

Aspect Ratio in Formats

Aspect Ratio in DV 25

DISP: Display select mode

DISP	Aspect ratio and format	Position
0 0 0	4:3 full format	Not applicable
0 0 1	Reserved	
0 1 0	16:9 full format (squeeze)	Not applicable
0 1 1 | 1 1 1	Reserved	

Aspect Ratio in DV25

DISP: Display select mode

DISP	Aspect ratio and format	Position
0 0 0	4:3 full format	Not applicable
0 0 1	Reserved	
0 1 0	16:9 full format (squeeze)	Not applicable
0 1 1 | 1 1 1	Reserved	

image width	image height	sample aspect ratio width	sample aspect ratio height	display aspect ratio width	display aspect ratio height
(720	/480) *	(8	/9) =	(4	/3)
(720	/480) *	(32	/27) =	(16	/9)
(720	/576) *	(16	/15) =	(4	/3)
(720	/576) *	(64	/45) =	(16	/9)

Aspect Ratio in Matroska

DisplayWidth	4	0x54B0	-	-	not 0	[desc.]	u	*	*	*	*	*	Width of the video frames to display. Applies to the video frame after cropping (PixelCrop* Elements). If the DisplayUnit of the same TrackEntry is 0, then the default value for DisplayWidth is equal to PixelWidth - PixelCropLeft - PixelCropRight, else there is no default value.
DisplayHeight	4	0x54BA	-	-	not 0	[desc.]	u	*	*	*	*	*	Height of the video frames to display. Applies to the video frame after cropping (PixelCrop* Elements). If the DisplayUnit of the same TrackEntry is 0, then the default value for DisplayHeight is equal to PixelHeight - PixelCropTop - PixelCropBottom, else there is no default value.
DisplayUnit	4	0x54B2	mand.	-	-	0	u	*	*	*	*	*	How DisplayWidth & DisplayHeight are interpreted. 0 - pixels, 1 - centimeters, 2 - inches, 3 - display aspect ratio, 4 - unknown

Aspect Ratio in AVI

OpenDML AVI File Format Extensions

Version 1.02

OpenDML AVI M-JPEG File Format Subcommittee

Last revision: February 28, 1996

Reformatting: September 1997

Video Format Token

```
enum {FORMAT_UNKNOWN, FORMAT_PAL_SQUARE, FORMAT_PAL_CCIR_601,
   FORMAT_NTSC_SQUARE, FORMAT_NTSC_CCIR_601,...} VIDEO_FORMAT;
```

The format token indicates that a known standard is defined for the following data fields. Those fields must be filled, but their value can be expected to be the defined standard. If the format is defined as `FORMAT_UNKNOWN` then the fields may contain special values. Known tokens are defined in the table below:

Token	*Standard*	*Refresh Rate*	*H-Total*	*V-Total*	*Frame Aspect Ratio*	*Frame Width*	*Frame Height*	*Pixel Aspect Ratio (derived)*
NTSC CCIR 601	NTSC	60	858	525	0x00040003 (4:3)	720	485	2160:1940
NTSC SQUARE	NTSC	60	780	525	0x00040003 (4:3)	640	480	1:1
PAL CCIR 601	PAL	50	864	625	0x00040003 (4:3)	720	576	2160:2304
PAL SQUARE	PAL	50	944	625	0x00040003 (4:3)	768	576	1:1

Aspect Ratio in QuickTime

Pixel aspect ratio ('pasp')

An extension that specifies the height-to-width ratio of pixels found in the video sample.

Overview

This is a required extension for MPEG-4 and uncompressed Y´CbCr video formats when non-square pixels are used. It is optional when square pixels are used.

The units of measure for the `hSpacing` and `vSpacing` parameters are not specified, as only the ratio matters. The units of measure for height and width must be the same, however.

The following table shows some common pixel aspect ratios.

Description	hSpacing	vSpacing
4:3 square pixels (composite NTSC or PAL)	1	1
4:3 non-square 525 (NTSC)	10	11
4:3 non-square 625 (PAL)	59	54
16:9 analog (composite NTSC or PAL)	4	3
16:9 digital 525 (NTSC)	40	33
16:9 digital 625 (PAL)	118	81
1920x1035 HDTV (per SMPTE 260M-1992)	113	118

Data fields

`Size`

An unsigned 32-bit integer holding the size of the pixel aspect ratio atom.

`Type`

An unsigned 32-bit field.

`hSpacing`

An unsigned 32-bit integer specifying the horizontal spacing of pixels, such as luma sampling instants for Y´CbCr or YUV video.

`vSpacing`

An unsigned 32-bit integer specifying the vertical spacing of pixels, such as video picture lines.

Aspect Ratio in QuickTime

2007-09-04

Added

- First public release of complete, updated *QuickTime File Format Specification* with information about atoms and atom types.
- Added licensing information and disclaimer for developers.
- A QuickTime file may now contain a file type compatibility atom. See `File type compatibility atom ('ftyp')`.
- A movie atom may now contain a movie profile atom. See `Movie profile atom ('prfl')`.
- A track atom may now contain a track profile atom. See `Track profile atom ('prfl')`.
- Video sample descriptions may now contain a pixel aspect ratio atom for non-square pixels. See `Pixel aspect ratio ('pasp')` (`'pasp'`).
- Video sample descriptions may now also contain a color parameter atom. See `Color parameter atom ('colr')` (`'colr'`).
- Video sample descriptions may now a clean aperture atom. See `Clean aperture ('clap')` (`'clap'`).
- MPEG-4 video and audio sample descriptions may now contain elementary stream descriptor atoms. See `MPEG-4 elementary stream descriptor atom ('esds')` (`'esds'`) and `MPEG-4 elementary stream descriptor atom ('esds')` (`'esds'`).

STAR WARS
EPISODE I
THE PHANTOM MENACE

railer now enhanced for QuickTime 4.
rger image size and full 44kHz Stereo.

ate for MacOS X Server
Live Streaming Content Area
n Source Darwin Streaming Server

QuickTime 4

Overview	Specifications	Showcase	Authoring	Developer

Why does this video has a 3/2 display aspect ratio?

Unspecified aspect ratio implies square pixels, aka a sample aspect ratio of 1/1.

Goal: Present video at 4/3 display aspect ratio.

But: Players might inconsistently apply aspect ratio metadata.

So: export access files with a 1/1 sample aspect ratio.

With No Aspect Ratio Metadata

720x480

640x480

A file with no aspect ratio information

ffmpeg

Stream #0:0[0x1]: Video: v210 (v210 / 0x30313276), yuv422p10le(progressive), 320x240, 43008 kb/s, 25 fps, 25 tbr, 12800 tbn (default)

ffporbe

sample_aspect_ratio=N/A
display_aspect_ratio=N/A

A file with aspect ratio information

ffmpeg

Stream #0:0[0x1]: Video: v210 (v210 / 0x30313276), yuv422p10le(progressive), 320x240, 43008 kb/s, SAR 1:1 DAR 4:3, 25 fps, 25 tbr, 12800 tbn (default)

ffprobe

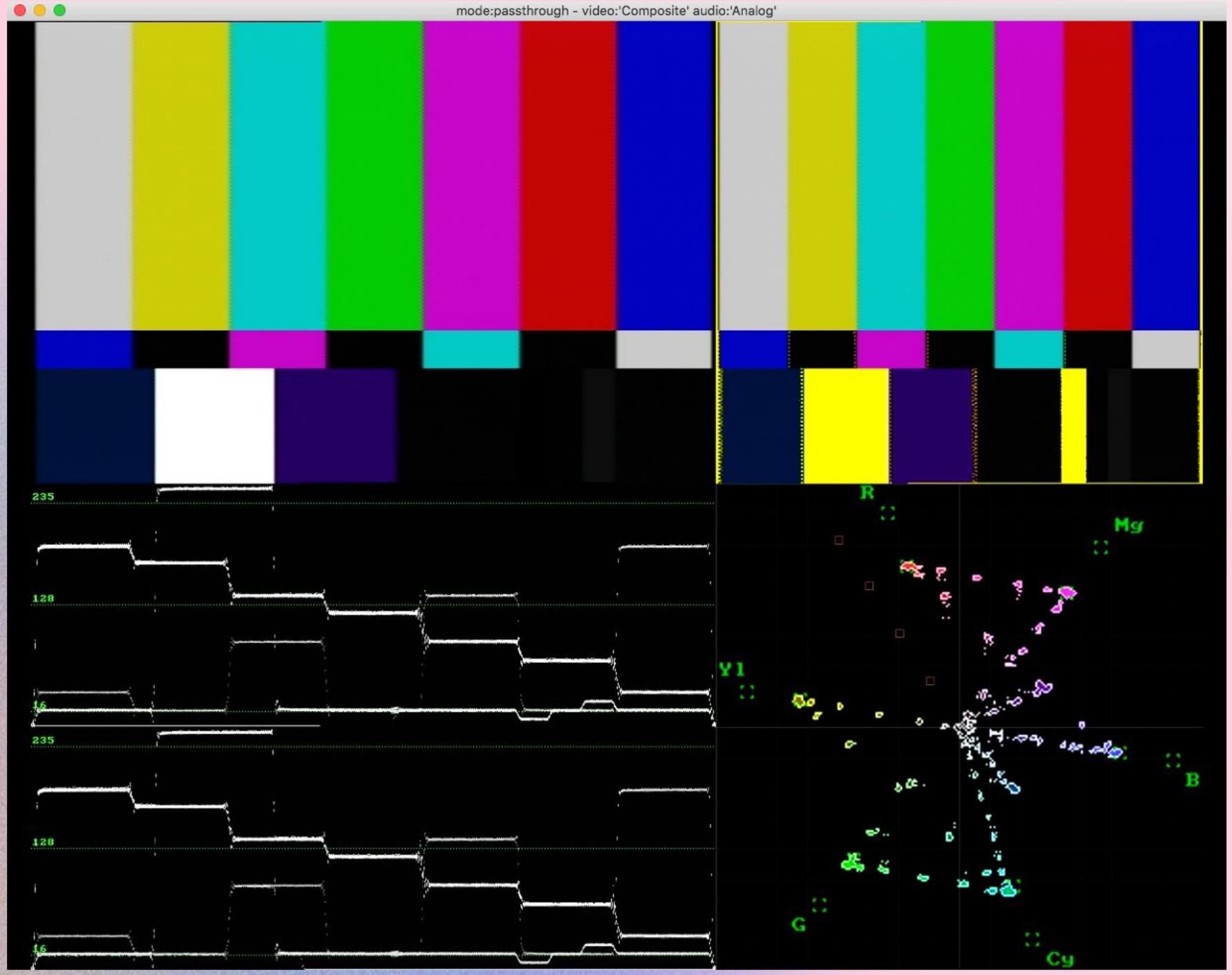
sample_aspect_ratio=1:1
display_aspect_ratio=4:3

MediaInfo and Aspect Ratio

```
$ mediainfo test.avi
General
Complete name                            : test.avi
Format                                   : AVI
Format/Info                              : Audio Video Interleave
Format settings                          : BitmapInfoHeader
File size                                : 853 KiB
Duration                                 : 40 ms
Overall bit rate                         : 175 Mb/s
Frame rate                               : 25.000 FPS
Writing application                      : Lavf61.7.100
Video
ID                                       : 0
Format                                   : YUV
Codec ID                                 : v210
Codec ID/Hint                            : AJA Video Systems Xena
Duration                                 : 40 ms
Bit rate                                 : 172 Mb/s
Width                                    : 638 pixels
Height                                   : 480 pixels
Display aspect ratio                     : 4:3
Frame rate                               : 25.000 FPS
Color space                              : YUV
Chroma subsampling                       : 4:2:2
```

Code Blame 4158 lines (3922 loc) · 237 KB Raw

```
3513  void File__Analyze::DisplayAspectRatio_Fill(const Ztring &Value, stream_t StreamK
3532      }
3533
3534      // /String version
3535      Ztring DARS;
3536           if (DAR>=(float)1.23 && DAR<(float)1.27)   DARS=__T("5:4");
3537      else if (DAR>=(float)1.30 && DAR<(float)1.37)   DARS=__T("4:3");
3538      else if (DAR>=(float)1.45 && DAR<(float)1.55)   DARS=__T("3:2");
3539      else if (DAR>=(float)1.55 && DAR<(float)1.65)   DARS=__T("16:10");
3540      else if (DAR>=(float)1.65 && DAR<(float)1.70)   DARS=__T("5:3");
3541      else if (DAR>=(float)1.74 && DAR<(float)1.82)   DARS=__T("16:9");
3542      else if (DAR>=(float)1.82 && DAR<(float)1.88)   DARS=__T("1.85:1");
3543      else if (DAR>=(float)2.15 && DAR<(float)2.22)   DARS=__T("2.2:1");
3544      else if (DAR>=(float)2.23 && DAR<(float)2.30)   DARS=__T("2.25:1");
3545      else if (DAR>=(float)2.30 && DAR<(float)2.37)   DARS=__T("2.35:1");
3546      else if (DAR>=(float)2.37 && DAR<(float)2.395)  DARS=__T("2.39:1");
3547      else if (DAR>=(float)2.395 && DAR<(float)2.45)  DARS=__T("2.40:1");
3548      else                                            DARS.From_Number(DAR);
3549        DARS.FindAndReplace(__T("."), MediaInfoLib::Config.Language_Get(__T("  Conf
3550      if (MediaInfoLib::Config.Language_Get(__T("  Language_ISO639"))==__T("fr") &&
3551           DARS.FindAndReplace(__T(":"), __T("/"));
3552      Fill(StreamKind, StreamPos, Parameter_DisplayAspectRatio+1, DARS, true);
```

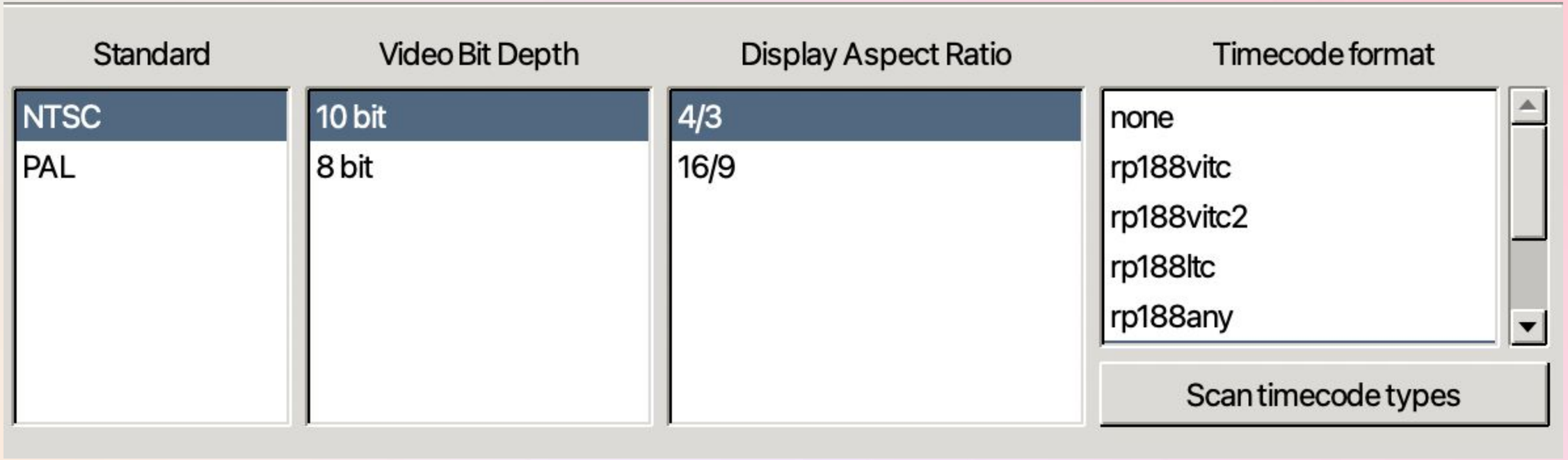


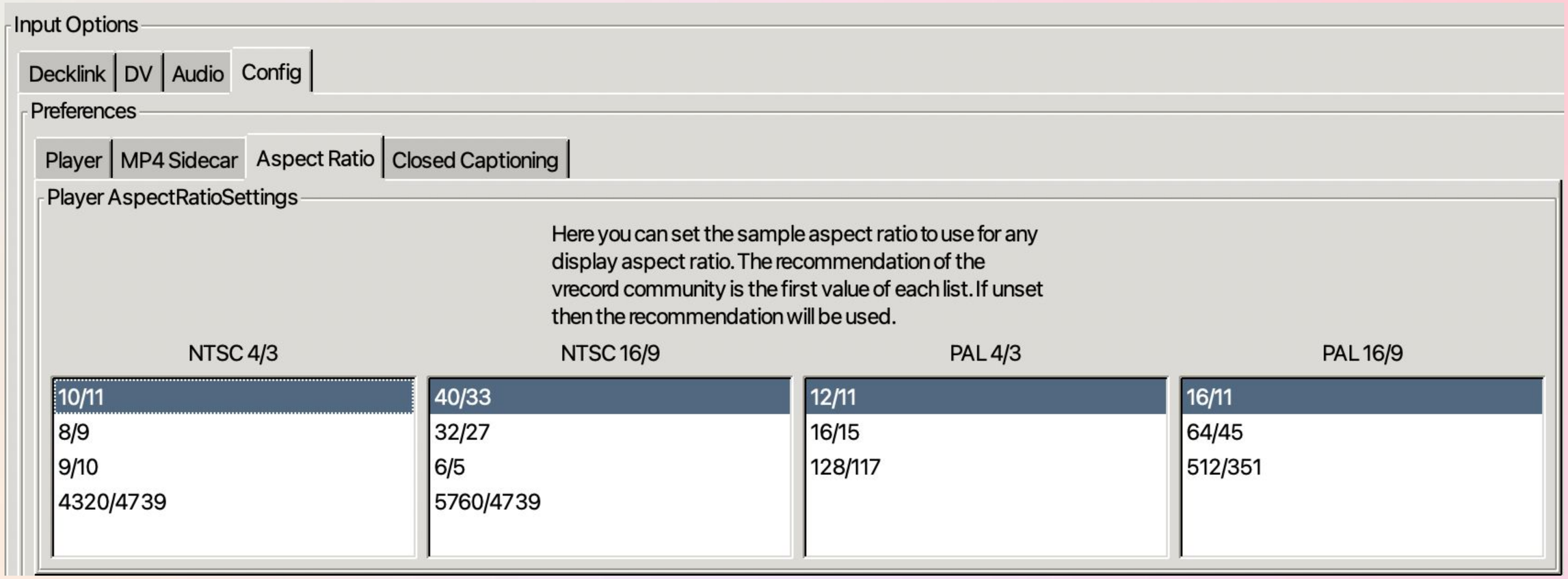
vrecord &
aspect ratio

initially

720x486

display apsect
ratio of 4/3


Standard
Video Bit Depth
Display Aspect Ratio
Timecode format
NTSC
PAL
10 bit
8 bit
4/3
16/9
none
rp188vitc
rp188vitc2
rp188ltc
rp188any
Scan timecode types


Input Options
Decklink
DV
Audio
Config
Preferences
Player
MP4 Sidecar
Aspect Ratio
Closed Captioning
Player AspectRatioSettings
Here you can set the sample aspect ratio to use for any display aspect ratio. The recommendation of the vrecord community is the first value of each list. If unset then the recommendation will be used.
NTSC 4/3
10/11
8/9
9/10
4320/4739
NTSC 16/9
40/33
32/27
6/5
5760/4739
PAL 4/3
12/11
16/15
128/117
PAL 16/9
16/11
64/45
512/351

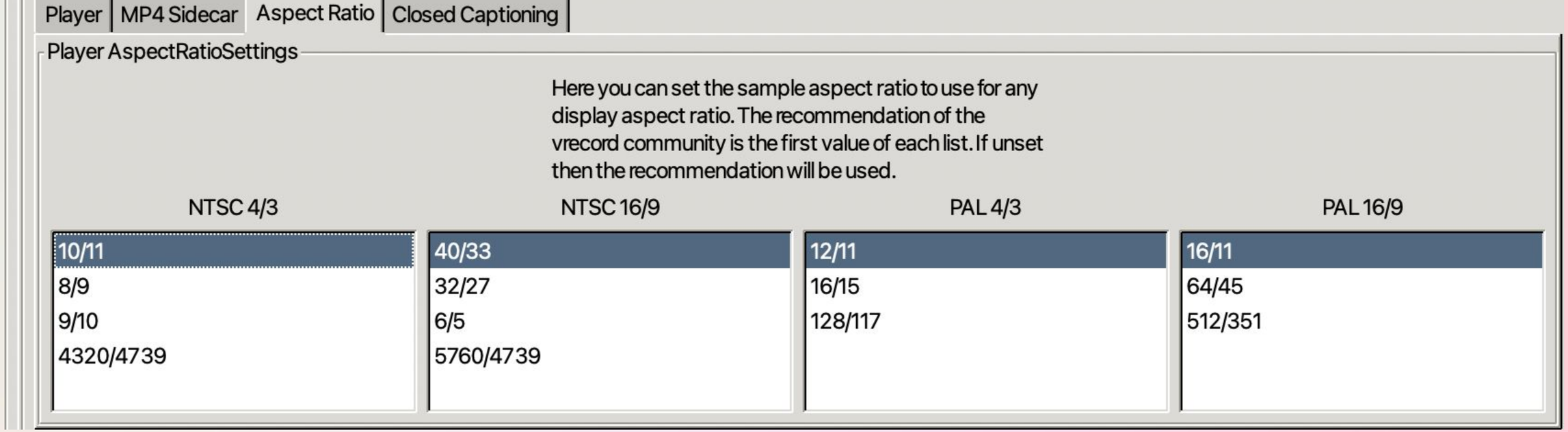


image width	image height	sample aspect ratio width	sample aspect ratio height	display aspect ratio width	display aspect ratio height
(720 / 486) *		(8 / 9) =		(4 / 3)	
(720 / 480) *		(9 /10) =		(4 / 3)	
(704 / 480) *		(10 / 11) =		(4 / 3)	
(710.85 / 486) *		(4320 / 4739) =		(4 / 3)	

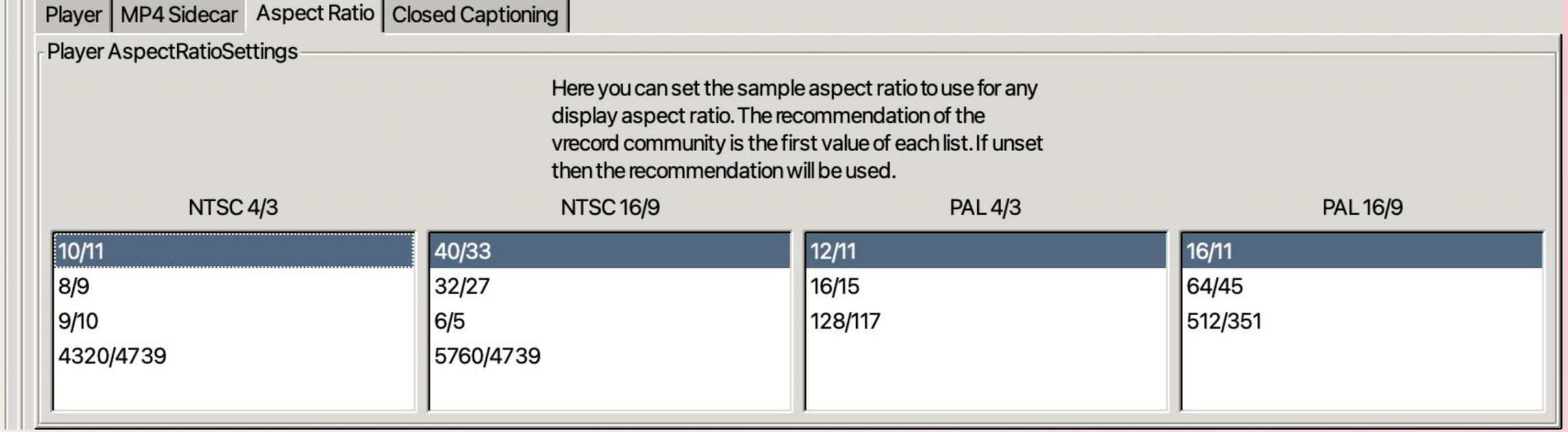
What's 4/3?

720x486

720x480

704x480

710.85x486



sample aspect ratio width	sample aspect ratio height	As decimal
(8 / 9) =		0.88888889
(9 /10) =		0.9
(10 / 11) =		0.90909091
(4320 / 4739) =		0.91158472

10/11

4320/4739

9/10

8/9

8/9

9/10

10/11

4320/4739

AMIA 2024
Milwaukee

Thursday, December 5th
4:30 - 5:30 P.M.

Regency D

O.A.R.

To Be Different

Demystifying Aspect Ratio and Forming a Community Consensus

Morgan Oscar Morel

Video Lab Supervisor

Library of Congress

Dave Rice

Archivist

CUNY TV

THIS COMMAND FIXES BAD ADOBE METADATA

```
ffmpeg -i -map 0 'input.mov'

-dn -map_metadata '-1' -c:a copy -c:v v210

-movflags write_colr -color_range mpeg
-color_primaries smpte170m -color_trc bt709
-colorspace smpte170m

-vf 'setfield=bff,setsar=40/27,setdar=4/3'

'output.mov'
```

Write correct color metadata

Write PAR and DAR

OFFLINE

Re: Unable to export interlaced NTSC from Resolve

Andrew Kolakowski

Posts: **9283**
Joined: **Tue Sep 11, 2012 10:20 am**
Location: **Poland**

Wed Sep 15, 2021 11:07 pm

Not sure why you need lossless codec for SD (except for some archive/scientific(?) work).
If you have access to ProRes and need 'lossless' then XQ mode is very close.
GV codecs have only intermediate ones in Resolve exporter (GV lossless is not implemented in export).
None of the lossless exporters (v210 etc.) in Resolve preserves interlacing. No ideas why BM made it this way.

No idea why you use 40/27 as SD pixel ratio. I don't know any standard which it's based on.
There is 32/27 or 40/33, but never seen 40/27.

Continued consternation about needed lossless SD, but then a new concern appears

WHAT DID WE LEARN ?

Folks who work in production are incredulous about the use of uncompressed/lossless formats

PAR values of 10/11 and 8/9 are both acceptable, but 9/10 (which vrecorded used) is not

Adobe Premiere uses a PAR of 10/11

DaVinci Resolve has incorrect PAR information