

AMIA 2023

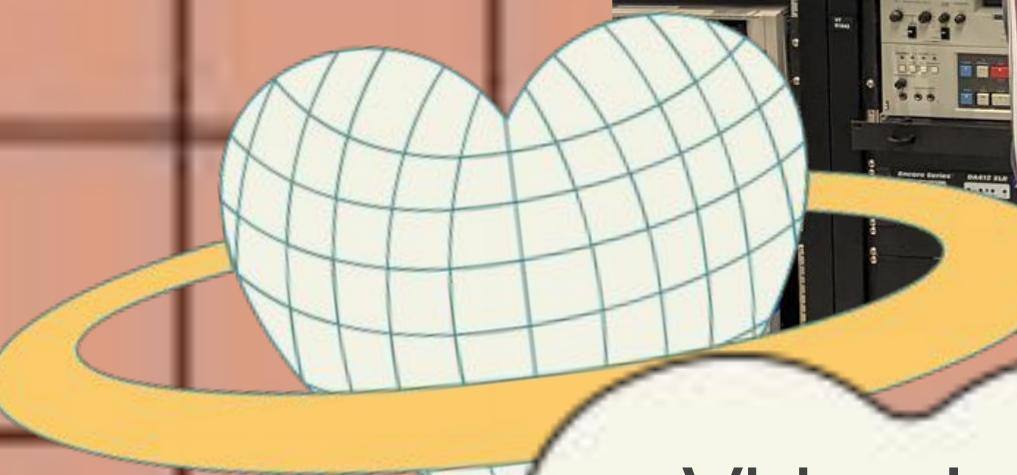
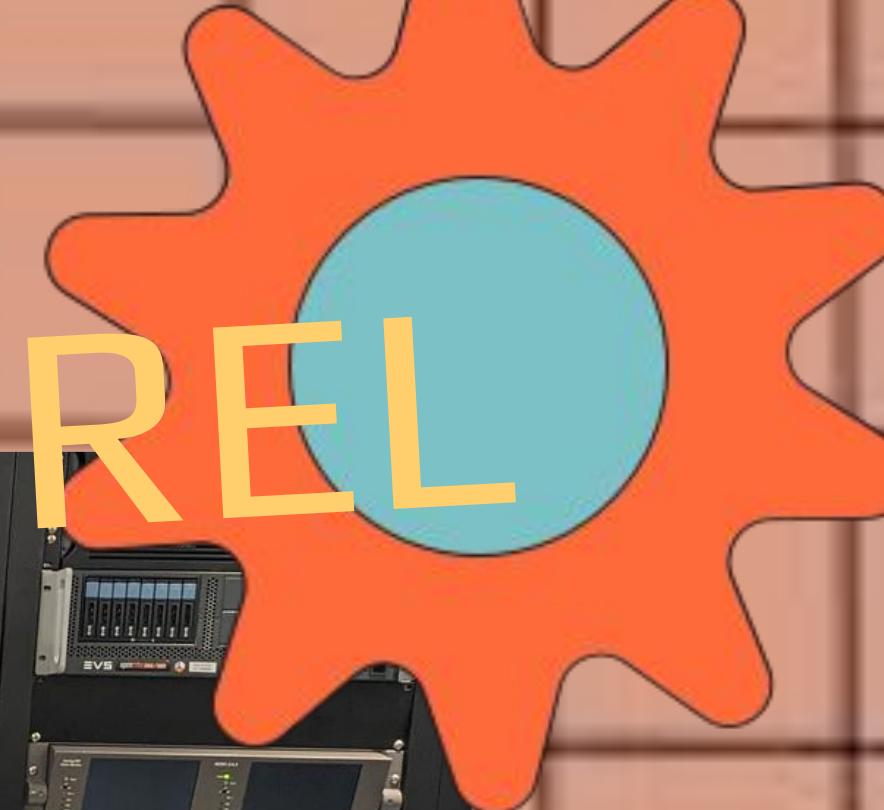
S-VHS & S-VIDEO

SUPER, OR
SUPERCILIOUS?

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Video Lab Supervisor
Library of Congress

LIBRARY
LIBRARY
OF CONGRESS

MORGAN MOREL



Video Lab Supervisor at Library of Congress
National Audiovisual Conservation Center

TOPICS COVERED

1

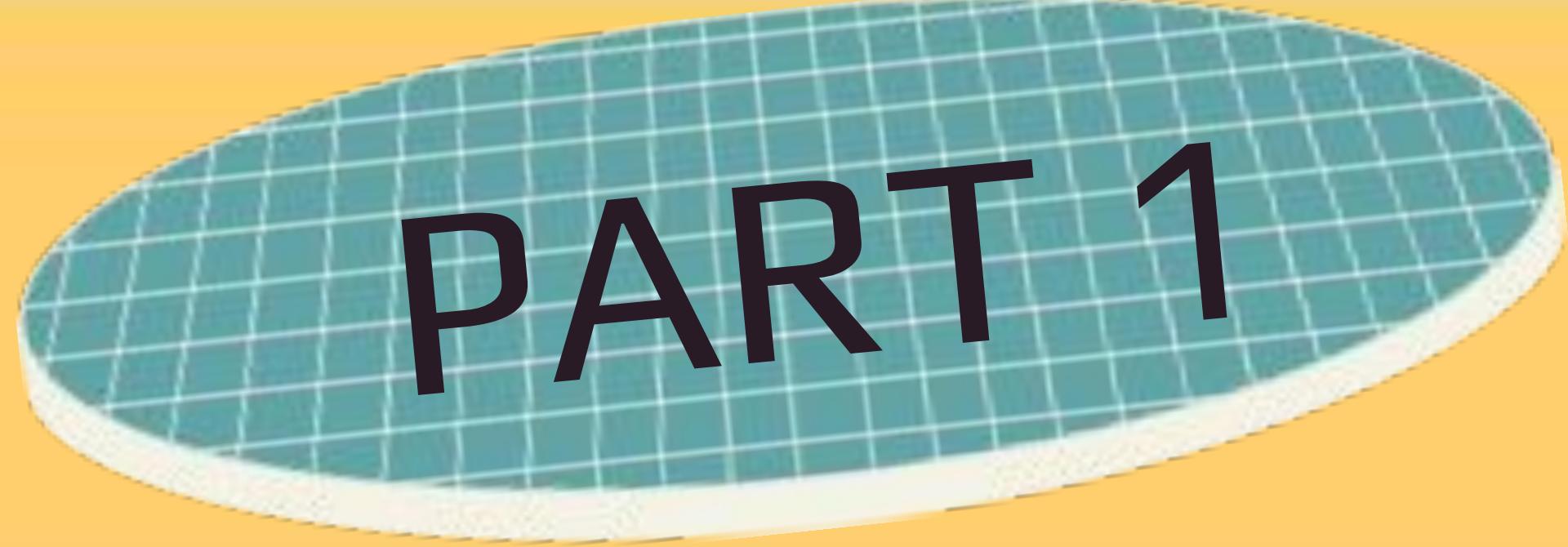
DEFINITION OF S-VHS, S-VIDEO, AND RELATED CONCEPTS

2

PERFORMING TESTS TO DETERMINE QUALITY DIFFERENCES

3

APPLYING THIS INFORMATION IN AN ARCHIVAL PRESERVATION CONTEXT



PART 1



DEFINITIONS

(WHAT IS THIS STUFF?)

DEFINITIONS



A videotape recording format

Stands for Super VHS

Improved version of VHS Format

Increased resolution from increased luminance bandwidth. Color is not improved

Cassette shells are nearly identical to VHS, with a detection hole punched in the bottom

S-Video

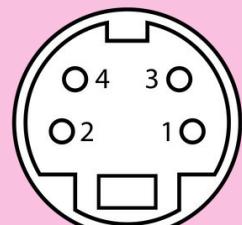
A video signal transmission format

Stands for Separate Video (not super!)

Improves artifacts inherent to composite video by allowing for the processing of Luma and Chroma separately

Can use the 4 pin DIN connector

Or two BNC cables

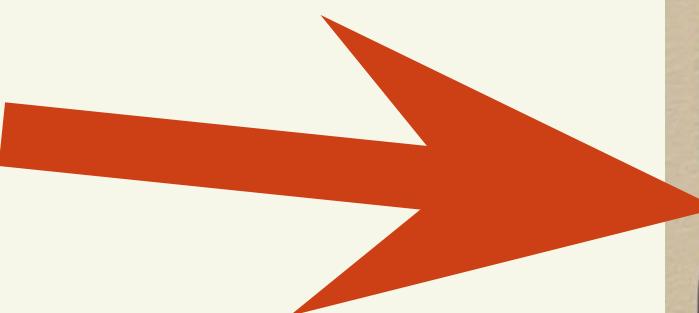


S-VHS & VHS

VHS

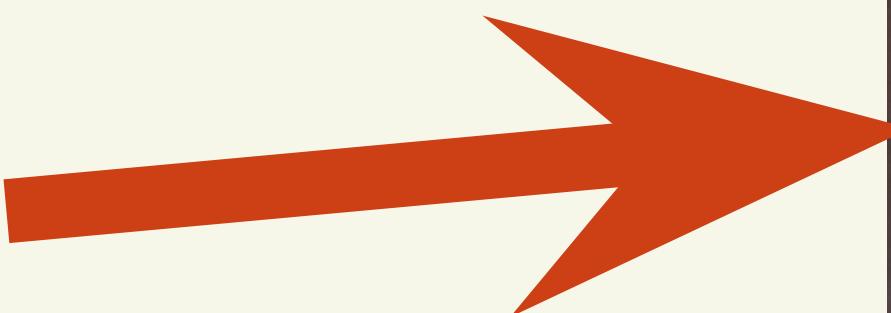


S VHS



S-VHS & VHS

VHS



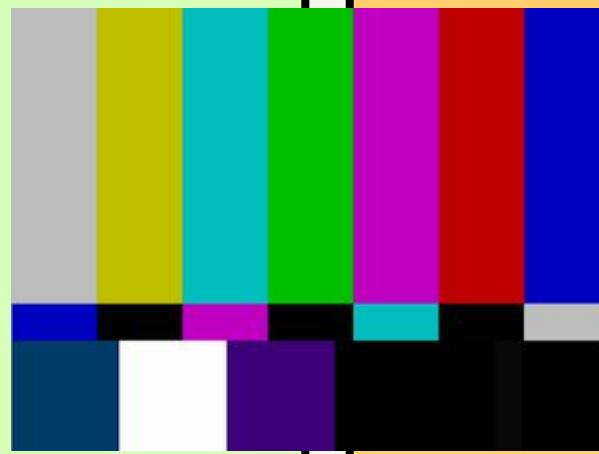
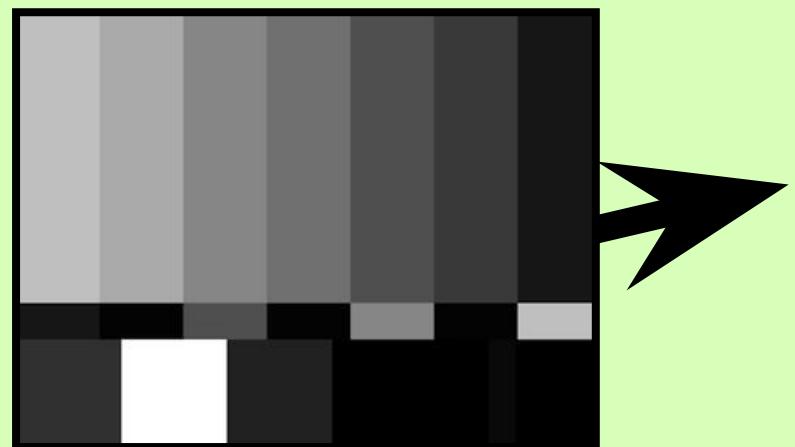
S-VHS



DEFINITIONS

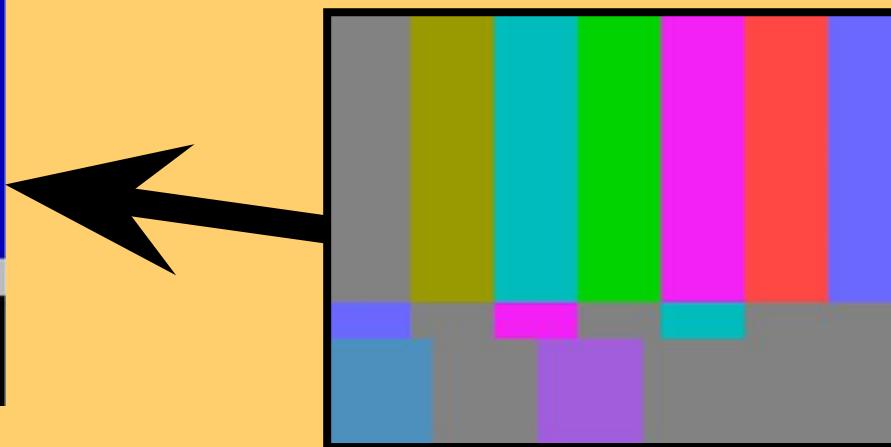
Luminance (Luma)

- The brightness or brilliance of the video signal
- Edges and details of an image depend on properly resolved luma
- Most of the bandwidth of a video signal is devoted to the luma

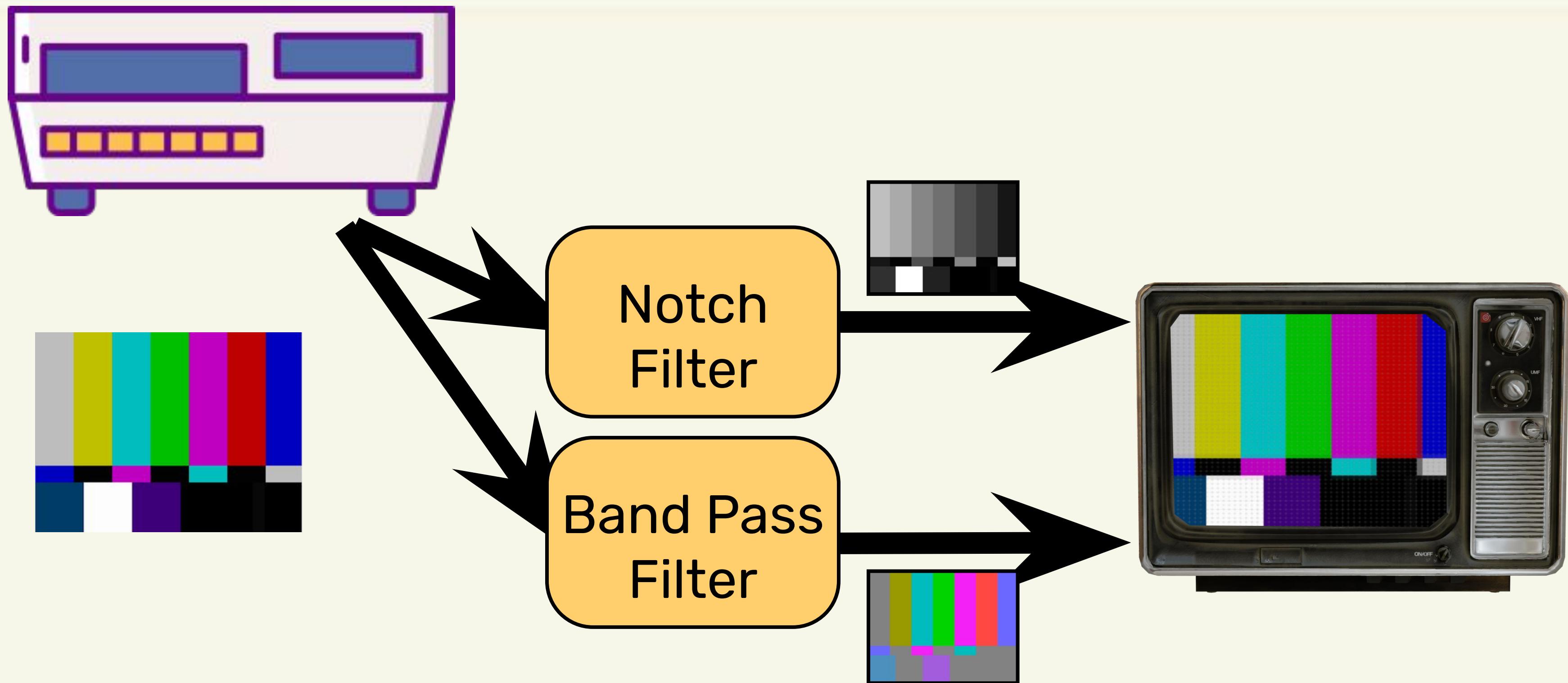


Chrominance (Chroma)

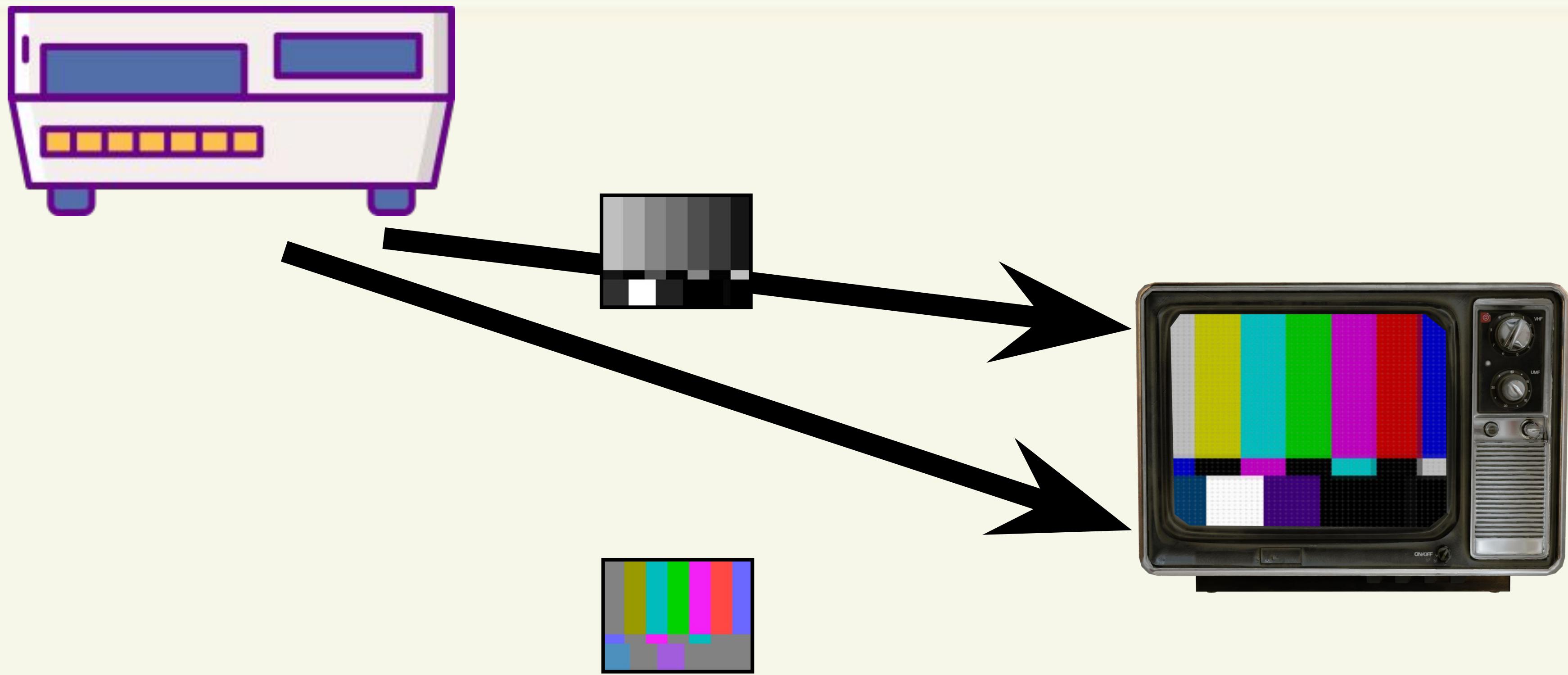
- The color information of a picture
- The color information is often downconverted (heterodyned) to a much smaller bandwidth than luma



COMPOSITE TRANSMISSION



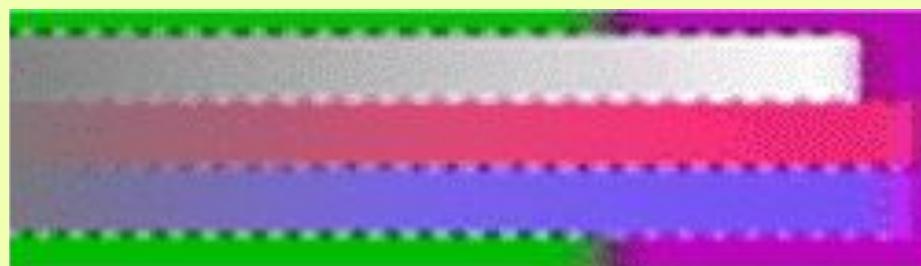
S-VIDEO TRANSMISSION



COMPOSITE ARTIFACTS

Dot Crawl

Cross Luma



Occurs at sharp transition between
saturated colors

Chroma information bleeds into
luma frequencies

Rainbow Effect

Cross Color



Occurs near sharp black or white
edges and text.

High frequency luma freqs bleed
into chroma freqs

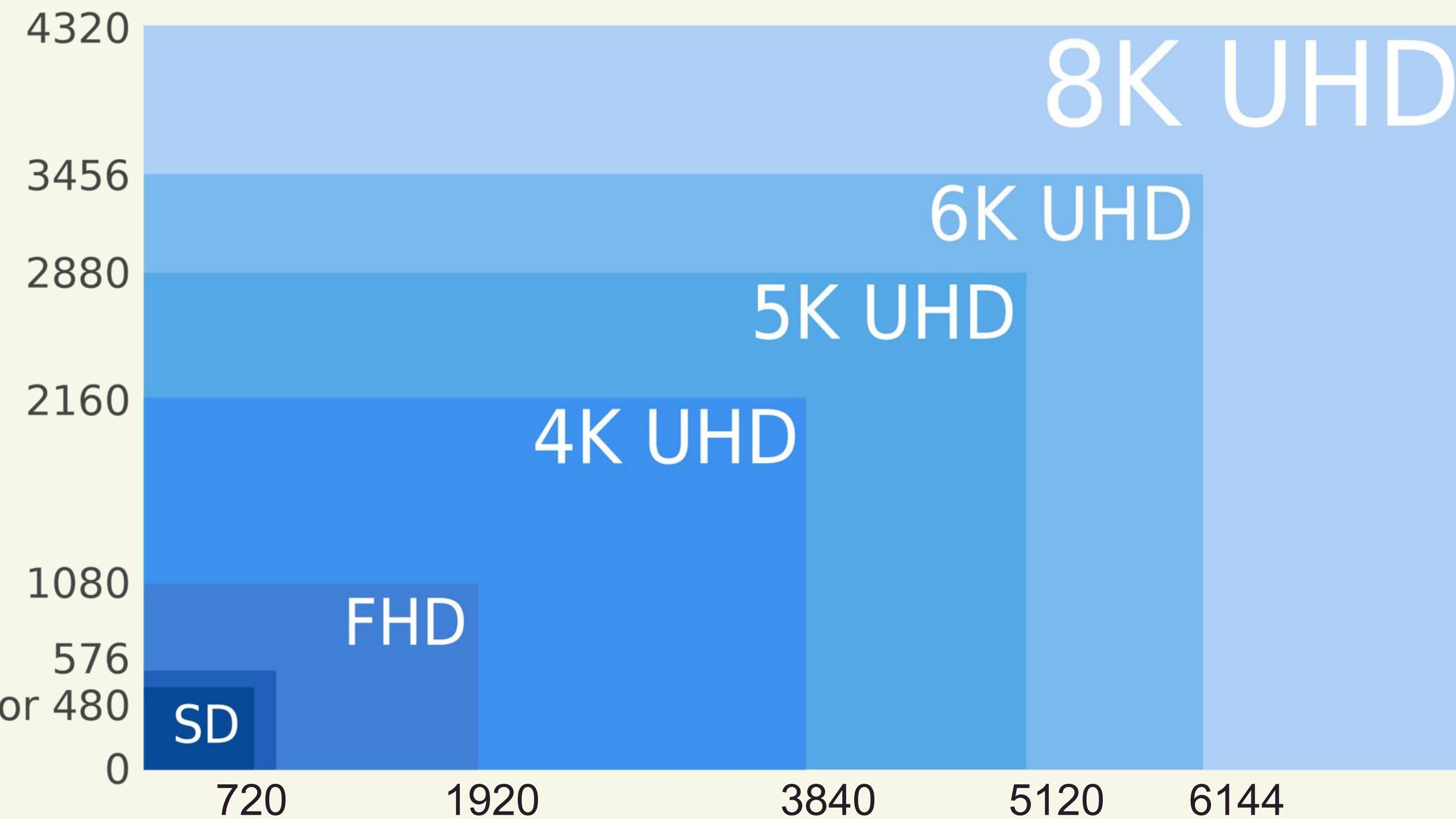
RESOLUTION

Digital resolution is measured in Pixels

Analog resolution is measured in
Total Vertical Lines (TVL)

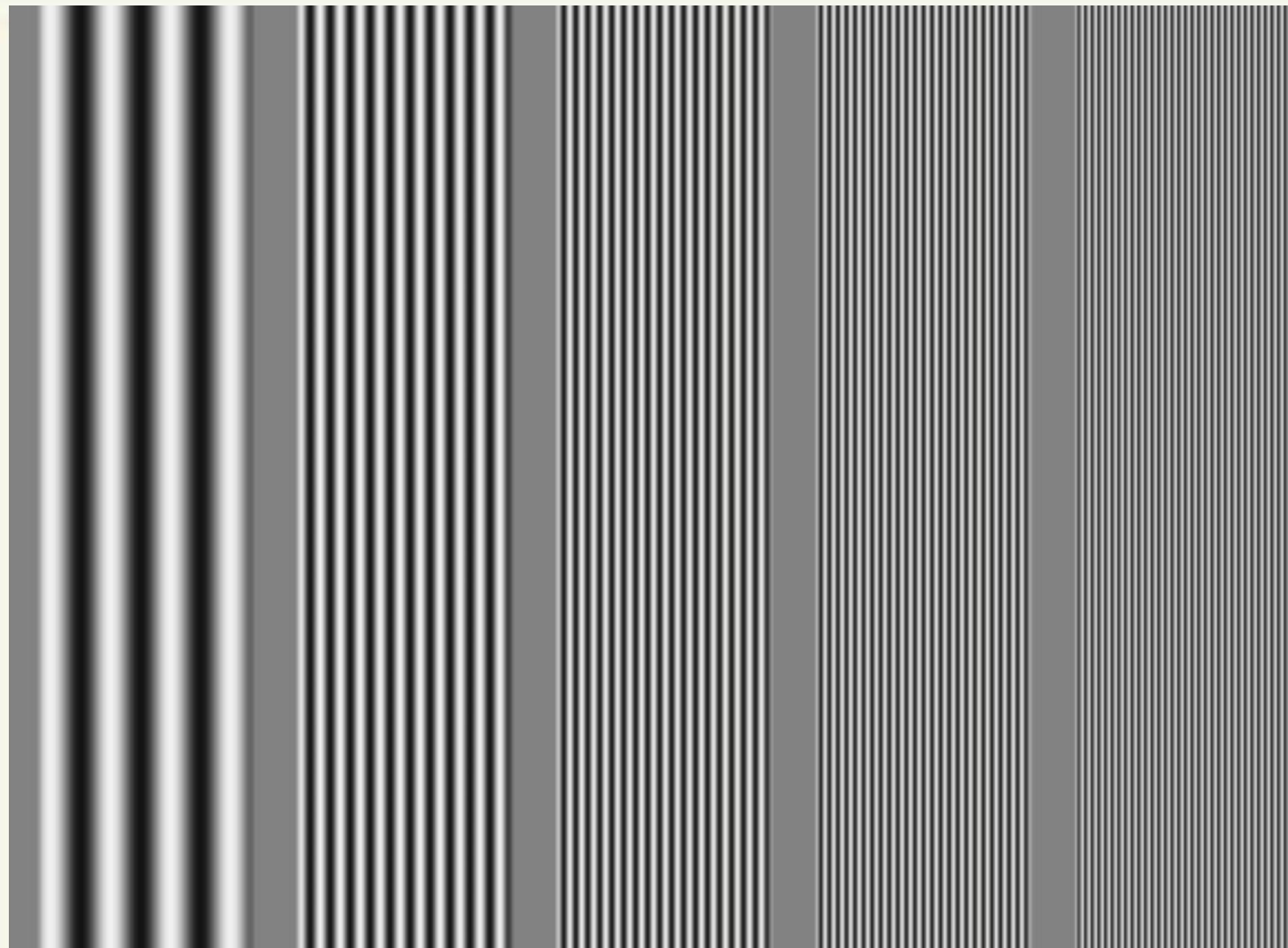
References to the “number of lines” a format can
reproduce refers to TVL, not to pixel height, or scan
lines

RESOLUTION



Digital
resolution
measured
in **Pixels**

RESOLUTION



40 TVL

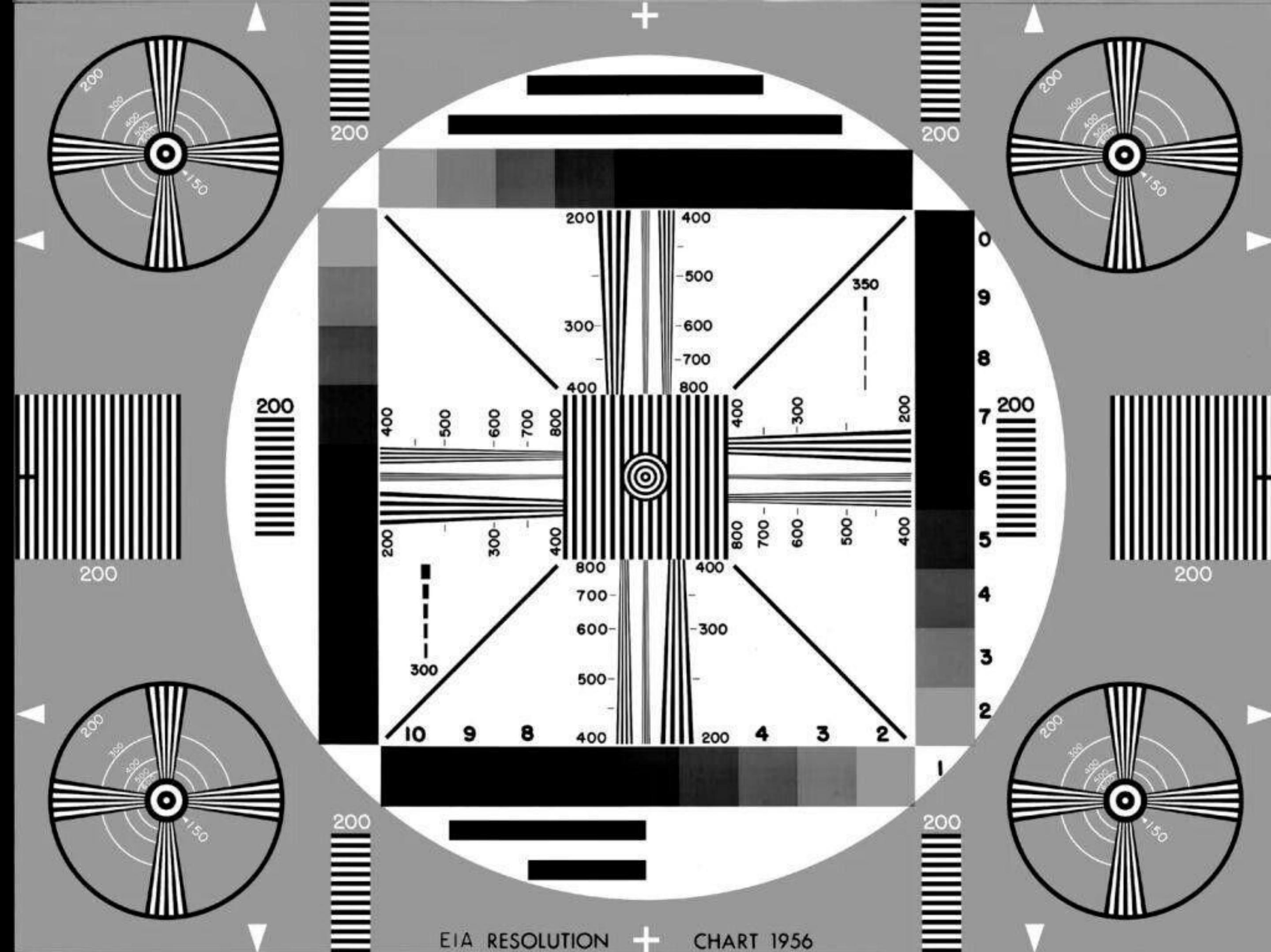
120 TVL

160 TVL

240 TVL

288TVL

Analog
resolution
measured by
how many Total
Vertical Lines
can be
represented



VHS
(maximum resolution)

NTSC or PAL-M
(maximum resolution)

RESOLUTION

$$TVL = \frac{(LP \times tHA \times BWs)}{AR}$$

tHA = 52 + (59/90) microseconds

BWs = Signal bandwidth (in MHz)

AR = Aspect Ration = 4:3 = 1.33

LP = Line pairs per cycle = 2

$$TVL = \frac{(2 \times 52.644 \times 1)}{1.33}$$

78.983 TVL per 1 MHz
of bandwidth

RESOLUTION

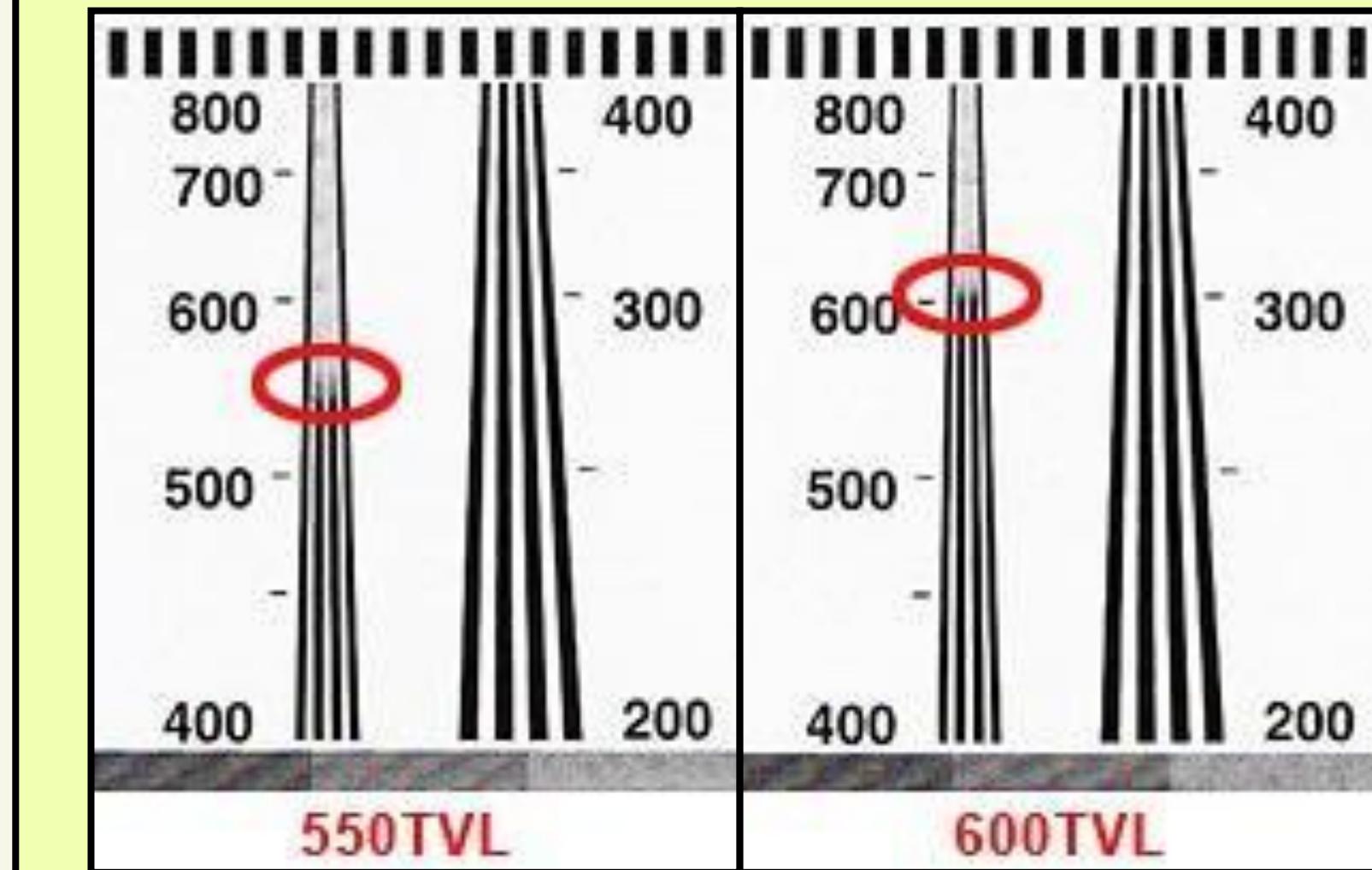
FORMAT	Broadcast NTSC	VHS	SVHS	U-matic	U-matic SP
TOTAL VERTICAL LINES	336	240	420	250	330
TOTAL PICTURE HEIGHT	448	320	560	333	440
LUMA CARRIER FREQUENCY	4.25 MHz	3.04 MHz	5.03 MHz	3.58 MHz	4.2 MHz

RESOLUTION ARTIFACTS

Moiré



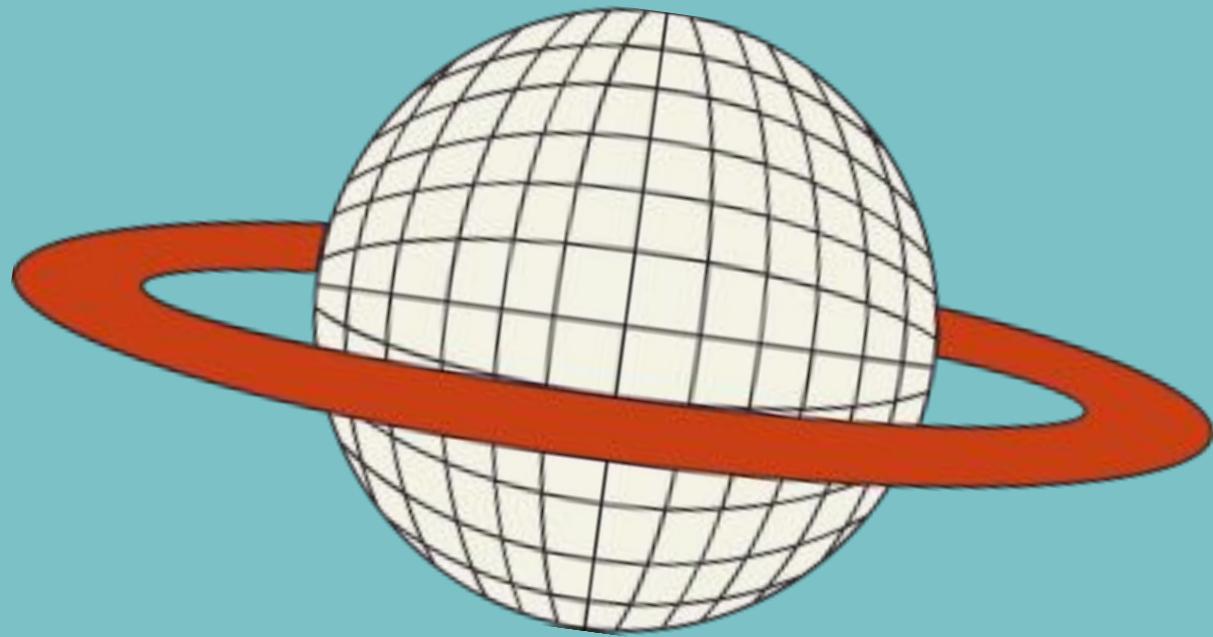
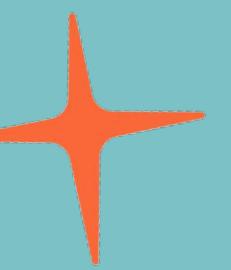
Lost Detail



RECAP

S-VHS Improves analog resolution, but maintains same color quality as VHS

S-Video reduces cross luma and cross chroma errors by allowing transmitting luma and chroma separately.



PART 2

QUALITY ANALYSIS



EXPERIMENT

I wanted to compare the quality differences between different permutations of S-VHS and VHS recordings, along with using S-Video and Composite transmission

METHODOLOGY

COMPARING RESULTS

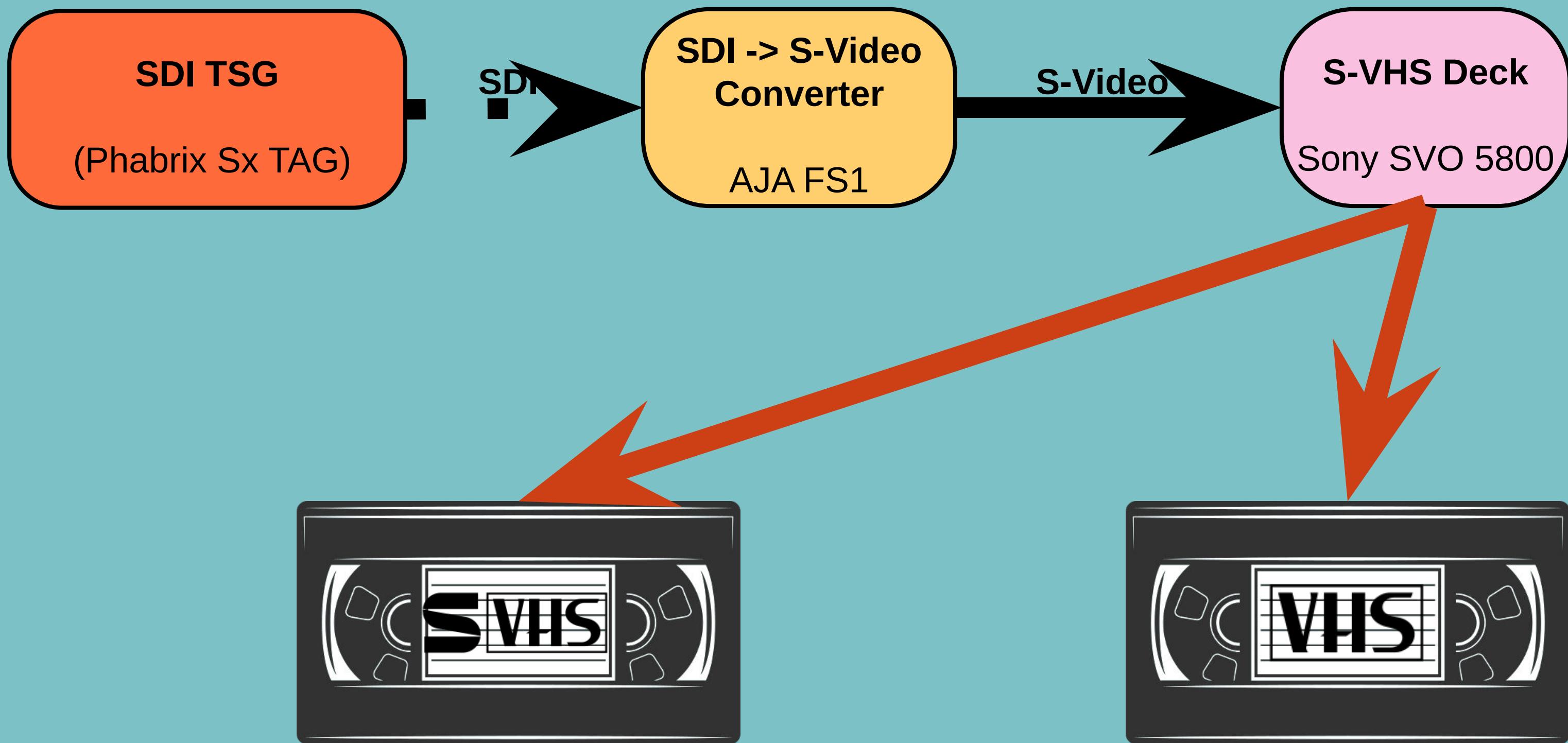
- Visual comparison: Compose videos in DaVinci Resolve to easily compare their resolution and any artifacts
- Data Comparison: Look at the resulting file in QC Tools. Analyze saturation and compression rates

METHODOLOGY USING QCTOOLS DATA

- SAT MAX
 - The highest saturation value in the frame
 - High saturation values in black and white content are indicative of cross-color errors
- PACKET SIZE:
 - The size in bytes of the frame, which is variable for compressed formats
 - Larger packet sizes indicate more complex visual

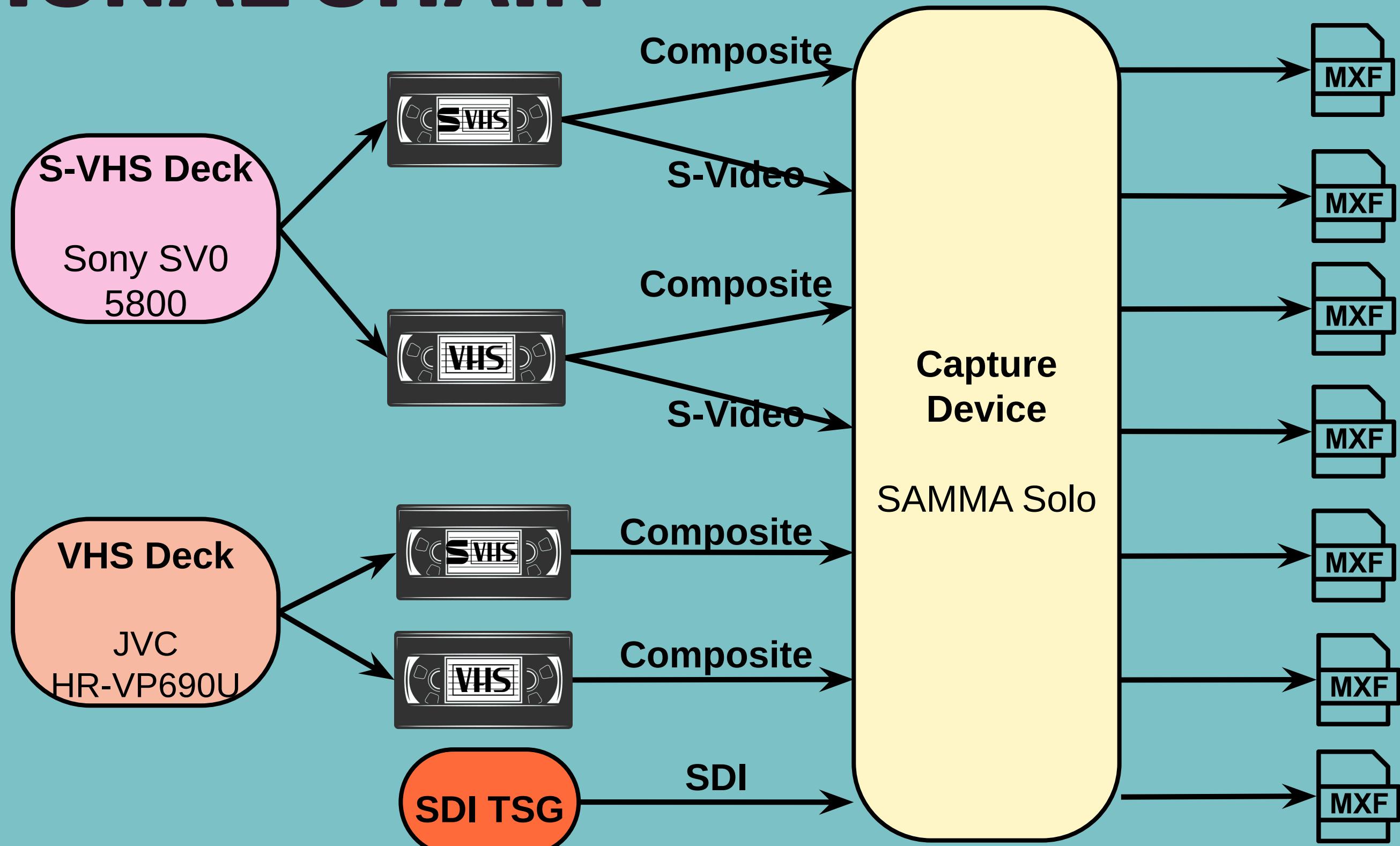
METHODOLOGY

SIGNAL CHAIN



METHODOLOGY

SIGNAL CHAIN



METHODOLOGY

TEST SIGNALS

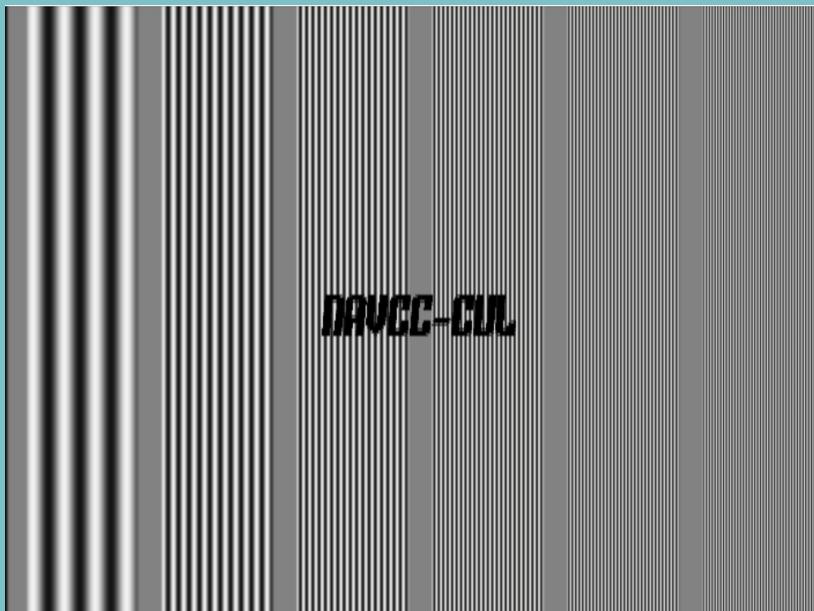
SMPTE Bars



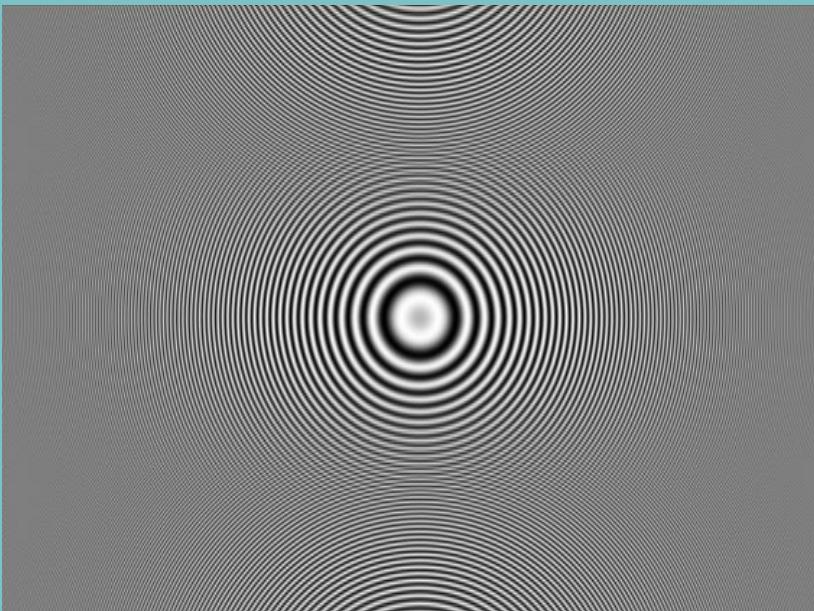
Tartan Bars



Multiburst



Zone Plate

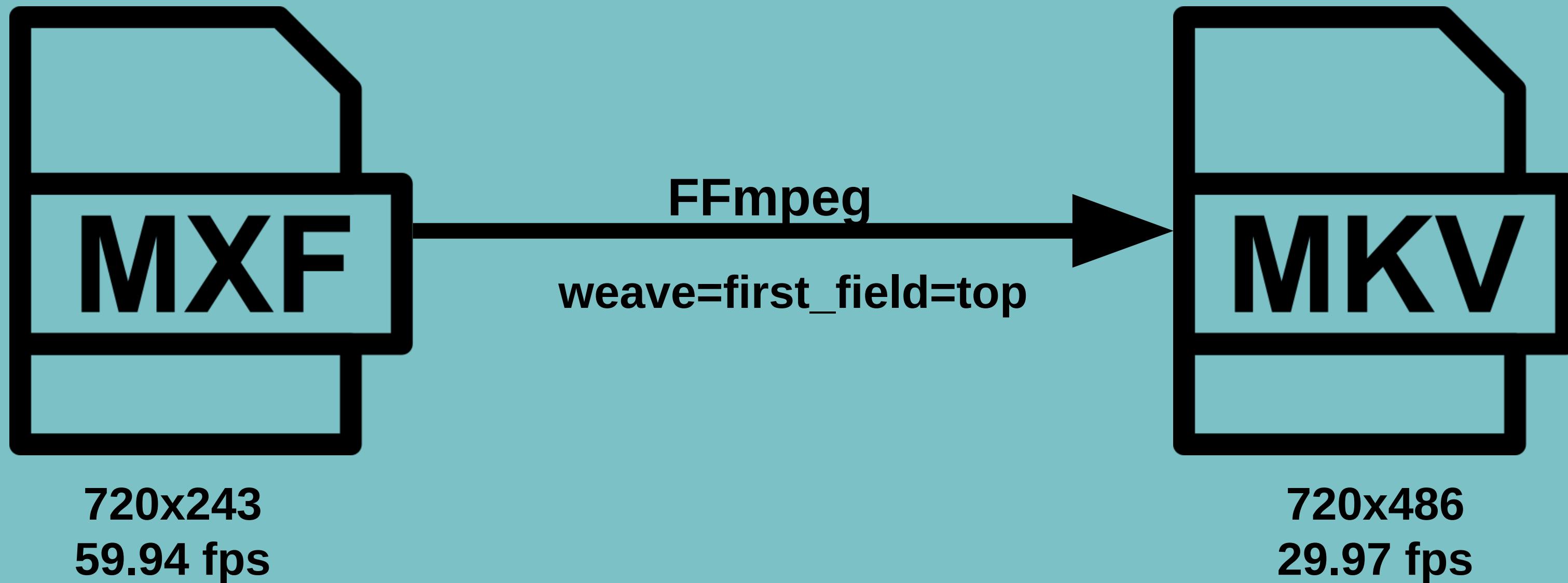


Content



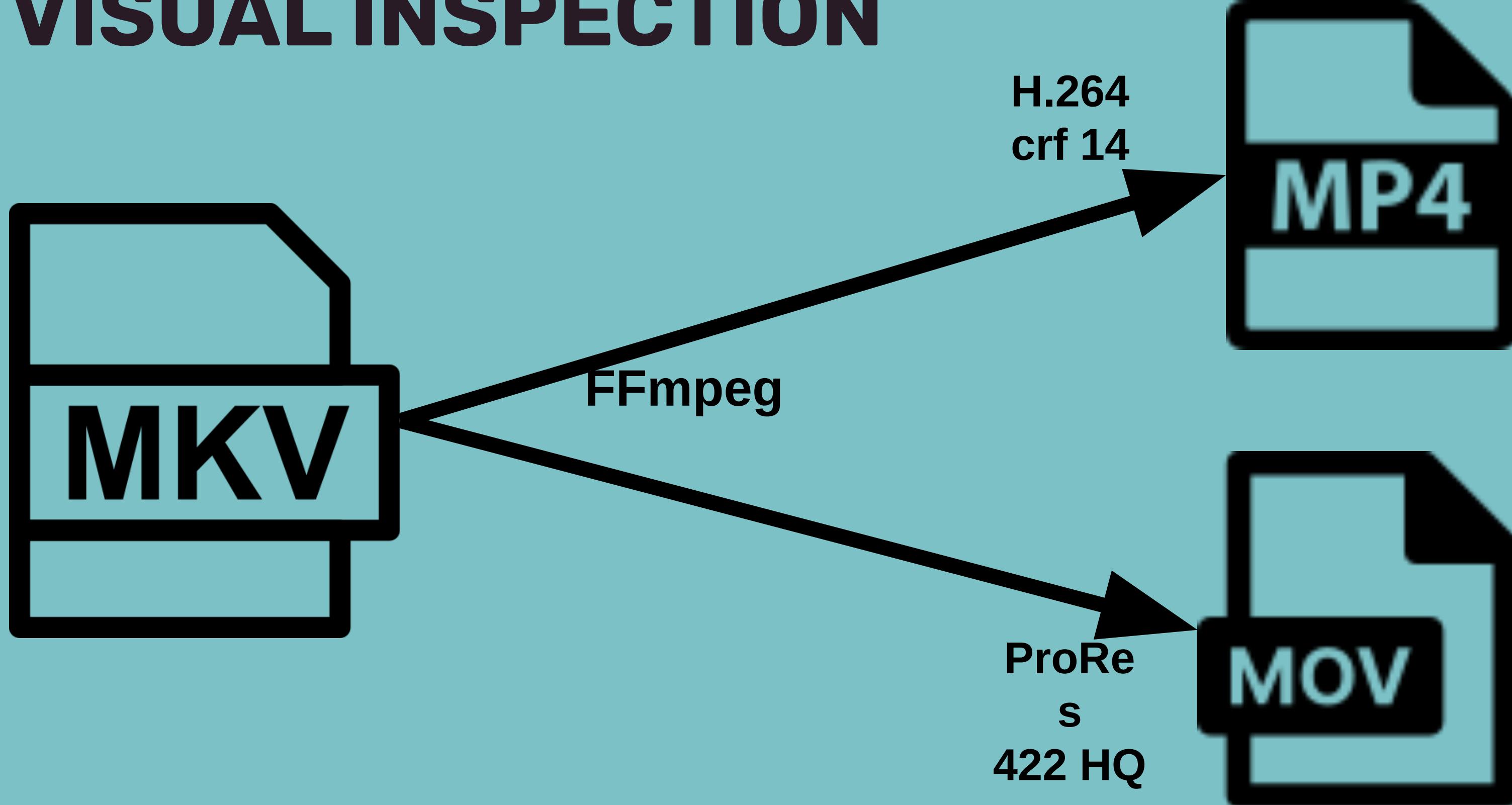
METHODOLOGY

VISUAL INSPECTION



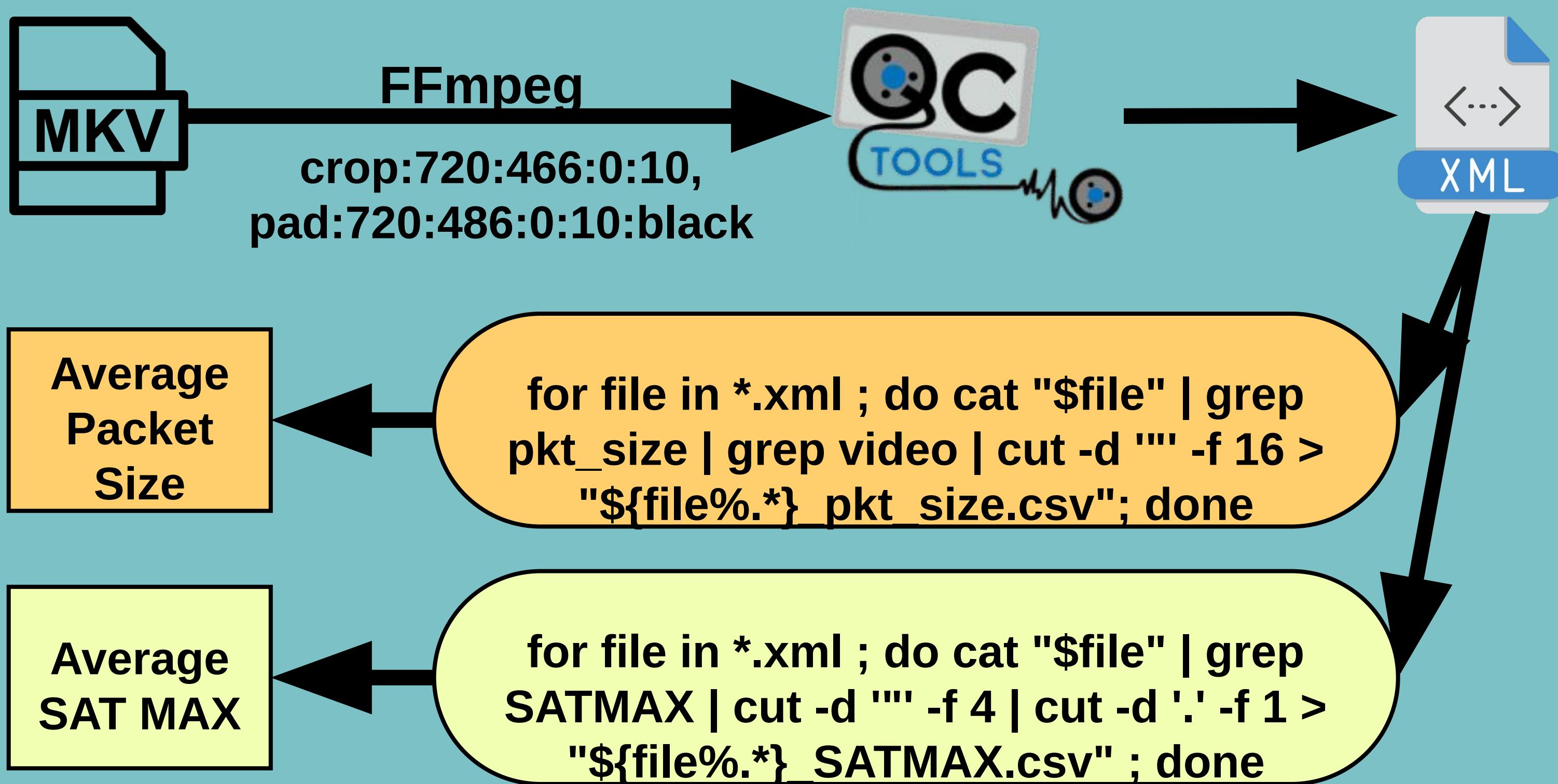
METHODOLOGY

VISUAL INSPECTION

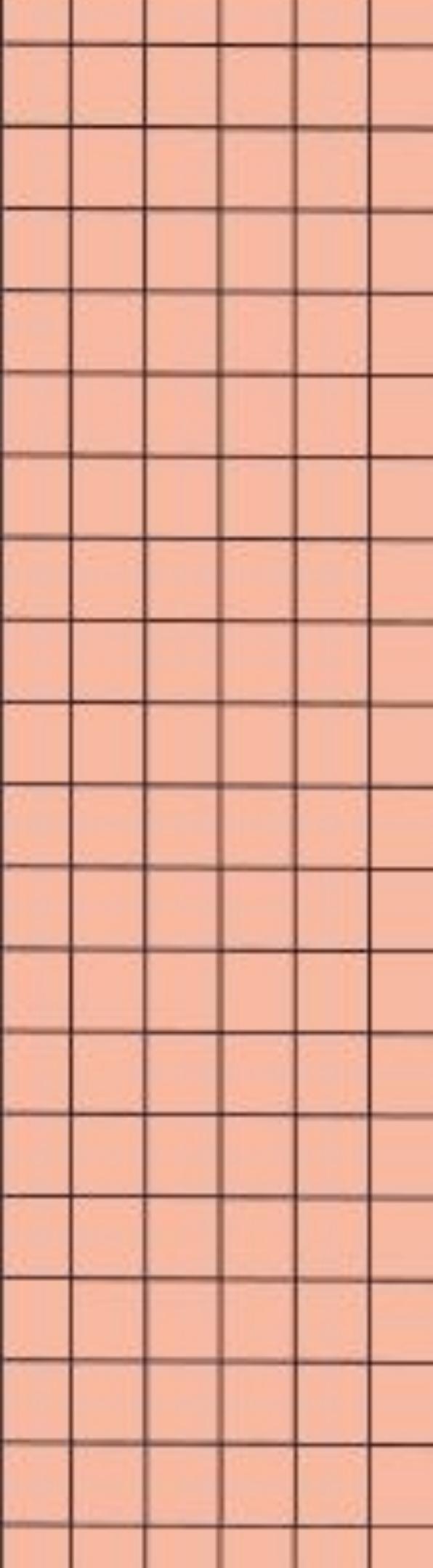
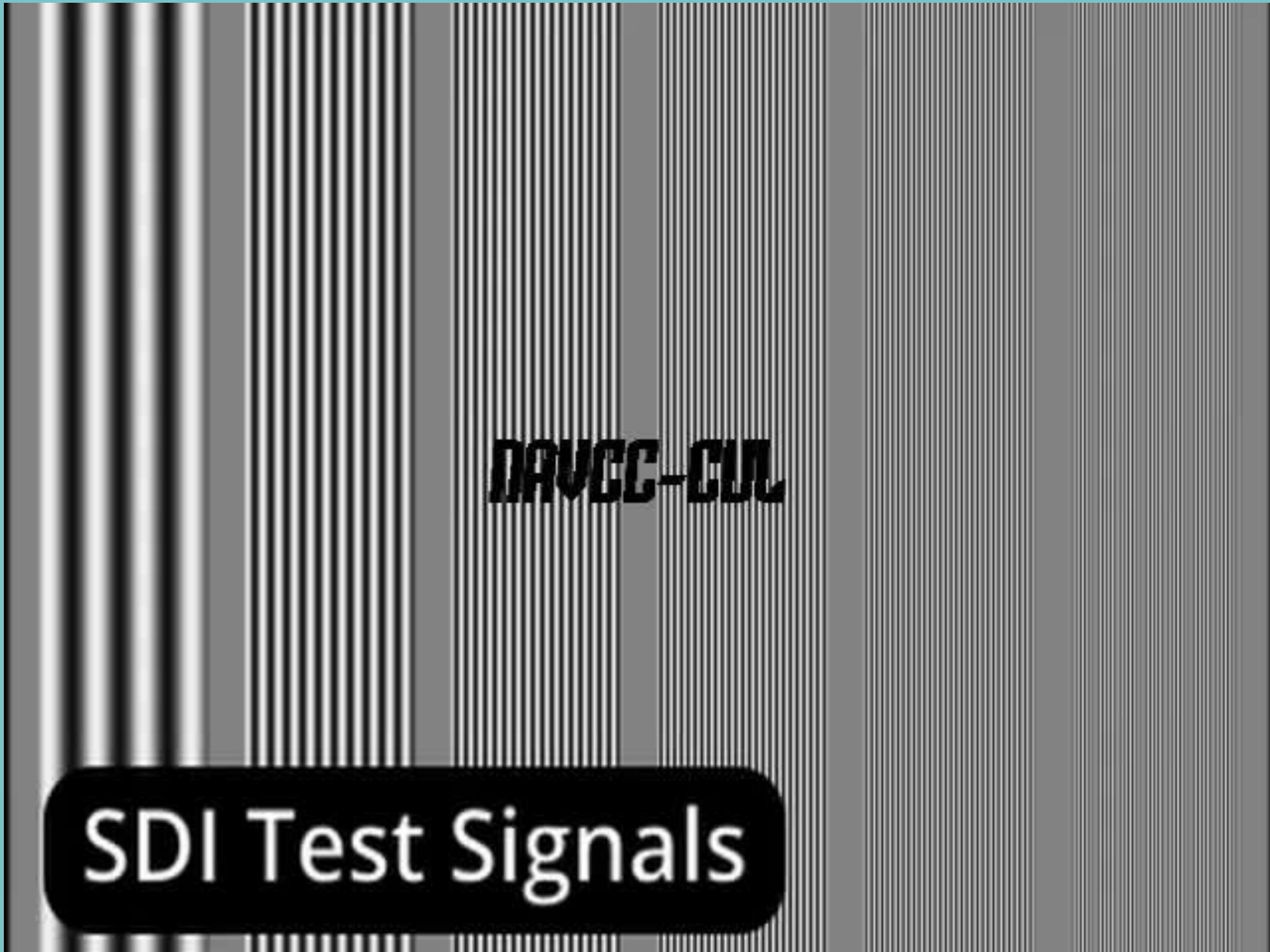


METHODOLOGY

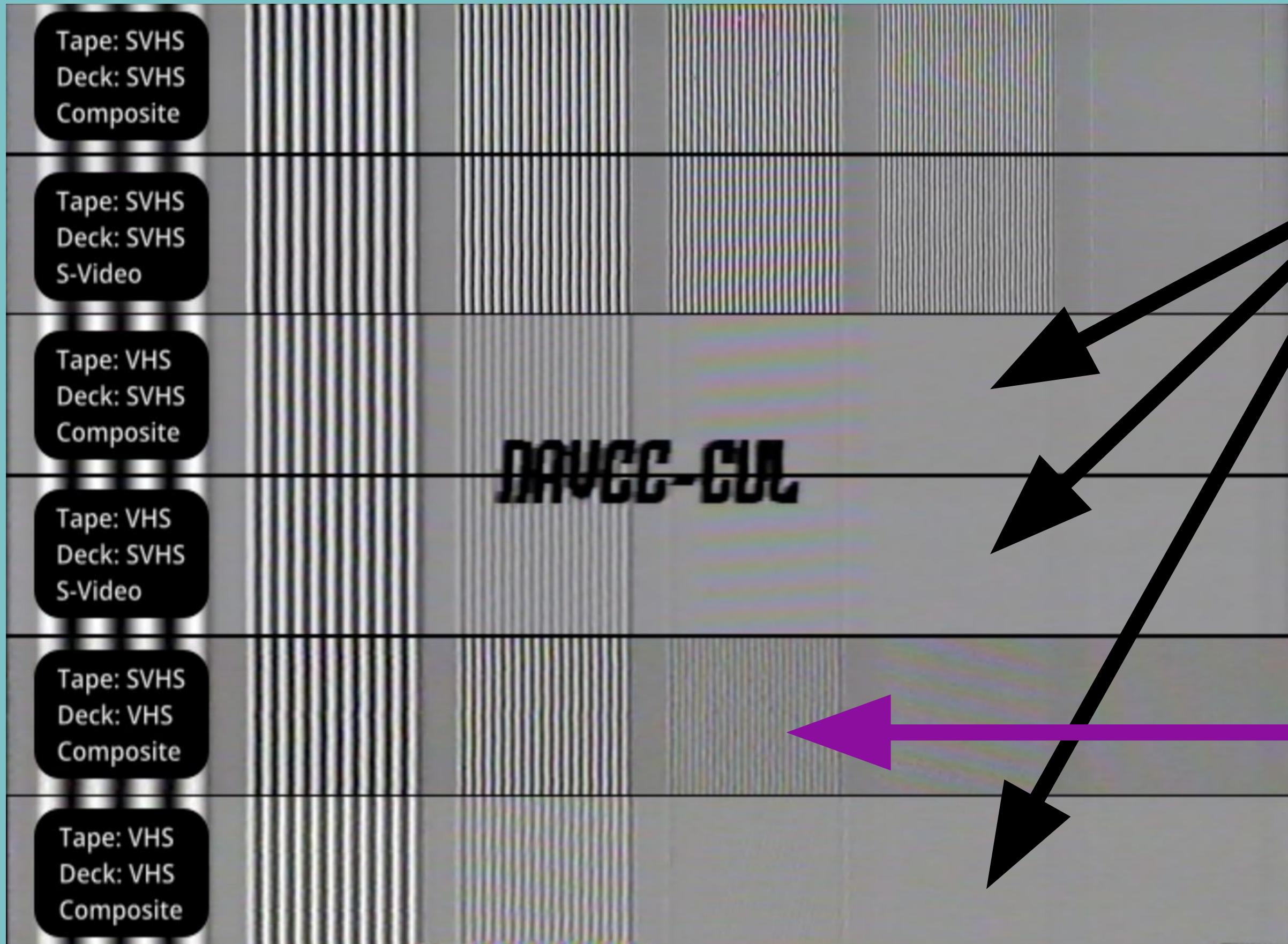
DATA INSPECTION



RESULTS: MULTIBURST



RESULTS: MULTIBURST



Details lost
entirely on VHS
tape

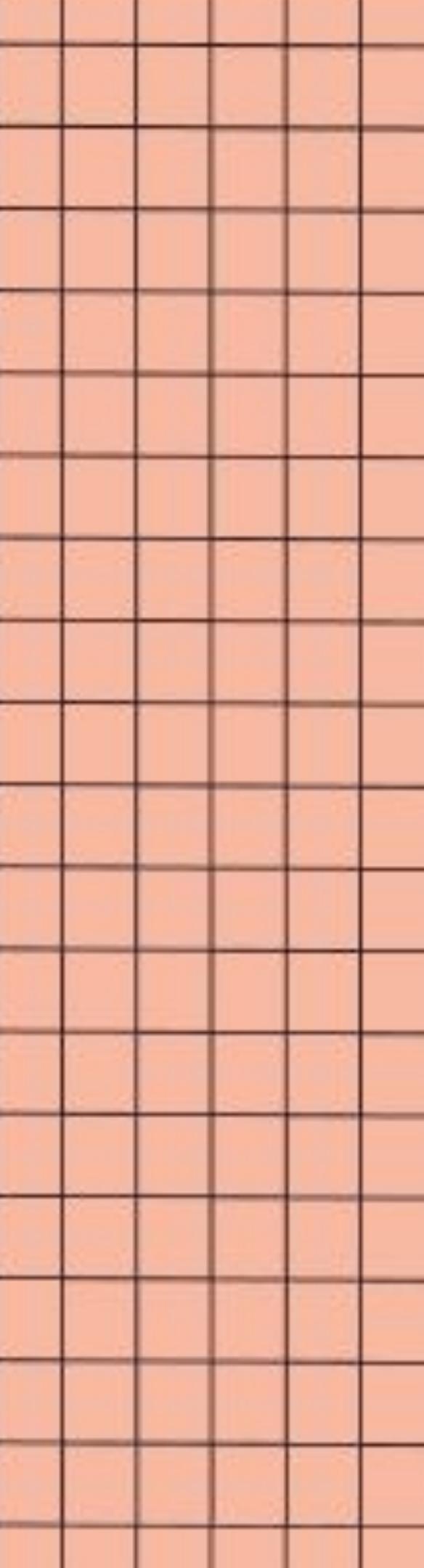
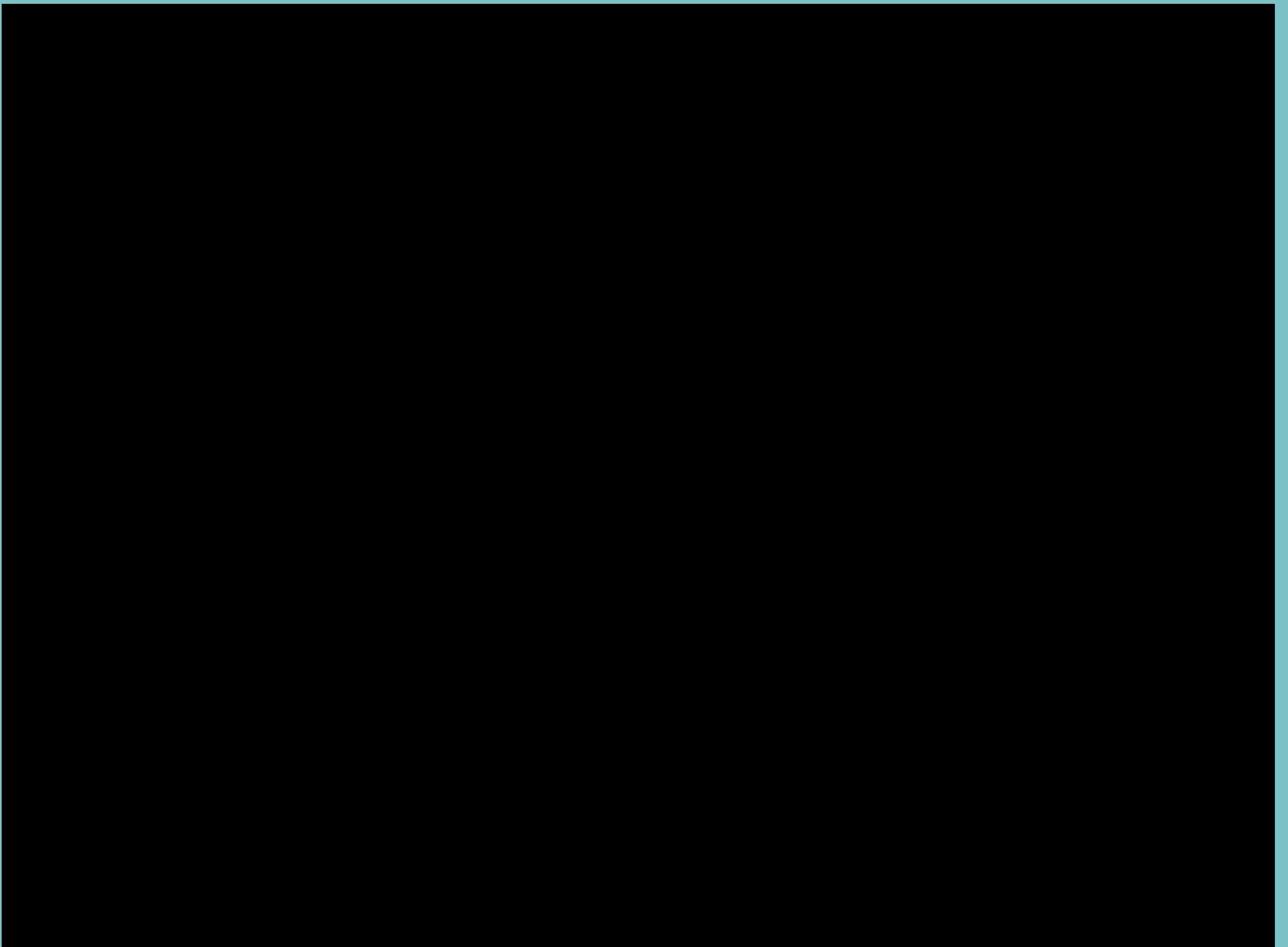
VHS deck able to get
some extra details
from an SVHS tape

WARNING

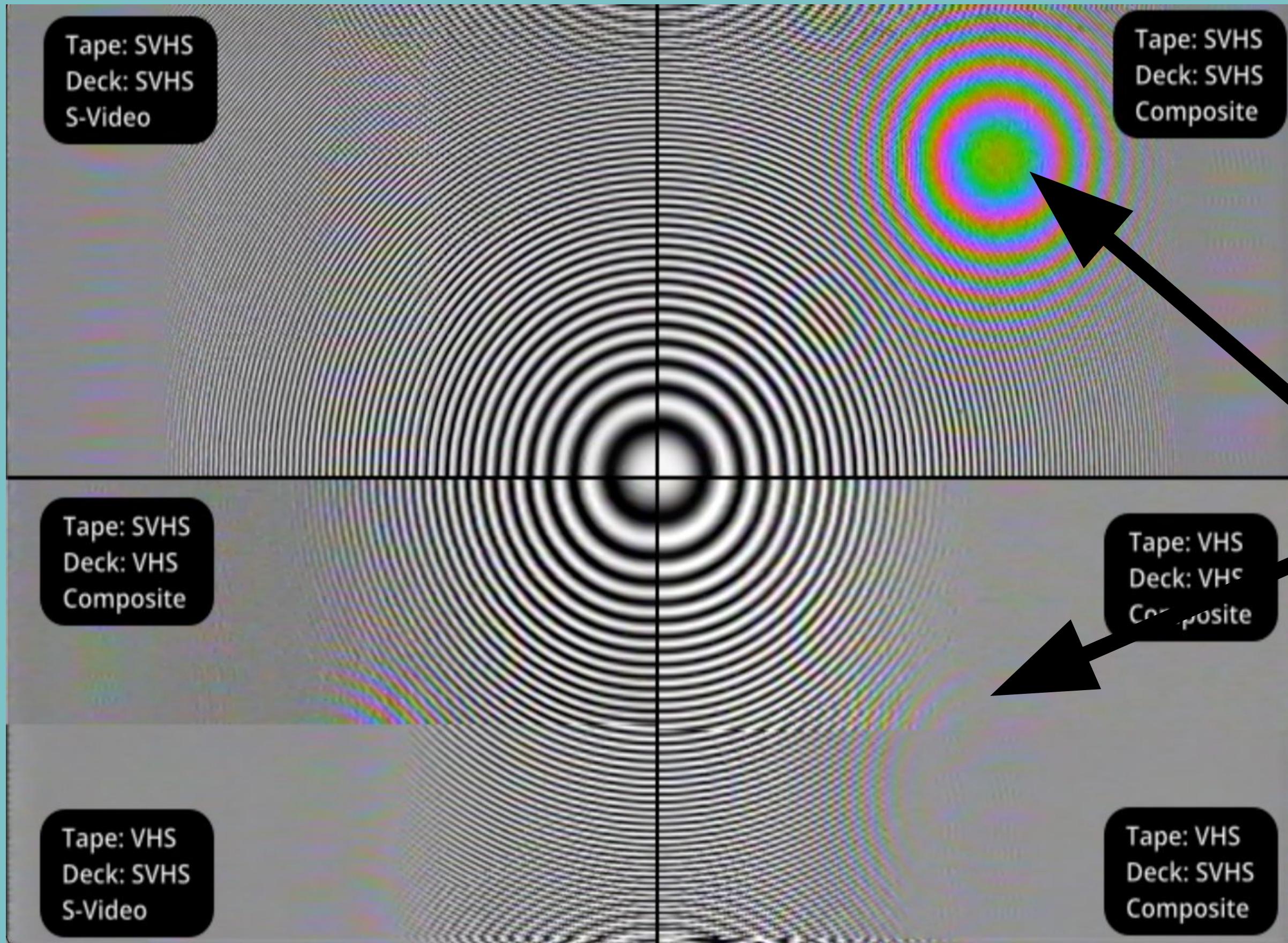
**THIS VIDEO HAS BEEN IDENTIFIED
BY EPILEPSY ACTION TO POTENTIALLY
TRIGGER SEIZURES FOR PEOPLE WITH
PHOTOSENSITIVE EPILEPSY.**

VIEWER DISCRETION IS ADVISED.

RESULTS: ZONE PLATE



RESULTS: ZONE PLATE

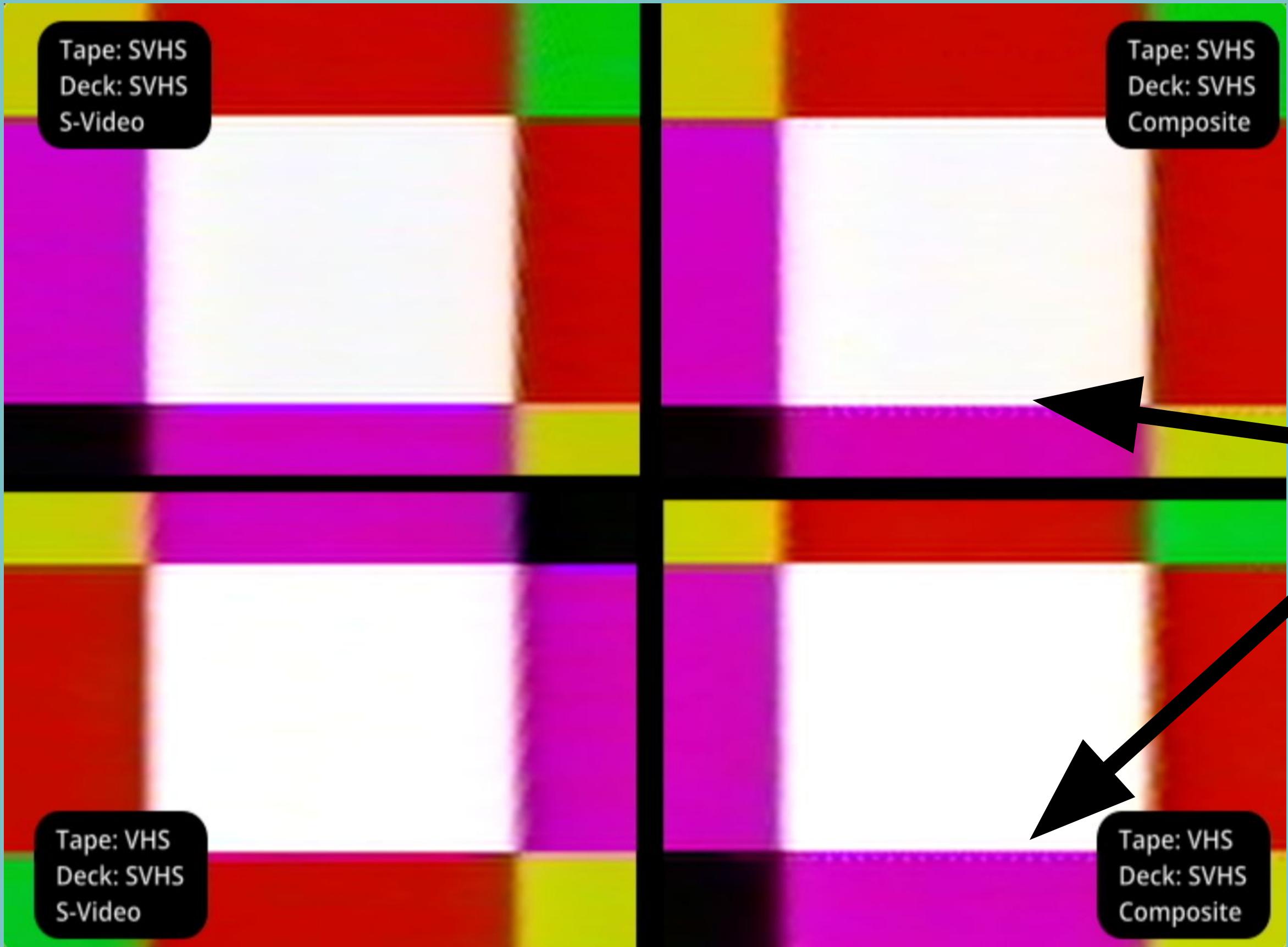


Significant Cross
color errors when
using composite

RESULTS: TARTAN BARS



RESULTS: TARTAN BARS



Dot-crawl visible
in composite
transmission of
both VHS and
SVHS

RESULTS: CONTENT



SVHS: S-Video
vs
SVHS: Composite

Cross Color in
tight details

RESULTS: CONTENT



SVHS: S-Video
vs
VHS: Composite

Lost detail, image
is blurry

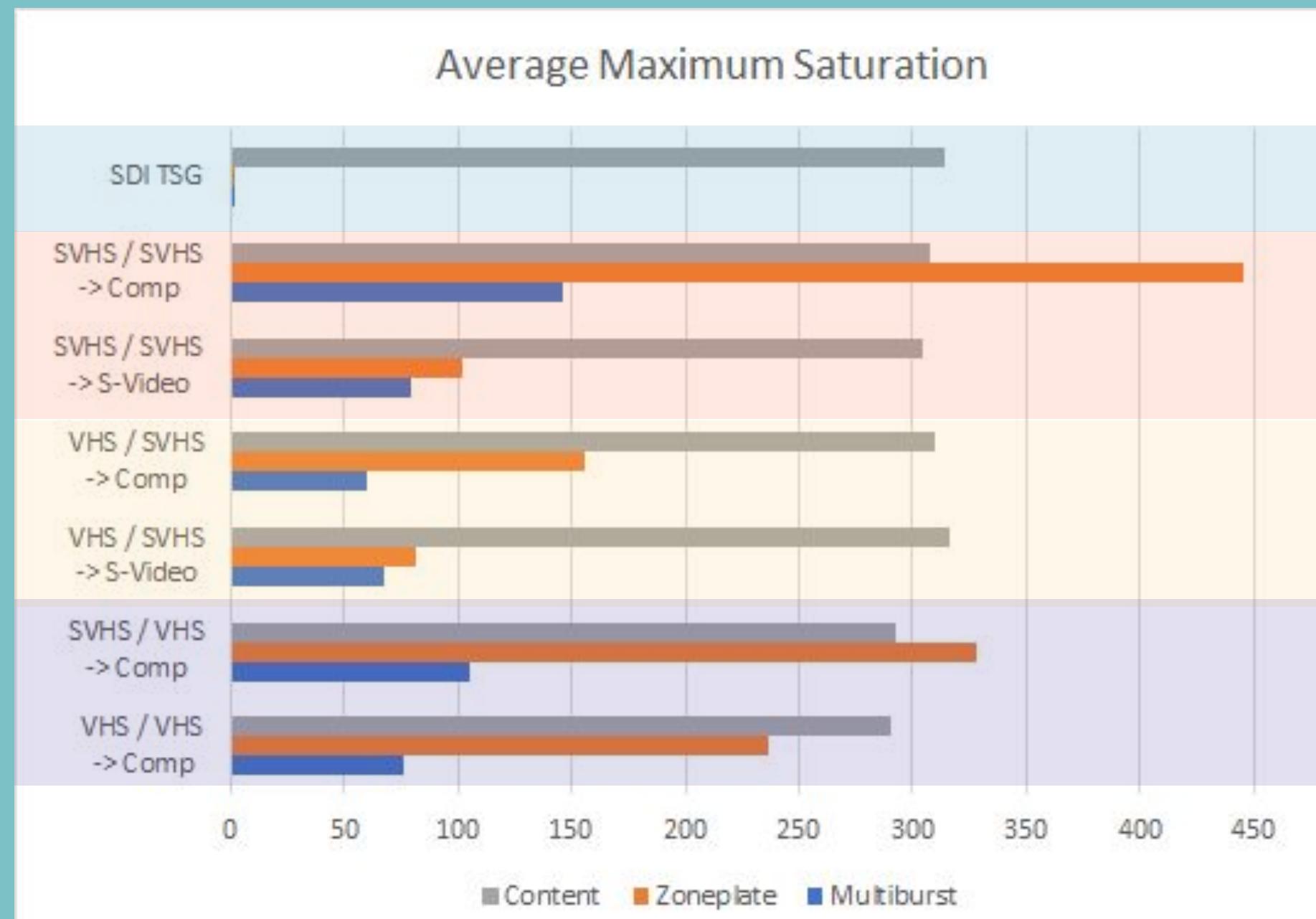
No cross color in
superimposed text

RESULTS: DATA

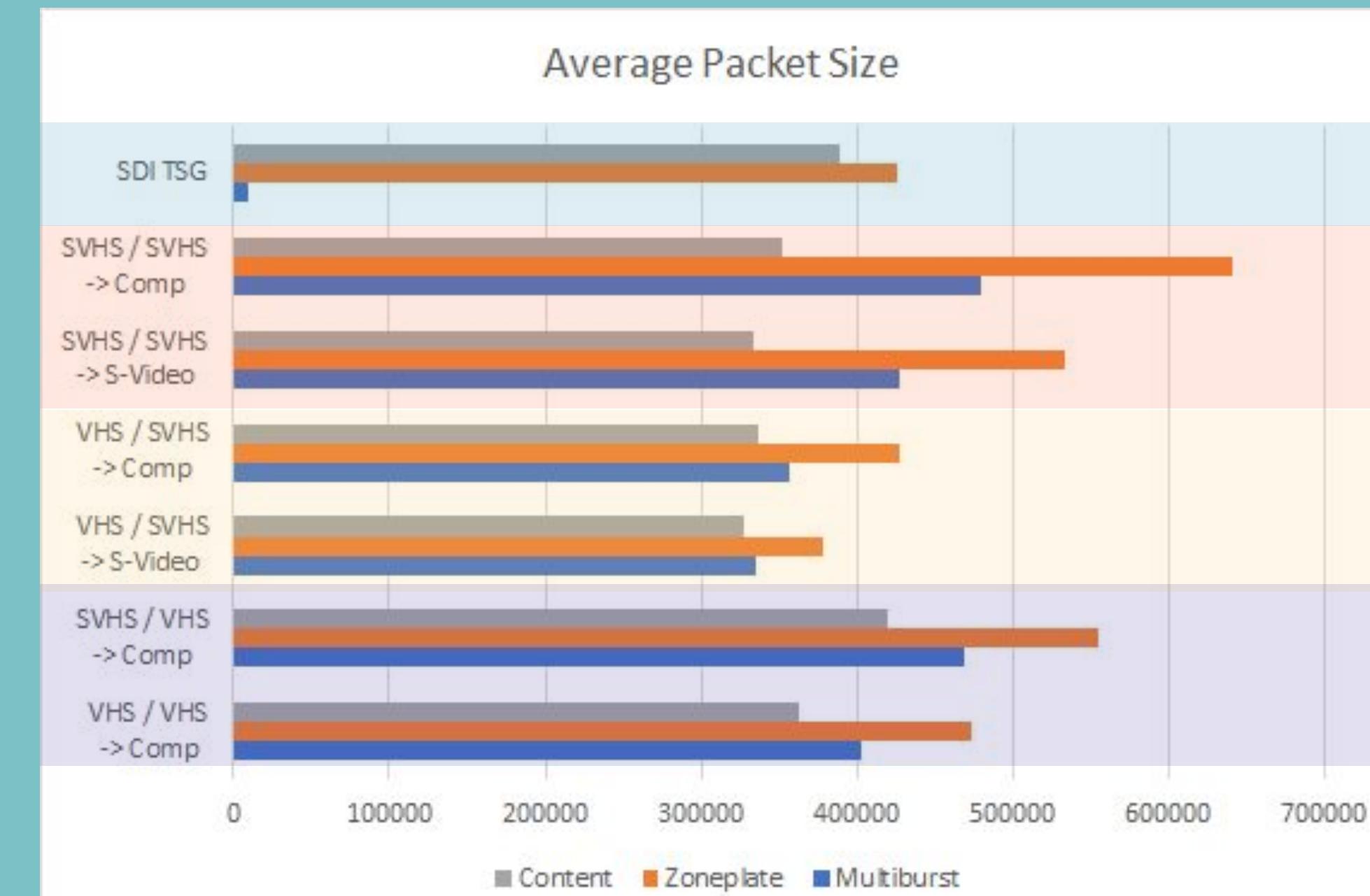
RECORDING	SDI	SVHS	SVHS	VHS	VHS	SVHS	VHS
PLAYBACK	N/A	SHVS	SVHS	SVHS	SVHS	VHS	VHS
TRANSMISSION	SDI	Comp	S-Video	Comp	S-Video	Comp	Comp
MULTIBURST SAT MAX	2	146	80	60	68	105	76.7
ZONEPLATE SAT MAX	2	445	102	156	82	328	237
CONTENT SAT MAX	314	308	304	310	316	293	290
MB PACKET SIZE	9969	480234	427413	356887	335185	468598	403388
ZP PACKET SIZE	426591	641312	533859	428285	378757	555583	473971
CONTENT PKT SIZE	392853	352949	334004	337335	328166	419224	363676

RESULTS: DATA

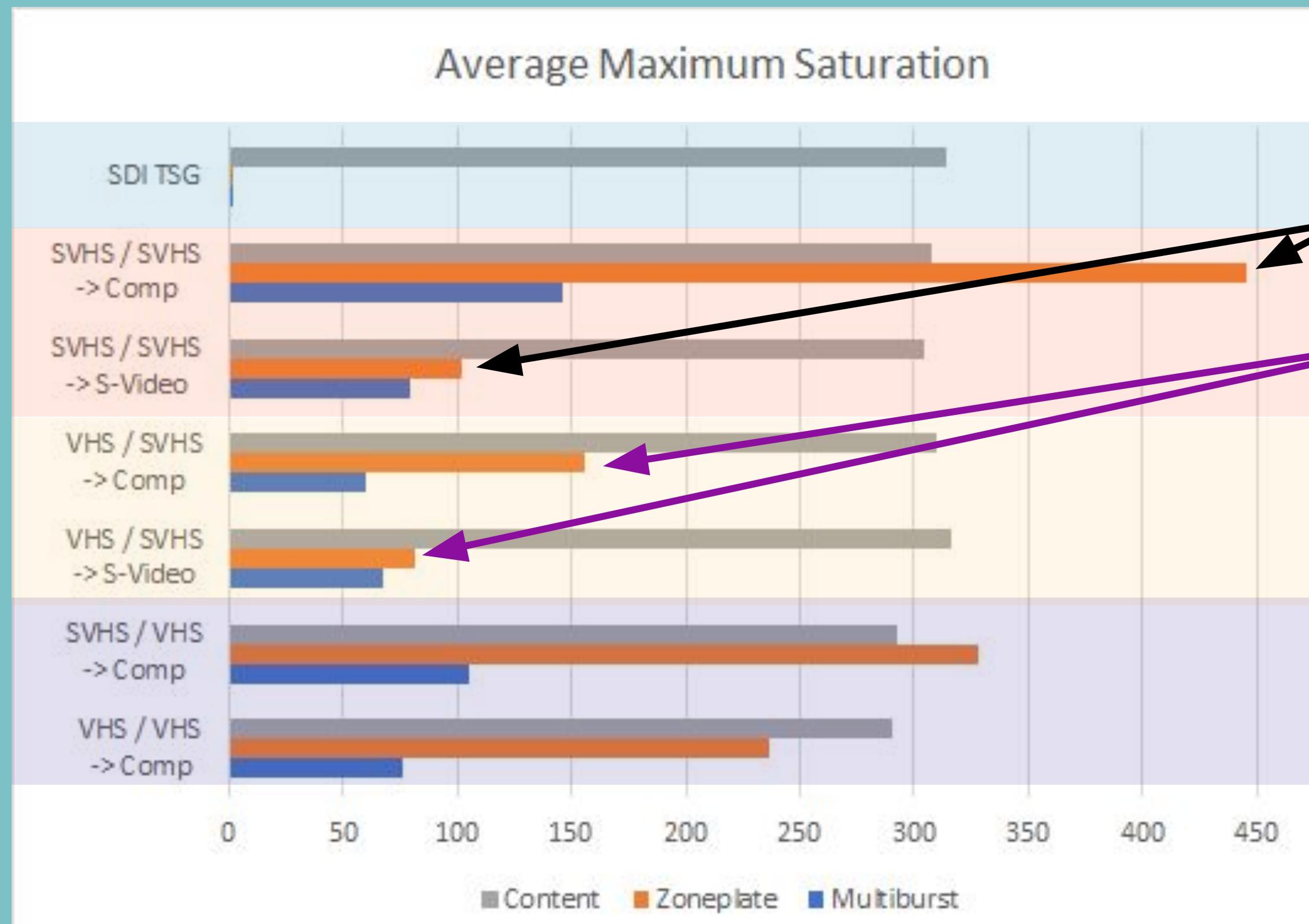
Average Maximum Saturation



Average Packet Size

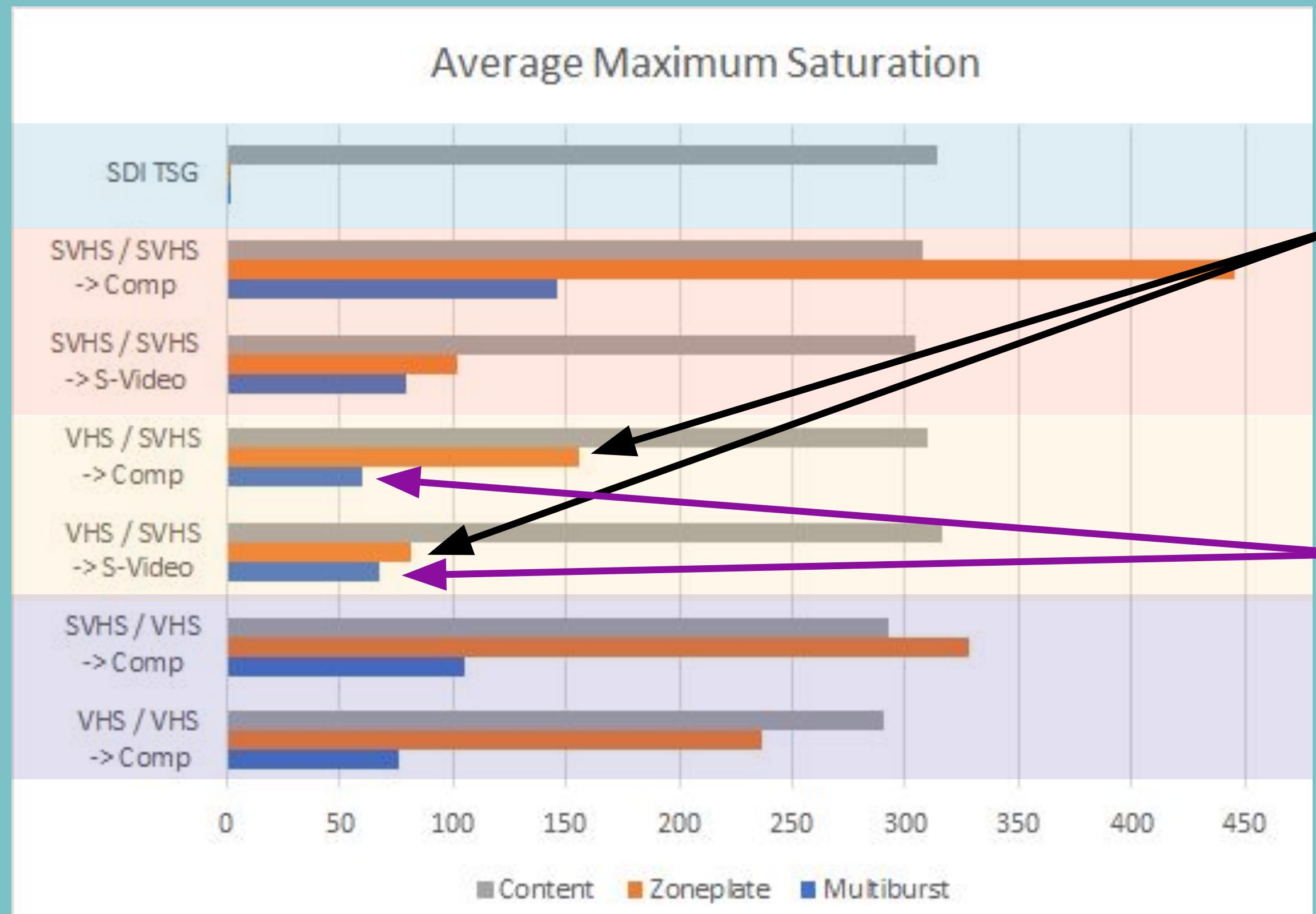


RESULTS: DATA



S-Video significantly
reduces cross-color
errors for SVHS tapes

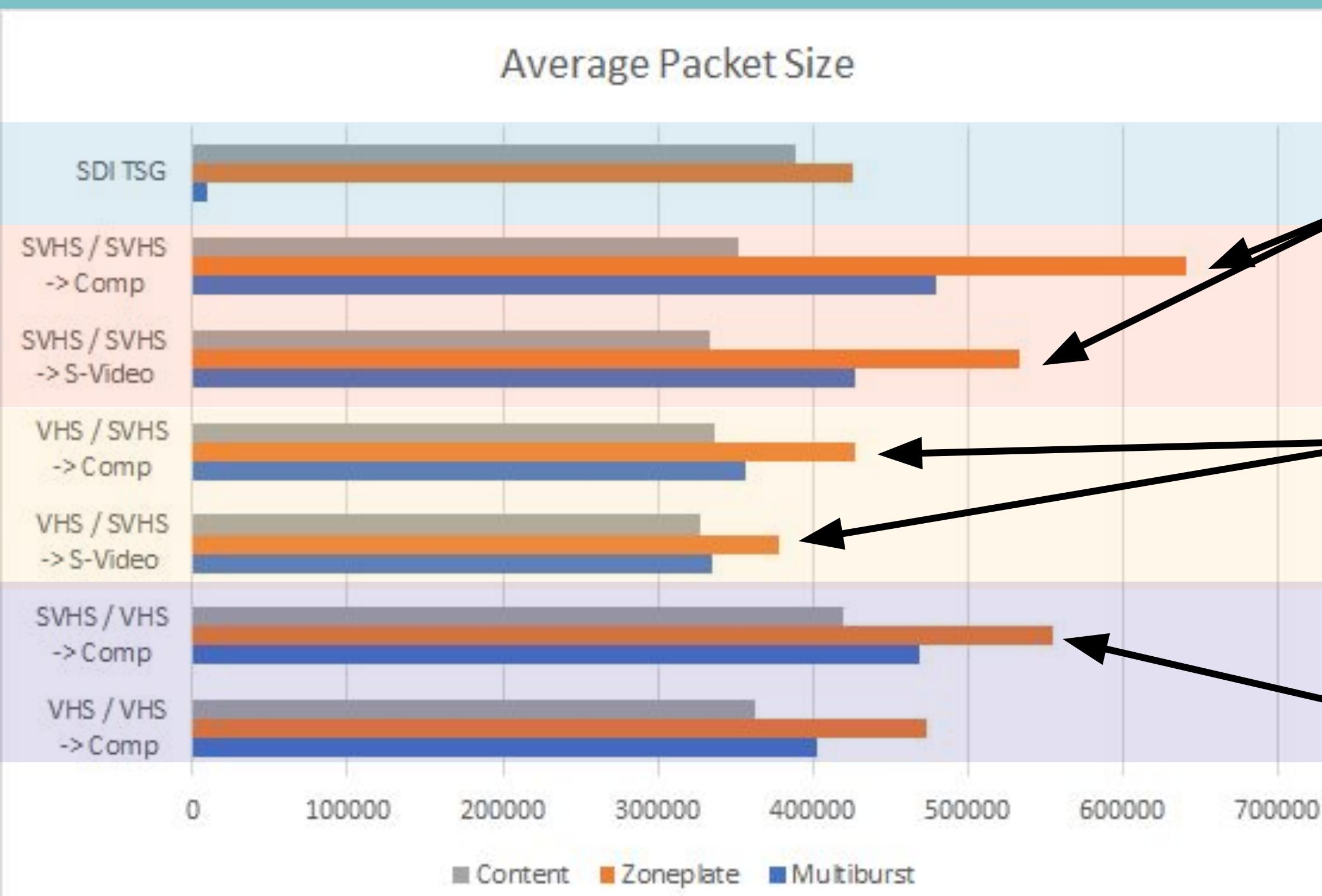
RESULTS: DATA



S-Video reduced errors
for VHS zone plate...

but slightly increased
errors in the multiburst

RESULTS: DATA



SVHS recording offers significantly more detail...

over VHS recordings

Even if played back on an VHS deck

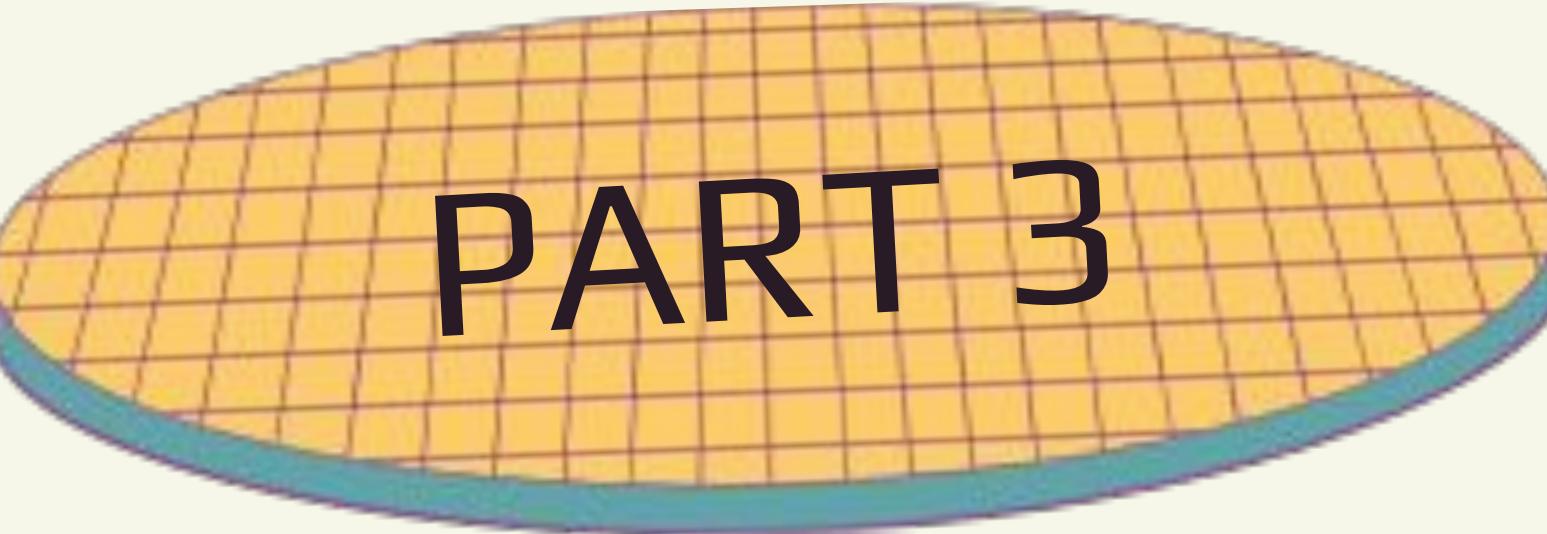
ANALYSIS

S-VHS offers **significantly more detail** over VHS, even if the playback deck is VHS

S-Video **reduces dot crawl** errors for SVHS and VHS tapes

S-Video significantly **reduces cross-color** errors for SVHS tapes

S-Video may increase cross color errors for VHS tapes depending on the complexity and detail of the recorded content



PART 3

APPLYING IN A PRESERVATION CONTEXT

RECOMMENDATIONS

Use S-VHS decks to transfer both S-VHS
and VHS Tapes

Use S-Video to transfer S-VHS tapes

I cannot make a recommendation for whether
to use S-Video or Composite VHS tapes

CHALLENGES

Equipment common in preservation labs does
not support S-Video

Blackmagic UltraStudio

DPS 575

Equipment that does support S-Video is expensive.
How do we prioritize our budgets?

AJA FS2

BrightEyes75

Adding more processing in signal chains adds
more opportunities for error

NEXT STEPS

Rerun the experiment focusing on different types of content

Find other QCTools parameters to use as data points

Experiment with U-matic Dub output

Further experimentation with 3D comb filters and tunable notch/bandpass filters

THANK YOU!

Q&A

