



vrecord: An Open Source Case Study

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Annie Schweikert, NYU Moving Image Archiving and Preservation @aeschweik
Andrew Weaver, Washington State University @private_zero



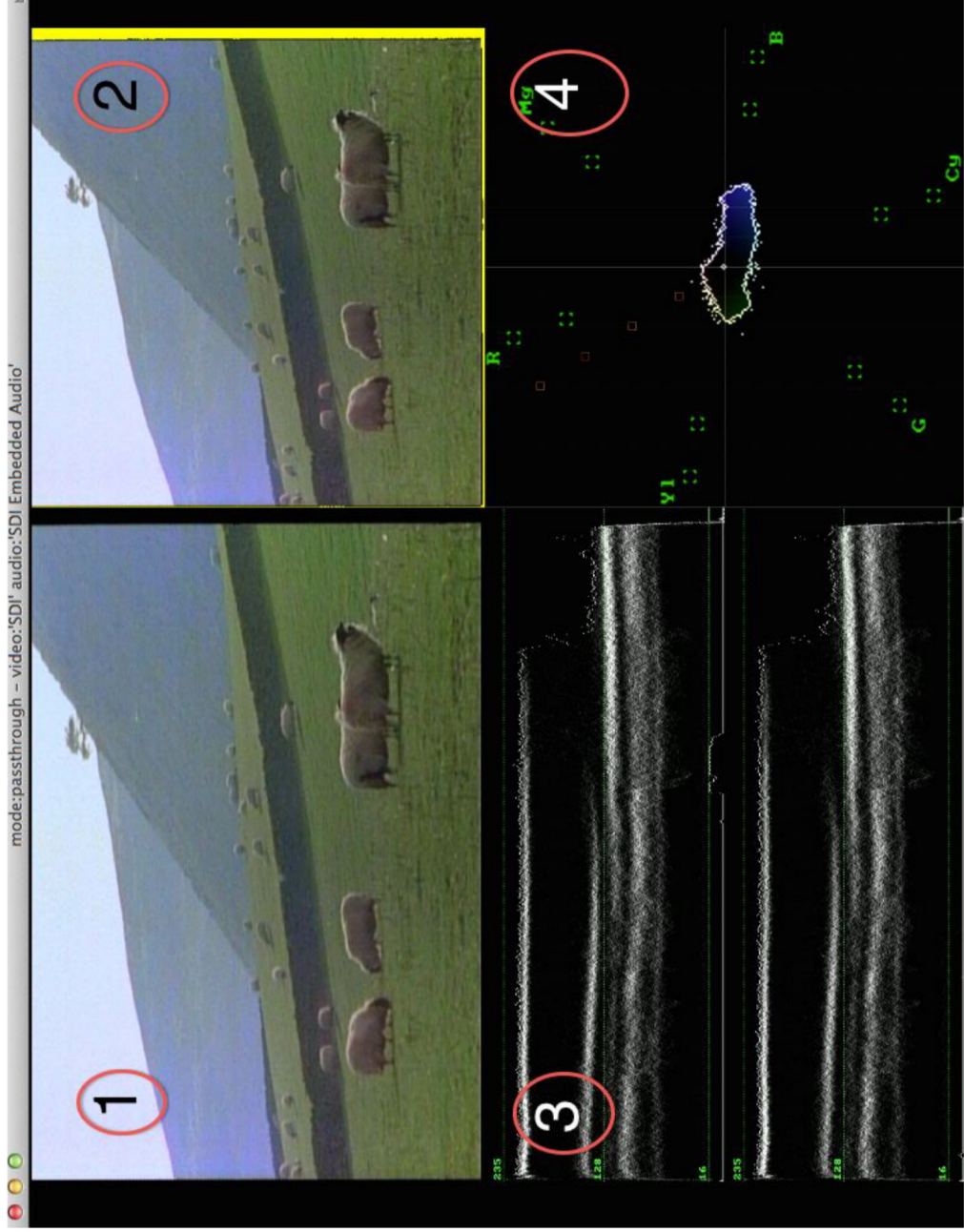
Who are we?

What is vrecord?



vrecord is:

- A way to digitize (analog) or transfer (digital) video
- Designed for AV archivists
- A 2014 Hack Day project shepherded by Dave Rice
- Open-source software - a tool to which you can contribute!
- A flexible, customizable tool



From the [vrecord documentation](#)

Set file recording options. Leave the option as "Undeclared" to be prompted later. Select a recording directory.

/Users/Annie/Desktop

Select a directory for auxiliary files (leave blank to match the recording directory).

/Users/Annie/Desktop

Select Video Input Select File Format Select Codec for Video Select Video Bit Depth

Undeclared Undeclared Undeclared Undeclared
 Composite QuickTime Uncompressed Video 10 bit
 SDI Matroska FFV1 version 3 8 bit
 Component AVI JPEG2000
 S-Video MXF ProRes

Select Audio Input Select Audio Channel Mapping

Undeclared 2 Stereo Tracks (Channels...)
 Analog
 SDI Embedded Audio
 Digital Audio (AES/EBU)

Select Television Standard

Undeclared NTSC
 PAL

Create QCTools XML?

Undeclared
 Yes, after recording
 Yes, concurrent with recording
 No

Create frame-level MD5 checksums? (recommended)

Undeclared
 Yes
 No

Embed digitization logs in video file? (Matroska only)

Undeclared
 Yes
 No

Set recording time (integer or decimal) in minutes. Enter the name of the person digitizing this tape.

Select View

Quality Control View (mpv)

WARNING: Do not use this option unless required to convert Second Channel of Audio

Options geared towards AV archivists

```

test_capture_options.log
computer_name: Annie-MacBook-Pro.local
computer_model_name: MacBook Pro
computer_model_id: MacBookPro12,1
computer_processor_name: Intel Core i5
computer_processor_speed: 2.7 GHz
computer_processor_count: 1
computer_cores: 2
computer_memory: 8 GB
computer_serial: C02QRJRVFVH5
user_name: Annie
operating_system_version: Darwin Kernel Version 17.0.0: Wed Oct 10 23:06:14 PDT 2018;
root:xnu-4570.71.13~1/RELEASE_ARM64_T8020
record version: 2018-11-30T13:19:07
datetime_start: 2018-11-30T13:19:07
capture_device_node: /dev/disk1
capture_device_protocol: PCI
capture_device_name: APPLE SSD SM0256G
capture_device_block_size: 4096 bytes
capture_device_location: Internal
capture_device_partition_type: 41594653-0000-11AA-A111-003066543ECAC
capture_device_volume_name: APFS
capture_device_volume_uuid: 001D84ED-2227-326E-AE11-548033256670
capture_device_volume_total: 250.8 GB (250790436864 Bytes) (exactly 489825072 512-Byte-Units)
FILE_PATH: /Users/Annie/Desktop/test_ffv1.mkv
video_card_driver_version: 10.11.2
video_card_name: UltraStudio Express
VIDEO_INPUT_CHOICE: Composite
AUDIO_INPUT_CHOICE: Analog
VIDEO_BIT_DEPTH_CHOICE: 10 bit
AUDIO_MAPPING_CHOICE: 2 Stereo Tracks (Channels 1 & 2 -> 1st Track Stereo, Channels 3 & 4 -> 2nd Track Stereo)
STANDARD_CHOICE: NTSC
PLAYBACKVIEW_CHOICE: Quality Control View (mpv)
CONTAINER_CHOICE: Matroska
VIDEO_CODEC_CHOICE: FFV1 version 3
QCTOOLXML_CHOICE: Yes, after recording
FRAMEWDS_CHOICE: Yes
EMBED_LOGS_CHOICE: No

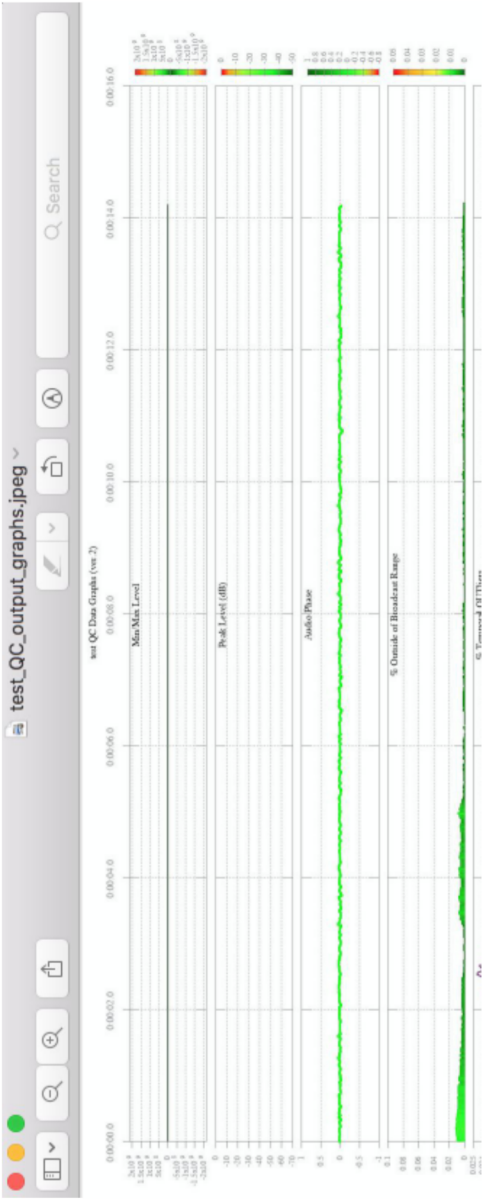
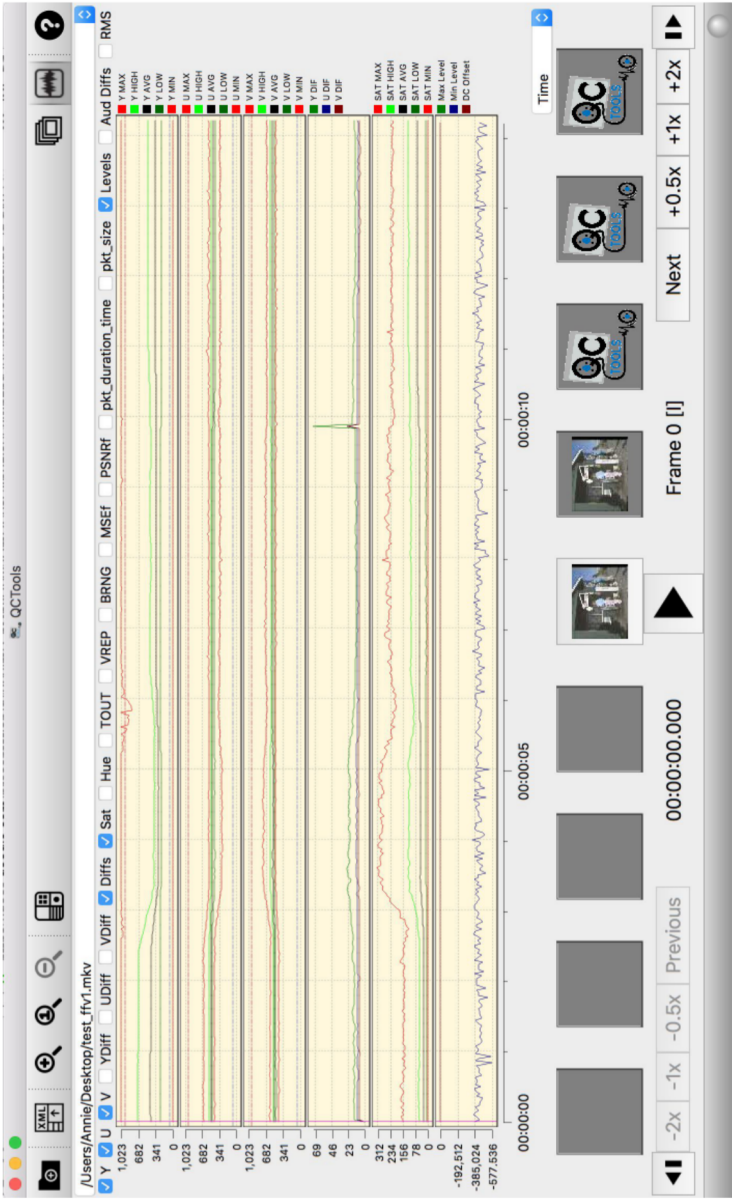
```

```

TECHNICIAN: Annie
FFmpeg command: /usr/local/opt/ffmpegdecklink/bin/ffmpeg-dl -nostdin -nostats -loglevel info -
f decklink -draw_bars 0 -audio_input analog -video_input composite -format_code ntscc -channels
8 -audio_depth 32 -raw_format yuv422p10 -i UltraStudioExpress -metadata:s:v:0 encoder=FFV1
version 3 -color_primaries smpte170m -color_trc bt709 -colospace smpte170m -color_range mpeg
-metadata creation_time=now -c:v ffv1 -level 3 -g 1 -slices 16 -sliceccr 1 -c:a pcm_s24le -
filter_complex [0:v:0]setsar=40/27,setw=4/3; [0:a:0]pan=stereo|c0=c0|ci=c1|stereo!|[0:a:
0]pan=stereo|c0=c2|ci=c3|stereo2] -map [stereo2] -map [stereo2] -f matroska /Users/Annie/
Desktop/test_ffv1.mkv -an -f framewds /Users/Annie/Desktop/test_ffv1.framewds -c copy -map 0 -
f nut -syncpoints none -f strict_experimental -write_index 0 -
datetime_end: 2018-11-30T13:19:23
Peak Volume is (dB): -71.407016
PTS_DISCONTINUITY: none

```

Lots of logs





Open source software is:

- **Available:** It can be used by anyone
- **Decentralized:** It can be modified by anyone
- **Public:** Its source code is available for inspection and study
- **Collaborative** (in the best cases): Contributors share, discuss, approve, and clarify as a group



Challenges of open source

- **Relies on volunteer work:** Maintenance of record is not written into anyone's job description, even if it is integral to their work
- **Maintenance:** Open source tools can easily break when dependencies update (such as FFmpeg or the BlackMagic drivers)



How to contribute to vrecord:

1. Writing code
2. Testing and giving feedback
3. Using vrecord and training others

Writing code (even if you're new!)

- vrecord is written in Bash, the language of the Mac/Unix command line
- Free tutorials are abundant
- Borrow from existing code
 - Mimic syntax, change values
- Ask others to review/test your code
 - Pull Request
- It's ok to make mistakes!

Cutting corners to meet arbitrary management deadlines



Essential

Copying and Pasting
from Stack Overflow

O'REILLY®

The Practical Developer
@ThePracticalDev



But you don't have to write code!

- Documentation
- Typos
- Feedback
- Error logs
- Commiserating
- Supportive emojis

Feedback and questions

amiaopensource / vrecord

Code Issues 16 Pull requests 3 Projects 0 Wiki Insights Settings

Unwatch 33 Unstar 48 Fork 11

Vrecord is open-source software for capturing a video signal and turning it into a digital file.

<https://github.com/amiaopensource/vre...>

Changes to code (work on the code in your own "branch," then propose merging your changes in a pull request)

History of the code

858 commits 14 branches 63 releases 14 contributors

Branch: master New pull request

Create new file Upload files Find file

Clone or download

Download the code to make changes locally

Individual scripts and documents


dericed Merge pull request #392 from amiaopensource/various-updates

Resources

CONTRIBUTING.md	start on timecode documentation	4 days ago
README.md	move "contributing" back to first level (#355)	4 months ago
qview.lua	fix incorrect link (#360)	4 months ago
vrecord	fix relationship between bitplanes numbers and images	6 months ago
vrecord.1	minor performance improvement when signalstats metadata is unused in ...	5 days ago
vrecord_logo.png	nicer output (#386)	a month ago
vrecord_policy_ffv1.xml	Update and add logos	2 years ago
vrecord_policy_uncompressed.xml	indent after prior commit	4 months ago
vtest	Clarity in policies	8 months ago
vtest.1	use same order (#388)	a month ago
	nicer output (#386)	a month ago

 **[wish] suffix/prefix custom settings** wish

#342 opened on Jun 20 by libbyhopfauf

 **Issue with display timer speed** bug

#341 opened on Jun 20 by libbyhopfauf



Perspectives: Savannah Campbell



First Pull Request Failure



savcambell commented on Oct 5, 2016

Contributor



No description provided.



Added Color Matrix Filter and Edited Out cropdetect 

21a419e



dericed commented on Oct 5, 2016

Member



I think your fork was out of date as this undoes some of @privatezero's recent changes.



redid color matrix addition

5a10a0e



Learning GitHub Etiquette

The screenshot displays a GitHub commit history for a repository. It shows a merge commit by user **savcampbell** on Nov 22, 2016. The commit message is "Merge branch 'master' into 10-bit-saturation-warning". Below the commit message, there are two commit hashes: `9792c1c` and `5081dc0`. A comment by **savcampbell** is visible, stating "Saturation warning adjusted to report on illegal values in both 8-bit and 10-bit captures." Below the comment, there is a link to "Fixes #96". The commit is marked as "LGTM" (Looks Good To Me) by user **dericed** on Nov 22, 2016. The commit is merged into the `amaaopensource:master` branch. The commit hash for the merge is `1506a51`.

savcampbell commented on Nov 22, 2016 Contributor ...

Saturation warning adjusted to report on illegal values in both 8-bit and 10-bit captures.

savcampbell added some commits on Nov 22, 2016

Merge branch 'master' into 10-bit-saturation-warning `9792c1c`

Saturation warning adjusted for 10-bit `5081dc0`

savcampbell commented on Nov 22, 2016 Contributor ...

Fixes #96

dericed commented on Nov 22, 2016 Member ...

LGTM

dericed merged commit `1506a51` into `amaaopensource:master` on Nov 22, 2016



User Feedback and Testing



savcambell commented on Apr 27

Contributor

After updating vrecord to the latest version, I was getting the same error message as Libby. Running `brew reinstall qcli --HEAD`, `brew reinstall mpv`, and `brew reinstall bmdtools` fixed that issue, and record mode is running again. However, I am now getting a ton of errors that look like this:

```
metadata:
  encoder       : Lavc58.18.100 pcm_s24le
[decklink @ 0x7fe8fe03000] Frame received (#20) - Input returned - Frames dropped 2
[decklink @ 0x7fe8fe03000] Decklink input buffer overrun!
Last message repeated 20977 times
[matroska @ 0x7fe8ff09a00] Starting new cluster due to timestamp
[decklink @ 0x7fe8fe03000] Decklink input buffer overrun!
Last message repeated 19298 times
av_interleaved_write_frame(): Broken pipe
[decklink @ 0x7fe8fe03000] Decklink input buffer overrun!
Last message repeated 1 times
[nut @ 0x7fe8ff019c00] Multiple keyframes with same PTS
Last message repeated 10053 times
[decklink @ 0x7fe8fe03000] Decklink input buffer overrun!
[nut @ 0x7fe8ff019c00] Multiple keyframes with same PTS
[decklink @ 0x7fe8fe03000] Decklink input buffer overrun!
[nut @ 0x7fe8ff019c00] Multiple keyframes with same PTS
Last message repeated 2580 times
```

And the resulting video files have sync issues.

This might be a separate issue, though it only began for me after the latest update and reinstalling `qcli`, `bmdtools`, and `mpv`. I'm running the latest version of the BlackMagic drivers as well.



aeschweik commented on May 8

Contributor

Hi @savcambell, when you get a chance would you mind testing with `brew reinstall vrecord --HEAD` and choosing to create a QCTools XML after the transfer? (It'll be a new option in `vrecord -e`, or the `cli` will prompt you.) We've made some changes that we're hoping will lessen the conflict between `qcli` and `ffmpeg` 4.0.



savcambell commented on May 9

Contributor

Hi @aeschweik ! After reinstalling and selecting the option for creating a QCTools XML after the transfer, I am happy to say that I am no longer having issues with `pts_discontinuity` and `buffer_overrun`. Captures are going smoothly! However, even with that option selected it appears that currently a QCTools XML is not being created at all post-recording?



aeschweik commented on May 9

Contributor

Thank you for testing! #321 should fix this problem.



1



Perspectives: Annie Schweikert



How testing and feedback make vrecord better

- “vrecord is broken”
 - Logging and error reporting features make finding problems easier
 - Include the terminal output when you’re reporting an issue!
- “Is vrecord supposed to work like this?”
 - Maybe!
- “vrecord could be better”
 - Sure!



Positive feedback loop

Integrating policy checks into vrecord #241

Merged aeschweik merged 13 commits into amiaopense:master from aeschweik:policy on Feb 7

Conversation 6 Commits 13 Checks 0 Files changed 4

aeschweik commented on Feb 5

Supersedes #194, building on the work of @beccabender !

Member + 😊 ...

- Automating quality control feedback in vrecord
 - When is it my setup's fault? When is it vrecord's fault?
 - Making vrecord's feedback clearer can be a great contribution
- The more QC we add to vrecord, the more we will know when something is wrong, and the more we can send feedback to GitHub
- Keep your logs!

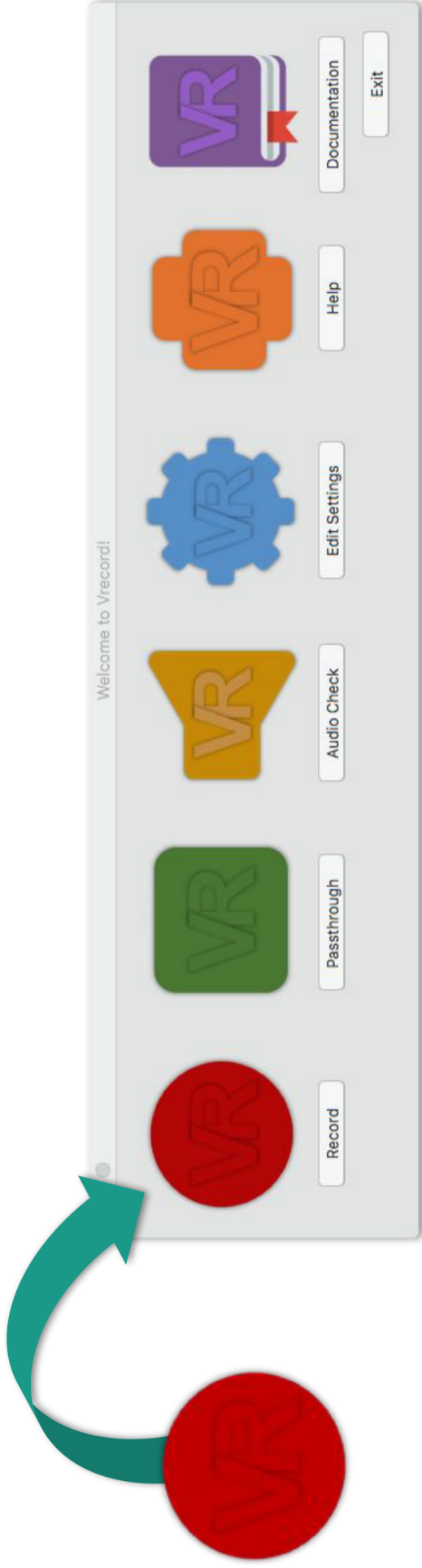


Perspectives: Libby Savage Hopfauf



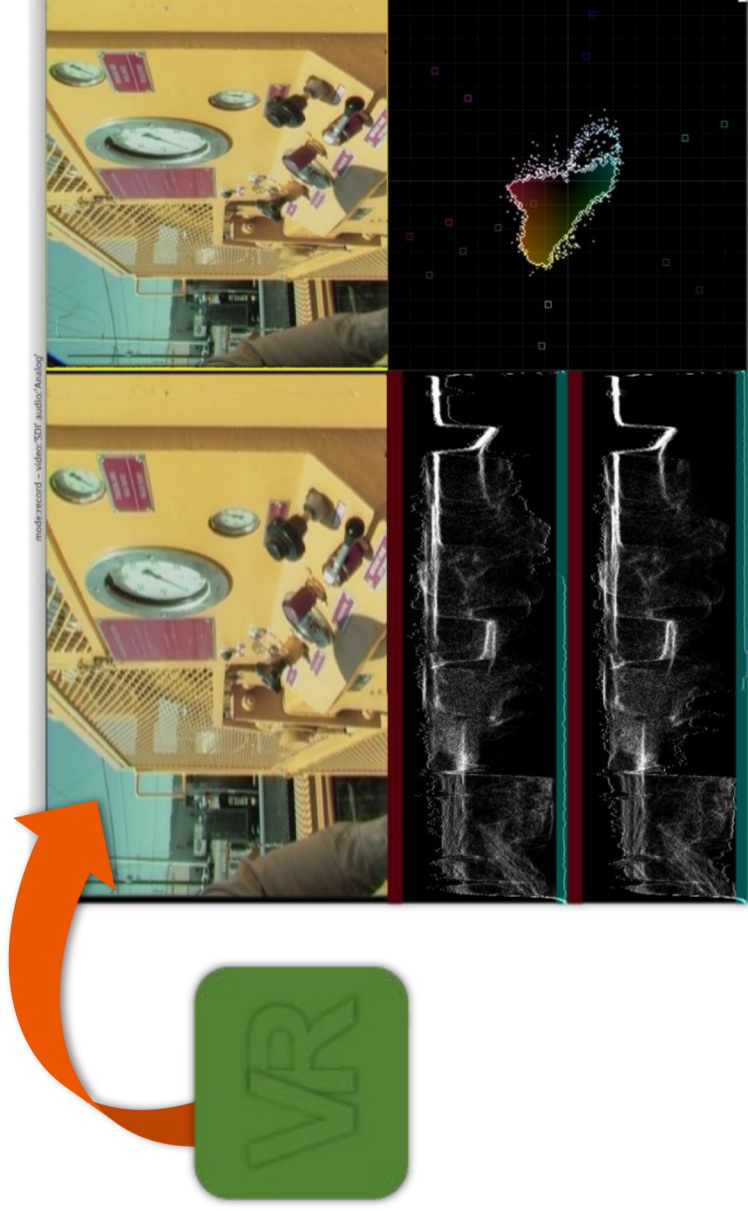
Using and Training: GUI

- GUI makes vrecord more accessible and intuitive for archivists with varying levels of coding experience.



Using and Training: Passthrough Mode

- **Visual + Numerical** view allows for intuitive level correction prior to capture



Using Logs

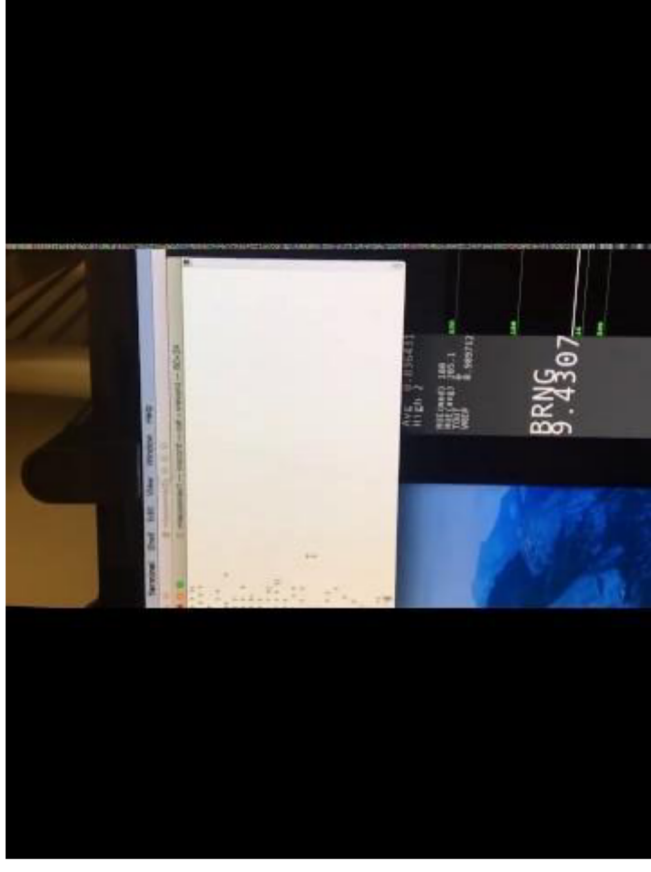


```
computer_name: mac2.local
user_name: mac2
operating_system_version: Darwin Kernel Version 15.6.0: Mon Jan  9 23:07:29 PST 2017; root:xnu-
3248.60.11.2.1~1/RELEASE_ARM_T8020
datetime_start: 2017-11-17T14:30:55
video_bit_depth: 10
codec_name: FFV1 version 3
container: Matroska
television_standard: NTSC
video_input: SDI
audio_input: Analog
framemd5_choice: Yes
audio_mapping_choice: 2 Stereo Tracks (Channels 1 & 2 -> 1st Track Stereo, Channels 3 & 4 -> 2nd Track Stereo)
qtoolsxml_choice: Yes
file_path: /Users/mac2/Desktop/UWSC/PHColl_2016-080_T08A/PHColl_2016-080_T08A.mkv
technician: hopfaul
datetime_end: 2017-11-17T14:31:52
Peak Volume is (dB): -6.93721
pts_discontinuity: none
```



Testing and Feedback: Unfiltered View

- Unfiltered vs. Visual + Numerical
- Buffer overruns
- PTS Discontinuities



Perspectives: Andrew Weaver



First Github pull request: Apologetic and confused



privatezero commented on Sep 25, 2015

Member



Hi, hope I am using the GitHub interface correctly!
Since we have a bunch of PAL here at the UW, I worked a bit on this to add options for PAL capture. Thought I would send them along!



Added options for PAL capture

#2 by privatezero was merged on Sep 29, 2015 • Review required

I BROKE IT!!



Fixed PAL options on passthrough

#3 by privatezero was merged on Oct 2, 2015 • Review required

Audio help issues from the community

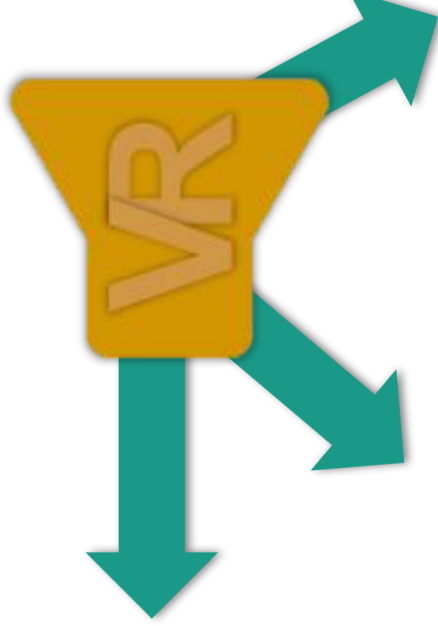
iamdamosuzuki commented on Nov 7, 2017

The following Audio Channel Mappings are currently available:

- Undeclared
- 2 Stereo Tracks (Channels 1 & 2 -> 1st Track Stereo, Channels 3 & 4 -> 2nd Track Stereo)
- 1 Stereo Track (From Channels 1 & 2)
- 1 Stereo Track (From Channels 3 & 4)
- Channel 1 -> 1st Track Mono, Channel 2 -> 2nd Track Mono
- Channel 2 -> 1st Track Mono, Channel 1 -> 2nd Track Mono

I would like to request the addition of the following Mappings

- 1 Mono Track (From Channel 1)
- 1 Mono Track (From Channel 2)



filmarc commented on Feb 1, 2016

Would it be possible to add audio monitoring to Vrecord using waveforms or levels or spectrograms? Thanks,
Hannah

derfeed commented on Oct 17, 2016

The use case is for when a DPS-575AV has Umatic audio wired to audio input 1/2 and VHS audio wired to audio input 3/4. If vrecord can simply map only 3/4 to a stereo first track then we can avoid the need for a hardware based audio switcher.

burkus commented on Oct 21, 2015

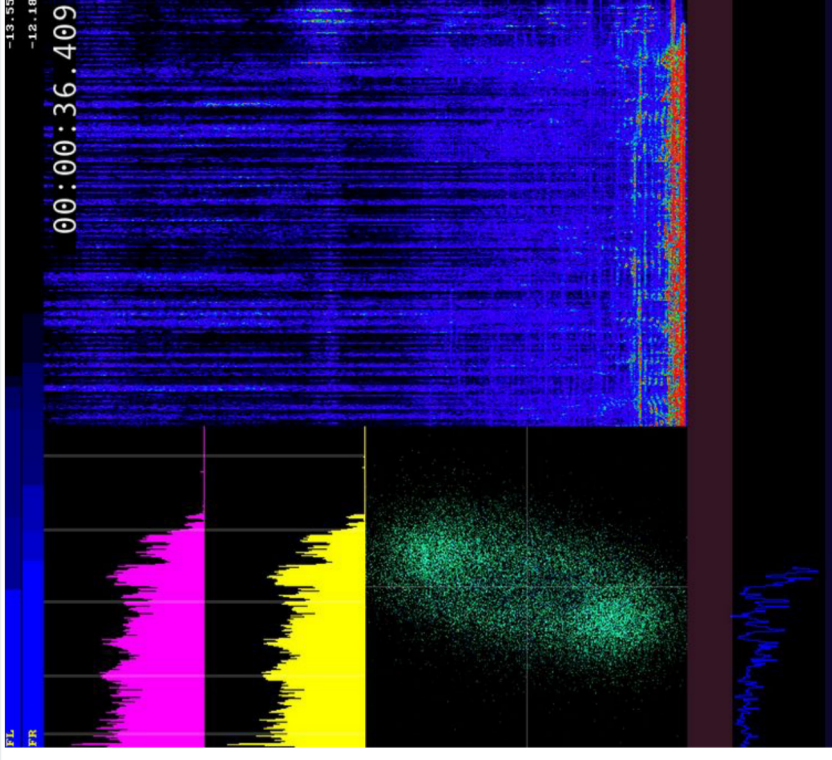
Hi,

Not sure if this is something on our end, but in running some VRecord tests, we're finding that audio levels are noticeably lower than comparable captures with other software. We've tested on two stations, and gotten the same result.

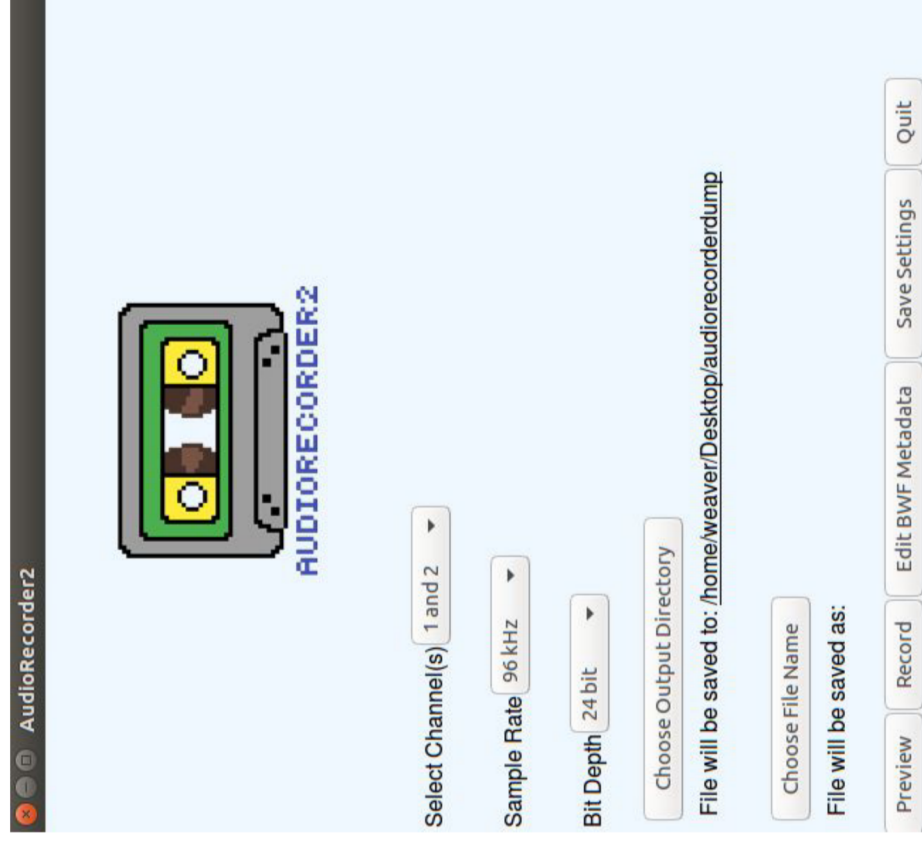
Here's an email and screenshot from Kully, who first noticed the difference:

I combined the bars and tone captured from BAVCI003332. ElectroOpera using (in order from left to right) Media Express, vRecord and Premiere. As you can see below, the vRecord capture's audio levels are noticeably lower than the other two captures.

Additions and Inspiration



Additions and Inspiration



Recent Github pull request: Still breaking stuff - it's ok!




ablwr requested changes on Aug 29

[View changes](#)

index.html **Outdated**

```
110 + <div class="hiding">
111 + <h3>Codec Defaults</h3>
112 + <p>Unless specified, FFmpeg will automatically set codec choices
113 + <p>When creating or transcoding files with FFmpeg, it is important
```

 **ablwr** on Aug 29 **Member**
needs a closing p tag!



fix tag/add link

Pull Request Demonstration!

<https://github.com/amiaopensource/vrecord>



Thanks to:

The vrecord team:

- Dave Rice, for creating vrecord, maintaining it, and constantly making it better
- All [developers](#), [issue submitters](#), commenters, users, and typo fixers!

All information and images in this presentation come from the [vrecord documentation](#) or from the panelists.



Links

- vrecord documentation and code: <https://github.com/amiapopensource/vrecord>
- vrecord contribution guide: <https://github.com/amiapopensource/vrecord/blob/master/CONTRIBUTING.md>
- How to make a pull request: <https://www.thinkful.com/learn/github-pull-request-tutorial/#Finding-a-Project-to-Contribute-to>
- GitHub contribution guide: <https://guides.github.com/activities/contributing-to-open-source/>



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