Next: ABOUT CINELERRA, Up: (dir)

SECRETS OF CINELERRA

Version 4.1

by Adam Williams

1 SHORT CONTENTS

Table of Contents

Next: INSTALLATION, Previous: Top, Up: Top

2 ABOUT CINELERRA

BROADCAST 1.0

In 1996 our first editor came out: Broadcast 1.0. It was just a window with a waveform in it, it could cut and paste stereo audio waveforms on a UNIX box, except unlike other audio editors it could handle files up to 2 gigabytes with only 64 megs of RAM. That was a feature normally only accessible to the highest end professional audio houses.

BROADCAST 2.0

In 1997 Broadcast 1.0 was replaced by Broadcast 2.0. This time the window had a menubar, patchbay, console, and transport control. Broadcast 2.0 still only handled audio but this time it handled unlimited tracks, and it could perform effects on audio and save the resulting waveform to disk. More notably a few effects could be performed as the audio was playing back, in realtime. A user could mix unlimited numbers of tracks, adjust fade, pan, and EQ, and hear the result instantly. Amazingly this real time tweeking is still unavailable on most audio programs.

BROADCAST 2000

But Broadcast 2.0 still didn't handle video and it wasn't very graceful at audio either. In 1999 video broke into the story with Broadcast 2000. This iteration of the Broadcast series could do wonders with audio and offered a pretty good video feature set. It could edit video files up to 64 terabytes. It could do everything Broadcast 2.1 did with audio except now all effects for video and audio could be chained and performed on the fly, with instant feedback as a user tweeked parameters during playback. Broadcast 2000 made it very easy to do a lot of processing and editing on video and audio that would otherwise involve many hours setting up command line sequences and writing to disk. For a time it seemed as if the original dream of immersive movie making for everyone regardless of income level had arrived.

CINELERRA

Later on Broadcast 2000 began to come short. Its audio and video was graceful if you knew how to use it efficiently, but quality issues and new user interface techniques were emerging. Broadcast 2000 kept the audio interface from its ancestors, which didn't apply well to video. Users likewise were maturing. No longer would it be sufficient to just edit video on a UNIX box. Most users expected on UNIX the same thing they got in Win or Mac. In mid 2000 designs for a Broadcast 2000 replacement were drafted. The Broadcast name was officially retired from the series and the software would now be called Cinelerra. Cinelerra would allow users to configure certain effects in much less time than required with Broadcast 2000. It would begin to emulate some of the features found in Win and Mac software while not attempting to become a clone. It's interface would be designed for video from the ground up, while supplementing that with the Broadcast audio interface. As always, quality improvements would happen.

LINUX DERIVATIVES

Linux became more and more fragmented after corporations adopted it. Threading once worked the same on all derivatives. Today there are more threading models than days of the week. We try to focus on 1 of the most popular Linux derivatives at any moment. The threading model is ported to that Linux derivative shortly before a release, but Linux derivatives quickly evolve to new threading models and everything breaks.

Also, there is no consistent behaviour for sound and video drivers. The situation with video capture has improved in that modern video sources can all be mounted like disk drives. The audio capture drivers have been a bit more reliable.

- ABOUT THIS MANUAL

Up: ABOUT CINELERRA

2.1 ABOUT THIS MANUAL

This is the original manual for Cinelerra. This manual has been copied and translated into many languages on many websites in varying degrees of completeness.

Organizing information in the easiest manner for users to find out what they need to know is sort of like cataloging the internet. They've been trying to get it right for 30 years and will probably keep trying until the end of time.

There a lot of fragments of documentation scattered throughout the internet about Cinelerra. This document attempts to combine all the pieces of information in one piece.

Like the operating system and compiler for a piece of software, the document writing format is the most important thing in choosing our document format. We wanted a format which would be readable regardless of corporate whims and fads. A piece of software which compiles on GCC and Linux will be usable as long as there are C compilers. Documents written in Texinfo will be readable as long as there's a C compiler.

After many years of searching for the perfect documentation format we've arrived at TexInfo. This format can be converted to HTML, printed, automatically indexed, but most importantly is not bound to any commercial word processor.

There are no screenshots in this manual. Screenshots become obsolete quickly and as a result confuse the users. What looks one way in a screenshot will always look different in the real program because the real program and the manual are always evolving, never perfectly synchronized. It is true that manuals should have screenshots, but our objective in omitting screenshots is to keep the software costs minimal so you don't have to pay for it. That includes additional labor to synchronize the manual with the software.

In addition to telling you the basic editing features of Cinelerra this manual covers tricks that won't be described anywhere else. We're going to try to come up with certain things you can do with Cinelerra that you wouldn't think of on your own.

Next: CONFIGURATION, Previous: ABOUT CINELERRA, Up: Top

3 INSTALLATION

The Cinelerra package contains Cinelerra and most of the libraries needed to run it. We try to include all the dependancies because of the difficulty in tracking down the right versions. Also included are some utilities for handling files. The following are the general contents of all Cinelerra packages.

- **Foreign language translations** - These go into /usr/share/locale.

- **Cinelerra executable** - This goes into /usr/bin
- **Cinelerra plugins** - These go into /usr/lib/cinelerra in 32 bit systems and /usr/lib64/cinelerra in 64 bit systems.
- **soundtest** - Utility for determining sound card buffer size.
- **mplexlo** - Multiplexing of MPEG elementary streams without standards conformance but more efficiently.
- **mpeg3cat** - Utility for reading an MPEG file from a certain standard and outputting it to stdout.
- **mpeg3toc, mpeg3cat, mpeg3dump** - Utilities/ for indexing and reading MPEG files.
- **mpeg3peek** - Utility for displaying the byte offset of a frame in an MPEG file.

Next: COMPILING FROM SCRATCH, Up: INSTALLATION

3.1 INSTALLING AN RPM

Cinelerra is easiest installed by downloading an RPM and running

```
rpm -U --force --nodeps hvirtual*.rpm
```

on a Fedora 4 system.

On systems which don't support RPM look for a utility called **rpm2cpio**. Download a Cinelerra RPM and from the / directory run

```
rpm2cpio hvirtual*.rpm | cpio -i --make-directories
```

This doesn't always work because there are many forks of the C library, each incompatible with the others. This is the biggest reason to compile from scratch.

Next: RUNNING CINELERRA, Previous: INSTALLING AN RPM, Up: INSTALLATION

3.2 COMPILING FROM SCRATCH

It should be noted that the compiler used in building Cinelerra binaries is the free GNU compiler and very conservative optimization flags. Alternative optimization flags and compilers produce varying results. Compiling the source is hard and there's no warranty if the source code fails to compile, but the method for compiling starts by downloading the source code and decompressing.

The compilation is verified on a vanilla Fedora 4 installation, workstation mode. Fedora doesn't install a lot of dependancies like **nasm** and **yasm**. Yes, 3 assemblers are now required to assemble x86 code. Compiling the source is hard and there's no warranty if the source code fails to compile, but the method for compiling starts by downloading the source code and decompressing.

```
    tar jxf cinelerra*.tar.bz2
```

The compilation is verified on a Fedora 4 installation. Fedora 4 doesn't install a lot of the reqiured compilers. Mainly **nasm** and **yasm**, 2 of the 3 assemblers. These have to be installed manually for compilation to succeed.

Enter the hvirtual directory

```
    cd cinelerra
```

Then run

```
    ./configure
```

This checks the build environment for the right tools and should give you an error if a tool is missing. Once that succeeds run

```
    make
```

The make procedure should run through all the directories and put binaries in the **i686** or **x86_64** directories. When NFS was a lot faster, we compiled Alpha and i686 binaries in the same filesystem with the objects in different subdirectories, so all the binaries are still put in subdirectories.

A lot of libraries are included to get the version numbers right. Some of the libraries don't compile on SMP systems. One solution is to disable SMP when rebooting and reenable it when compilation is finished. Another solution is to rerun make over and over until it gets through the offending libraries.

Once finished, make sure you are root and run

```
    make install
```

to install the binaries. If installation fails it means something failed to compile or you weren't root. Run **make** again and watch for errors.

Sometimes you'll want to run **make clean** if you're programming something or the system libraries change. In this case, you'll probably need to run **configure** again because some libraries delete their configuration files in **make clean**.

Previous: COMPILING FROM SCRATCH, Up: INSTALLATION

3.3 RUNNING CINELERRA

The simplest way to run Cinelerra is by running

```
    /usr/bin/cinelerra
```

This command hides a much more capable command line interface. Run **cinelerra -h** to get a listing of command line options. The use of these options is described in several sections.

For rendering from the command line See RENDERING FILES.

Next: CREATING A NEW PROJECT, Previous: INSTALLATION, Up: Top

4 CONFIGURATION

Because of the variety of uses, Cinelerra cannot be run optimally without some intimate configuration for your specific needs. Very few parameters are adjustible at compile time. Runtime configuration is the only option for most configuration because of the multitude of parameters.

Here we discuss not only the configuration options but which of the different API's in Linux are supported.

Go to **settings->preferences** and to see the options.

- ENVIRONMENT VARIABLES: These environment variables are recognized by Cinelerra
- AUDIO DRIVERS: Information about the audio drivers
- VIDEO DRIVERS: Information about the video drivers
- PLAYBACK: Configuring parameters related to playback.
- RECORDING: Configuring parameters related to recording.
- PERFORMANCE: Configuring parameters related to how fast things go.
- INTERFACE: Configuring the user interface.
- ABOUT: Viewing information about the program.

Next: AUDIO DRIVERS, Up: CONFIGURATION

4.1 ENVIRONMENT VARIABLES

In UNIX derivatives, environment variables are global variables in the shell which all applications can read. They are set with a command like **set VARIABLE=value**. All the environment variables can be viewed with a command like **env**. Cinelerra recognizes the following environment variables:

- **LADSPA_PATH -** If you want to use LADSPA plugins, this must be defined: a colon separated list of directories to search for LADSPA plugins. These are not native Cinelerra plugins. See LADSPA EFFECTS.

Next: VIDEO DRIVERS, Previous: ENVIRONMENT VARIABLES, Up: CONFIGURATION

4.2 AUDIO DRIVERS

The audio drivers are used for both recording and playback to get data to and from the hardware. Since the same drivers are used for both recording and playback, their functionality is described here in a separate section.

- COMMON SOUND DRIVER ATTRIBUTES: Attributes used for more than one sound driver.
- OSS: Notes about the OSS driver
- OSS Envy24: Notes about the OSS driver for the Envy24 chip
- ALSA: Notes about the ALSA driver
- ESOUND: Notes about the ESound driver
- RAW 1394: Notes about the Raw1394 driver
- DV 1394: Notes about the DV1394 driver
- IEC 61883: Notes about the IEC 61883 driver

Next: OSS, Up: AUDIO DRIVERS

4.2.1 COMMON SOUND DRIVER ATTRIBUTES

- DEVICE PATH

  Usually a file in the **/dev/** directory which controls the device.

- BITS

  The number of bits of precision Cinelerra should set the device for. This sometimes has a figuritive meaning. Some sound drivers need to be set to 32 bits to perform 24 bit playback and won't play anything when set to 24 bits. Some sound drivers need to be set to 24 bits for 24 bit playback.

Next: OSS Envy24, Previous: COMMON SOUND DRIVER ATTRIBUTES, Up: AUDIO DRIVERS

4.2.2 OSS

This was the first Linux sound driver. It had an open source implementation and a commercial implementation with more sound cards supported. It was the standard sound driver up to linux 2.4. It still is the only sound driver which an i386 binary can use when running on an x86_64 system.

Next: ALSA, Previous: OSS, Up: AUDIO DRIVERS

4.2.3 OSS Envy24

The commercial version of OSS had a variant for 24 bit 96 Khz soundcards. This variant required significant changes to the way the sound drivers were used, which is what the OSS Envy24 variant is for.

Next: ESOUND, Previous: OSS Envy24, Up: AUDIO DRIVERS

4.2.4 ALSA

ALSA is the most common sound driver in Linux 2.6. It supports the most sound cards now. It takes advantage of low latency features in Linux 2.6 to get better performance than OSS had in 2.4 but roughly the same performance that OSS had in 2.0. Unfortunately ALSA is constantly changing. A program which works with it one day may not the next day. New wrappers are being developed on top of ALSA at such a pace, we plan to support them at regular intervals, not at every new release of a new wrapper.

ALSA is no longer portable between i386 and x86_64. If an i386 binary tries to play back on an x86_64 kernel it'll crash. For this scenario, use OSS.

Next: RAW 1394, Previous: ALSA, Up: AUDIO DRIVERS

4.2.5 ESOUND

ESOUND was a sound server that sat on top of OSS. It was written for a window manager called Enlightenment. It supported a limited number of bits and had high latency compared to modern times but multiplexed multiple audio sources. It's unknown whether it still works.

Next: DV 1394, Previous: ESOUND, Up: AUDIO DRIVERS

4.2.6 RAW 1394

The first interface between linux software and firewire camcorders. This was the least reliable way to play audio to a camcorder. It consisted of a library on top of the kernel commands.

Next: IEC 61883, Previous: RAW 1394, Up: AUDIO DRIVERS

4.2.7 DV 1394

The second rewrite of DV camcorder support in Linux. This was the most reliable way to play audio to a camcorder. This consisted of direct kernel commands.

Previous: DV 1394, Up: AUDIO DRIVERS

4.2.8 IEC 61883

The third rewrite of DV camcorder support in Linux. This is a library on top of RAW 1394 which is a library on top of the kernel commands. It's less reliable than DV 1394 but more reliable than RAW 1394. The next rewrite ought to fix that.

Next: PLAYBACK, Previous: AUDIO DRIVERS, Up: CONFIGURATION

4.3 VIDEO DRIVERS

The audio drivers are used for both recording and playback to get data to and from the hardware. Since the same drivers are used for both recording and playback, their functionality is described here in a separate section.

Next: X11, Up: VIDEO DRIVERS

4.3.1 COMMON VIDEO DRIVER ATTRIBUTES

- DISPLAY

  The is intended for dual monitor displays. Depending on the value of Display, the Compositor window will appear on a different monitor from the rest of the windows.

- DEVICE PATH

  Usually a file in the ***/dev/*** directory which controls the device.

- SWAP FIELDS

  Make the even lines odd and the odd lines even when sending to the device. On an NTSC or 1080i monitor the fields may need to be swapped to prevent jittery motion.

- OUTPUT CHANNEL

  Devices with multiple outputs may need a specific connector to send video on.

- PORT

  The IEEE1394 standard specifies something known as the **port**. This is probably the firewire card number in the system to use.

- CHANNEL

  The IEEE1394 standard specifies something known as the **channel**. For DV cameras it's always **63**.

Next: X11-XV, Previous: COMMON VIDEO DRIVER ATTRIBUTES, Up: VIDEO DRIVERS

4.3.2 X11

This was the first method of video playback on any UNIX system, valid all the way until 1999. It just writes the RGB triplet for each pixel directly to the window. It's the slowest playback method. It's still useful as a fallback when graphics hardware can't handle very large frames.

Next: X11-OPENGL, Previous: X11, Up: VIDEO DRIVERS

4.3.3 X11-XV

This was the second big method of video playback in UNIX starting in 1999. It converts YUV to RGB in hardware with scaling. It's the preferred playback method but can't handle large frame sizes. The maximum video size for XV is usually 1920x1080.

Next: BUZ, Previous: X11-XV, Up: VIDEO DRIVERS

4.3.4 X11-OPENGL

The most powerful video playback method is OpenGL. With this driver, most effects are done in hardware. OpenGL allows video sizes up to the maximum texture size, which is usually larger than what XV supports, depending on the graphics driver.

OpenGL doesn't affect rendering. It just accelerates playback. OpenGL relies on PBuffers and shaders to do video rendering. The graphics driver must support OpenGL 2 and Cinelerra needs to be explicitely compiled with OpenGL 2 support. This requires compiling it on a system with the OpenGL 2 headers.

PBuffers are known to be fickle. If the graphics card doesn't have enough memory or doesn't have the right visuals, PBuffers won't work. Try seeking several frames or restarting Cinelerra if OpenGL doesn't work.

Because of OpenGL limitations, X11-OpenGL processes everything in 8 bit colormodels, although the difference between YUV and RGB is retained.

The **scaling equation** in Preferences is ignored by OpenGL. OpenGL always uses linear scaling.

Project and track sizes need to be multiples of 4 for OpenGL to work.

To get the most acceleration, OpenGL-enabled effects must be placed after software-only effects. All rendering before the last software-only effect is done in software. The core Cinelerra operations like camera and projector are of course OpenGL.

Next: RAW 1394 VIDEO PLAYBACK, Previous: X11-OPENGL, Up: VIDEO DRIVERS

4.3.5 BUZ

This is a method for playing motion JPEG-A files directly to a composite analog signal. It uses a popular hack of the Video4Linux 1 driver from 2000 to decompress JPEG in hardware. Sadly, even though analog output is largely obsolete, newer drivers have replaced BUZ.

Next: DV 1394 VIDEO PLAYBACK, Previous: BUZ, Up: VIDEO DRIVERS

4.3.6 RAW 1394 VIDEO PLAYBACK

The first interface between linux software and firewire camcorders. This was the least reliable way to play video to a camcorder. It consisted of a library on top of the kernel commands.

Next: IEC 61883 VIDEO PLAYBACK, Previous: RAW 1394 VIDEO PLAYBACK, Up: VIDEO DRIVERS

4.3.7 DV 1394 VIDEO PLAYBACK

The second rewrite of DV camcorder support in Linux. This was the most reliable way to play video to a camcorder. This consisted of direct kernel commands.

Previous: DV 1394 VIDEO PLAYBACK, Up: VIDEO DRIVERS

4.3.8 IEC 61883 VIDEO PLAYBACK

The third rewrite of DV camcorder support in Linux. This is a library on top of RAW 1394 which is a library on top of the kernel commands. It's less reliable than DV 1394 but more reliable than RAW 1394. The next rewrite ought to fix that.

Next: RECORDING, Previous: VIDEO DRIVERS, Up: CONFIGURATION

4.4 PLAYBACK

Next: VIDEO OUT, Up: PLAYBACK

4.4.1 AUDIO OUT

These determine what happens when you play sound from the timeline.

- SAMPLES TO SEND TO CONSOLE:

  For playing audio, small fragments of sound are read from disk and processed in a virtual console sequentially. A larger value here causes more latency when you change mixing parameters but gives more reliable playback.

  Some sound drivers don't allow changing of the console fragment so latency is unchanged no matter what this value is.

  A good way of ensuring high quality playback was to read bigger fragments from the disk and break them into smaller fragments for the soundcard. That changed when the virtual console moved from the push model to the pull model. Since different stages of the rendering pipeline can change the rate of the incoming data, it would now be real hard to disconnect size of the console fragments from the size of the fragments read from disk.

- AUDIO OFFSET:

  The ability to tell the exact playback position on Linux sound drivers is pretty bad if it's provided at all. Since this information is required for proper video synchronization, it has to be accurate. The **AUDIO OFFSET** allows users to adjust the position returned by the sound driver to reflect reality. The audio offset doesn't affect the audio playback or rendering at all. It merely changes the synchronization of video playback.

  The easiest way to set the audio offset is to create a timeline with 1 video track and one audio track. Expand the audio track and center the audio pan. The frame rate should be something over 24fps and the sampling rate should be over 32000. The frame size should be small enough for your computer to render it at the full framerate. Highlight a region of the timeline starting at 10 seconds and ending at 20 seconds. Drop a **gradient** effect on the video track and configure it to be clearly visible. Drop a **synthesizer** effect on the audio and configure it to be clearly audible.

  Play the timeline from 0 and watch to see if the gradient effect starts exactly when the audio starts. If it doesn't, expand the audio track and adjust the nudge. If the audio starts ahead of the video, decrease the nudge value. If the audio starts after the video, increase the nudge value. Once the tracks play back synchronized, copy the nudge value to the **AUDIO OFFSET** value in preferences.

Note: if you change sound drivers or you change the value of **USE SOFTWARE FOR POSITIONING INFORMATION**, you'll need to change the audio offset because different sound drivers are unequally inaccurate.

- VIEW FOLLOWS PLAYBACK

  Causes the timeline window to scroll when the playback cursor moves. This can bog down the X Server or cause the timeline window to lock up for long periods of time while drawing the assetse.

- USE SOFTWARE FOR POSITIONING INFORMATION

  Most soundcards and sound drivers don't give reliable information on the number of samples the card has played. When playing video you need this information for synchronization. This option causes the sound driver to be ignored and a software timer to be used for synchronization.

- AUDIO PLAYBACK IN REALTIME:

  Back in the days when 150Mhz was the maximum, this allowed uninterrupted playback on heavy loads. It forces the audio playback to the highest priority in the kernel. Today it's most useful for achieving very low latency between console tweeks and soundcard output. You must be root to get realtime priority.

- AUDIO DRIVER

  There are many sound drivers for Linux. This allows selecting one sound driver and setting parameters specific to it. The sound drivers and their parameters are described in the sound driver section. See AUDIO DRIVERS.

Previous: AUDIO OUT, Up: PLAYBACK

4.4.2 VIDEO OUT

These determine how video gets from the timeline to your eyes.

- PLAY EVERY FRAME

  Causes every frame of video to be displayed even if it means falling behind the audio. This should always be on unless you use mostly uncompressed codecs. Most compressed codecs don't support frame dropping anymore.

- FRAMERATE ACHIEVED

  The number of frames per second being displayed during playback. This is only updated during playback.

- DECODE FRAMES ASYNCHRONOUSLY

  If you have lots of memory and more than one CPU, this option can improve playback performance by decoding video on one CPU as fast as possible while dedicating other CPU to displaying video only. It assumes all playback operations are forward and no frames are dropped. Operations involving reverse playback or frame dropping are negatively impacted.

  Since this option requires enourmous amounts of memory, it may crash if the input frames are very large.

- SCALING EQUATION

  When video playback involves any kind of scaling or translation, this algorithm is used. This doesn't affect 1:1 playback.

  - NEAREST NEIGHBOR ENLARGE AND REDUCE

    lowest but fastest quality. Produces jagged edges and uneven motion.

  - BICUBIC ENLARGE AND BILINEAR REDUCE

    highest but slowest quality. For enlarging a bicubic interpolation is used, which blurs slightly but doesn't reveal stair steps. For reduction a bilinear interpolation is used, which produces very sharp images and reduces noise. The bilinear reduced images can be sharpened with a sharpen effect with less noise than a normal sized image.

  - BILINEAR ENLARGE AND BILINEAR REDUCE

    when slight enlargement is needed a bilinear enlargement looks better than a bicubic enlargement.

- PRELOAD BUFFER FOR QUICKTIME

  The Quicktime/AVI decoder can handle DVD sources better when this is around 10000000. This reduces the amount of seeking required. Unfortunately when reading high bitrate sources from a hard drive, this tends to slow it down. For normal use this should be 0.

- DVD SUBTITLE TO DISPLAY

  DVD IFO files usually contain subtitle tracks. These must be decoded with by the MPEG decoder. Select **Enable subtitles** to enable subtitle decoding. There are usually multiple subtitle tracks starting from 0. The subtitle track to be decoded for all MPEG streams goes in the DVD subtitlee to display text box. Go to the asset corresponding to the MPEG file in the Resources window and right click. Click on Info. The number of subtitle tracks is given at the bottom.

- INTERPOLATE CR2 IMAGES

  Enables interpolation of CR2 images. This is required since the raw image in a CR2 file is a bayer pattern. The interpolation uses dcraw's built-in interpolation and is very slow. This operation can be disabled and the **Interpolate Pixels** effect used instead for fast previewing.

- WHITE BALANCE CR2 IMAGES

  This enables white balancing for CR2 images if interpolation is also enabled. It uses the camera's matrix which is contained in the CR2 file. White balancing is not performed if interpolation is not performed because white balancing needs a blending of all 3 primary colors.

  Disabling white balancing is useful for operations involving dark frame subtraction. The dark frame and the long exposure need to have the same color matrix.

  If you disable **Interpolate CR2 Images** and use the **Interpolate Pixels** effect, be aware the **Interpolate Pixels** effect always does both interpolation and white balancing using the camera's matrix, regardless of the settings in Preferences. Dark frame subtraction needs to be performed before **Interpolate Pixels**.

- VIDEO DRIVER

  Normally video on the timeline goes to the compositor window during continuous playback and when the insertion point is repositioned. Instead of sending video to the Compositor window the video driver can be set to send video to another output device during continuous playback. This doesn't affect where video goes when the insertion point is repositioned, however.

  The video drivers and their parameters are described in the video driver section. See VIDEO DRIVERS.

Next: PERFORMANCE, Previous: PLAYBACK, Up: CONFIGURATION

4.5 RECORDING

The parameters here affect what happens when you go to **File->Record...**. The intention was to make **File->Record...** go as fast as possible into the record monitoring window, without a lengthy dialog to configure the file format. Instead the file format for recording is set here and it is applied to all recordings. Also set here is the hardware for recording, since the hardware determines the supported file format in most cases.

Next: AUDIO IN, Up: RECORDING

4.5.1 FILE FORMAT

This determines the output file format for recordings. It depends heavily on the type of driver used. The interface is the same as the rendering interface.

The **Record audio tracks** toggle must be enabled to record audio. The **Record video tracks** toggle must be enabled to record video. The wrench button left of each toggle opens a configuration dialog to set the codec corresponding to audio and video. The audio and video is wrapped in a wrapper defined by the **File Format** menu. Different wrappers may record audio only, video only, or both.

Some video drivers can only record to a certain wrapper. DV, for example, can only record to Quicktime with DV as the video compression. If the video driver is changed, the file format may be updated to give the supported output. If you change the file format to an unsupported format, it may not work with the video driver.

Next: VIDEO IN, Previous: FILE FORMAT, Up: RECORDING

4.5.2 AUDIO IN

These determine what happens when you record audio.

- RECORD DRIVER

  This is used for recording audio in the Record window. It may be shared with the Record Driver for video if the audio and video are wrapped in the same stream. It takes variable parameters depending on the driver. The parameters have the same meaning as they do for playback.

  - DEVICE PATH

    Usually a file in the ***/dev/*** directory which controls the device.

  - BITS

    The number of bits of precision Cinelerra should set the device for. This sometimes has a figuritive meaning. Some sound drivers need to be set to 32 bits to perform 24 bit recording and won't record anything when set to 24 bits. Some sound drivers need to be set to 24 bits for 24 bit recording.

- SAMPLES TO WRITE AT A TIME

  Audio is first read in small fragments from the device. Many small fragments are combined into a large fragment before writing to disk. The disk writing process is done in a different thread. The value here determines how large the combination of fragments is for each disk write.

- SAMPLE RATE FOR RECORDING

  Regardless of what the project settings are. This is the sample rate used for recording. This should be the highest the audio device supports.

Previous: AUDIO IN, Up: RECORDING

4.5.3 VIDEO IN

These determine what happens when you record video.

- RECORD DRIVER

  This is used for recording video in the Record window. It may be shared with the Record Driver for audio if the audio and video are wrapped in the same stream. It takes variable parameters depending on the driver. The parameters have the same meaning as they do for playback.

- FRAMES TO RECORD TO DISK AT A TIME

  Frames are recorded in a pipeline. First frames are buffered in the device. Then they're read into a larger buffer for writing to disk. The disk writing is done in a different thread as the device reading. For certain codecs the disk writing uses multiple processors. This value determines how many frames are written to disk at a time.

- FRAMES TO BUFFER IN DEVICE

  The number of frames to store in the device before reading. This determines how much latency there can be in the system before frames are dropped.

- USE SOFTWARE FOR POSITIONING INFORMATION

  Video uses audio for

  synchronization but most soundcards don't give accurate position information. This calculates an estimation of audio position in software instead of the hardware for synchronization.

- SYNC DRIVES AUTOMATICALLY

  For high bitrate recording the drives may be fast enough to store the data but Linux may wait several minutes and stall as it writes several minutes of data at a time. This forces Linux to flush its buffers every second instead of every few minutes and produce slightly better realtime behavior.

- SIZE OF CAPTURED FRAME

  This is the size of the frames recorded. It is independant of the project frame size because most video devices only record a fixed frame size. If the frame size given here isn't supported by the device it might crash Cinelerra.

- FRAME RATE FOR RECORDING

  The frame rate recorded is different from the project settings. This sets the recorded frame rate.

Next: INTERFACE, Previous: RECORDING, Up: CONFIGURATION

4.6 PERFORMANCE

You'll spend most of your time configuring this section. The main focus of performance is rendering parameters not available in the rendering dialog.

- CACHE ITEMS

  To speed up rendering, several assets are kept open simultaneously. This determines how many are kept open. A number too large may exhaust your memory pretty fast and result in a crash. A number too small may result in slow playback as assets need to be reopened more frequently.

- SECONDS TO PREROLL RENDERS

  Some effects need a certain amount of time to settle in. This sets a number of seconds to render without writing to disk before the selected region is rendered. When using the renderfarm you'll sometimes need to preroll to get seemless transitions between the jobs. Every job in a renderfarm is prerolled by this value. This does not affect background rendering, however. Background rendering uses a different preroll value.

- FORCE SINGLE PROCESSOR USE

  Cinelerra tries to use all processors on the system by default but sometimes you'll only want to use one processor, like in a renderfarm client. This forces only one processer to be used. The operating system, however, usually uses the second processor anyway for disk access so this option is really a 1.25 processor mode. The value of this parameter is used in renderfarm clients.

- BACKGROUND RENDERING
- RENDERFARM

Next: RENDERFARM, Up: PERFORMANCE

4.6.1 BACKGROUND RENDERING

Background rendering was originally concieved to allow HDTV effects to be displayed in realtime. Background rendering causes temporary output to constantly be rendered while the timeline is being modified. The temporary output is played during playack whenever possible. It's very useful for transitions and previewing effects which are too slow to display in a reasonable amount of time. If renderfarm is enabled, the renderfarm is used for background rendering, giving you the potential for realtime effects if enough network bandwidth and CPU nodes exist.

- FRAMES PER BACKGROUND RENDERING JOB

  This only works if renderfarm is being used, otherwise background rendering creates a single job for the entire timeline. The number of frames specified here is scaled to the relative CPU speed of rendering nodes and used in a single renderfarm job. The optimum number is 10 - 30 since network bandwidth is used to initialize each job.

- FRAMES TO PREROLL BACKGROUND

  This is the number of frames to render ahead of each background rendering job. Background rendering is degraded when preroll is used since the jobs are small. When using background rendering, this number is ideally 0. Some effects may require 3 frames of preroll.

- OUTPUT FOR BACKGROUND RENDERING

  Background rendering generates a sequence of image files in a certain directory. This parameter determines the filename prefix of the image files. It should be on a fast disk, accessible to every node in the renderfarm by the same path. Since hundreds of thousands of image files are usually created, **ls** commands won't work in the background rendering directory. The 🔍 browse button for this option normally won't work either, but the 🔧 configuration button for this option works.

- FILE FORMAT

  The file format for background rendering has to be a sequence of images. The format of the image sequence determines the quality and speed of playback. JPEG is good most of the time.

Previous: BACKGROUND RENDERING, Up: PERFORMANCE

4.6.2 RENDERFARM

To use the renderfarm set these options. Ignore them for a standalone system

- USE RENDER FARM FOR RENDERING

  When selected, all the **file->render** operations use the renderfarm.

- NODES

  Displays all the nodes on the renderfarm and which ones are active.

  Nodes are added by entering the host name of the node, verifying the value of **port** and hitting **add node**.

  Computer freaks may be better off editing the **~/.bcast/.Cinelerra_rc** file than this if they have hundreds of nodes. Remember that .Cinelerra_rc is overwritten whenever a copy of Cinelerra exits.

  Select the **ON** column to activate and deactivate nodes once they are created.

Nodes may be edited by highlighting a row and hitting **apply changes**.

- HOSTNAME

  Edit the hostname of an existing node or enter the hostname of a new node here.

- PORT

  Edit the port of an existing node or enter the port of a new node here.

- REPLACE NODE

  When editing an existing node, hit this to commit the changes to **HOSTNAME** and **PORT**. The changes won't be committed if you don't hit this button.

- ADD NODE

  Create a new node with the **HOSTNAME** and **PORT** settings.

- DELETE NODE

  Deletes whatever node is highlighted in the **NODES** list.

- SORT NODES

  Sorts the **NODES** list based on the hostname.

- RESET RATES

  This sets the framerate for all the nodes to 0. Frame rates are used to scale job sizes based on CPU speed of the node. Frame rates are only calculated when renderfarm is enabled.

- TOTAL JOBS TO CREATE

  Determines the number of jobs to dispatch to the renderfarm. The more jobs you create, the more finely balanced the renderfarm becomes.

  Determine the total jobs to create by multiplying the number of nodes including the master node by some number. Multiply them by 1 to have one job dispatched for every node. Multiply them by 3 to have 3 jobs dispatched for every node. If you have 10 slave nodes and one master node, specify 33 to have a well balanced renderfarm.

Next: ABOUT, Previous: PERFORMANCE, Up: CONFIGURATION

4.7 INTERFACE

These parameters affect purely how the user interface works.

- INDEX FILES GO HERE

  Back in the days when 4 MB/sec was unearthly speed for a hard drive, index files were introduced to speed up drawing the audio tracks. This option determines where index files are placed on the hard drive.

- SIZE OF INDEX FILE

  Determines the size of an index file. Larger index sizes allow smaller files to be drawn faster while slowing down the drawing of large files. Smaller index sizes allow large files to be drawn faster while slowing down small files.

- NUMBER OF INDEX FILES TO KEEP

  To keep the index directory from becoming unruly, old index files are deleted. This determines the maximum number of index files to keep in the directory.

- DELETE ALL INDEXES

  When you change the index size or you want to clean out excessive index files, this deletes all the index files.

- USE HOURS:MINUTES:SECONDS.XXX

  Various representations of time are given. Select the most convenient one. The time representation can also be changed by **CTRL** clicking on the time ruler.

- USE THUMBNAILS

  The Resource Window displays thumbnails of assets by default. This can take a long time to set up. This option disables the thumbnails.

- CLICKING IN/OUT POINTS DOES WHAT

  Cinelerra not only allows you to perform editing by dragging in/out points but also defines three seperate operations which occur when you drag an in/out point. For each mouse button you select the behavior in this window. The usage of each editing mode is described in editing.

- MIN DB FOR METER

  Some sound sources have a lower noise threshold than others. Everything below the noise threshold is meaningless. This option sets the meters to clip below a certain level. Consumer soundcards usually bottom out at -65. Professional soundcards bottom out at -90. See SOUND LEVEL

METERS.

- MAX DB FOR METER

  This sets the maximum sound level represented by the sound meters. No matter what this value is, no soundcard can play sound over 0 db. This value is presented merely to show how far over the limit a sound wave is. See SOUND LEVEL METERS.

- THEME

  Cinelerra supports variable themes. Select one here and restart Cinelerra to see it.

Previous: INTERFACE, Up: CONFIGURATION

4.8 ABOUT

This section gives you information about the copyright, the time of the current build, the lack of a warranty, and the versions of some of the libraries. Be sure to agree to the terms of the lack of the warranty.

Next: THE MAIN WINDOWS, Previous: CONFIGURATION, Up: Top

5 CREATING A NEW PROJECT

There are 2 ways to create a new project: going to **File->New** or loading new files See LOADING FILES. Once a new project is created, all the parameters can be changed later without creating a new project.

Next: CHANGING PARAMETERS AFTER LOADING, Up: CREATING A NEW PROJECT

5.1 USING THE NEW PROJECT DIALOG

One way is to go to **File->New**. This dialog contains the parameters for the new project. The sections of the **New** dialog are described here:

- **Presets** - Select an option from this menu to have all the project settings set to one of the known standards.
- **Audio -> Tracks** - Sets the number of audio tracks the new project should have. Tracks can be added or deleted later, but options are provided here for convenience.
- **Audio -> Channels** - Sets the number of audio channels the new project should have. The number of audio channels doesn't have to be the same

as the number of tracks.
- **Audio -> Samplerate** - Sets the samplerate of the audio. The project samplerate doesn't have to be the same as the media sample rate that you load. Media is resampled to match the project sample rate.
- **Video -> Tracks** - Sets the number of video tracks the new project should have. Tracks can be added or deleted later, but options are provided here for convenience.
- **Video -> Framerate** - Sets the framerate of the video. The project framerate doesn't have to be the same as the media frame rate that you load. Media is reframed to match the project framerate.
- **Video -> Canvas size** - Sets the size of the video output. Each track also has its own frame size. Initially the **New** dialog creates video tracks whose sizes all match the video output, but the video track sizes can be changed later without changing the video output.
- **Video -> Aspect ratio** - Sets the aspect ratio. The aspect ratio is applied to the video output. The aspect ratio can be different than the number of horizontal pixels / the number of vertical pixels. Setting a different aspect ratio than the number of pixels results in nonsquare pixels.
- **Video -> Auto aspect ratio** - If this is checked, the **New** dialog always recalculates the **Aspect ratio** setting when the **Canvas size** is changed. This ensures pixels are always square.
- **Video -> Color model** - This sets the color model video intermediates in the project will be stored in. Color models are described in a separate section See COLOR MODEL.

Previous: USING THE NEW PROJECT DIALOG, Up: CREATING A NEW PROJECT

5.2 CHANGING PARAMETERS AFTER LOADING

After a project is created, you have to use the set format dialog to change parameters without deleting the project. Go to **Settings->Set format**.

Most of the options are identical to the **File->New** options except the lack of a number of tracks to create and the addition of audio channel locations.

This section is discussed in See SETTING PROJECT ATTRIBUTES.

Next: LOADING AND SAVING FILES, Previous: CREATING A NEW PROJECT, Up: Top

6 THE MAIN WINDOWS

When Cinelerra first starts, you'll get four main windows. Hitting **CTRL-w** in any window closes it.

- VIEWER
- COMPOSITOR
- PROGRAM
- RESOURCES
- SOUND LEVEL METERS
- OTHER WINDOWS

Next: COMPOSITOR, Up: THE MAIN WINDOWS

6.1 VIEWER

In here you'll scrub around source media and clips, selecting regions to paste into the project. Operations done in the viewer affect a temporary EDL or a clip but not the timeline.

Next: PROGRAM, Previous: VIEWER, Up: THE MAIN WINDOWS

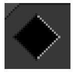
6.2 COMPOSITOR

This window displays the output of the timeline. It's the interface for most compositing operations or operations that affect the appearance of the timeline output. Operations done in the Compositor affect the timeline but don't affect clips.

The video output has several navigation functions. The video output size is either locked to the window size or unlocked with scrollbars for navigation. The video output can be zoomed in and out and panned. Navigating the video output this way doesn't affect the rendered output, it just changes the point of view in the compositor window.

If it is unlocked from the window size, middle clicking and dragging anywhere in the video pans the point of view.

Hitting the + and - keys zooms in and out of the video output.

Underneath the video output are copies of many of the functions available in the main window. In addition there is a zoom menu and a  tally light.

The zoom menu jumps to all the possible zoom settings and, through the **Auto** option, locks the video to the window size. The zoom menu does not affect the window size.

The tally light turns red when rendering is happening. This is useful for knowing if the output is current.

Right clicking anywhere in the video output brings up a menu with all the zoom levels and some other options. In this particular case the zoom levels resize the entire window and not just the video.

The **reset camera** and **reset projector** options center the camera and projector See COMPOSITING.

The **Hide controls** option hides everything except the video.

On the left of the video output is a toolbar specific to the compositor window. Here are the functions in the toolbar:

- PROTECT VIDEO
- MAGNIFYING GLASS
- MASKS TOOL
- CAMERA
- PROJECTOR
- CROP TOOL
- EYEDROPPER
- TOOL INFO
- SAFE REGIONS TOOL

Next: MAGNIFYING GLASS, Up: COMPOSITOR

6.2.1 PROTECT VIDEO

⌀

This disables changes to the compositor output from clicks in it. It is an extra layer on top of the track arming toggle to prevent unwanted changes.

Next: MASKS TOOL, Previous: PROTECT VIDEO, Up: COMPOSITOR

6.2.2 MAGNIFYING GLASS

🔍

This zooms in and out of the compositor output without resizing the window. If the video output is currently locked to the size of the window, clicking in it with the magnifying glass unlocks it and creates scrollbars for navigation.

Left clicking in the video zooms in.

Ctrl clicking in the video zooms out.

Rotating the wheel on a wheel mouse zooms in and out.

Next: CAMERA, Previous: MAGNIFYING GLASS, Up: COMPOSITOR

6.2.3 MASKS TOOL

This brings up the mask editing tool See MASKS. Enable the ? tool window to see options for this tool.

Next: PROJECTOR, Previous: MASKS TOOL, Up: COMPOSITOR

6.2.4 CAMERA

This brings up the camera editing tool See THE CAMERA AND PROJECTOR. Enable the ? tool window to see options for this tool.

Next: CROP TOOL, Previous: CAMERA, Up: COMPOSITOR

6.2.5 PROJECTOR

This brings up the projector editing tool See THE CAMERA AND PROJECTOR. Enable the ? tool window to see options for this tool.

Next: EYEDROPPER, Previous: PROJECTOR, Up: COMPOSITOR

6.2.6 CROP TOOL

This brings up the cropping tool See CROPPING. The ? tool window must be enabled to use this tool.

Next: TOOL INFO, Previous: CROP TOOL, Up: COMPOSITOR

6.2.7 EYEDROPPER

This brings up the eyedropper. The eyedropper detects whatever color is under it and stores it in a temporary area. Enabling the ? tool info shows the currently selected color. Click anywhere in the video output to select the color at that point.

The eyedropper not only lets you see areas which are clipped, but its value can be applied to many effects. Different effects handle the eyedropper differently.

Next: SAFE REGIONS TOOL, Previous: EYEDROPPER, Up: COMPOSITOR

6.2.8 TOOL INFO

?

This brings up a window containing options for the currently selected tool.

Previous: TOOL INFO, Up: COMPOSITOR

6.2.9 SAFE REGIONS TOOL

▣

This draws the safe regions in the video output. This doesn't affect the rendered output See SAFE REGIONS.

Next: RESOURCES, Previous: COMPOSITOR, Up: THE MAIN WINDOWS

6.3 PROGRAM

This contains the timeline and the entry point for all menu driven operations. The timeline consists of a vertical stack of tracks with horizontal representation of time. This defines the output of rendering operations and what is saved when you save files. Left of the timeline is the patchbay which contains options affecting each track.

Under the **Window** menu you'll find options affecting the main windows. **default positions** repositions all the windows to a 4 screen editing configuration. On dual headed displays, the **default positions** operation fills only one monitor with windows.

Next: SOUND LEVEL METERS, Previous: PROGRAM, Up: THE MAIN WINDOWS

6.4 RESOURCES

Effects, transitions, clips, and assets are accessed here. Most of the resources are inserted into the project by dragging them out of the resource window. Management of resource allocation is also performed here.

Next: OTHER WINDOWS, Previous: RESOURCES, Up: THE MAIN WINDOWS

6.5 SOUND LEVEL METERS

An additional window, the **levels window** can be brought up from the **Window** menu. The **levels** window displays the output audio levels after all mixing is done.

Sound level meters appear in many locations. They can be toggled in the viewer and compositor windows with the level toggle. They appear in the patchbay when a track is expanded (See THE PATCHBAY.) They appear in the recording monitor when audio is being recorded.

The sound levels in the **levels window, compositor, and viewer** correspond to the final output levels before they are clipped to the soundcard range. In the **record monitor** they are the input values from the sound card. In the **patchbay** they are the sound levels for each track after all effects are processed and before downmixing for the output.

Most of the time, audio levels have numerical markings in DB but in the patchbay there isn't enough room.

The sound level is color coded as an extra means of determining the sound level. Even without numerical markings, the sound level color can distinguish between several ranges and overload. Look at the color codings in a meter with numerical markings to see what colors correspond to what sound level. Then for meters in the patchbay in expanded audio tracks, use the color codings to see if it's overloading.

Be aware that sound levels in Cinelerra can go above 0DB. This allows not only seeing if a track is overloading but how much information is being lost by the overloading. Overloading by less than 3DB is usually acceptable. While overloading is treated as positive numbers in Cinelerra, it is clipped to 0 when sent to a sound card or file.

The visible range of the sound level meters is configurable in **settings->preferences->interface** (See INTERFACE.)

Previous: SOUND LEVEL METERS, Up: THE MAIN WINDOWS

6.6 OTHER WINDOWS

The **Overlays window** can be brought up from the **Window** menu. This is a quick way to toggle what is drawn in the timeline. Every option in the **View** menu is available here.

Next: NAVIGATING THE PROJECT, Previous: THE MAIN WINDOWS, Up: Top

7 LOADING AND SAVING FILES

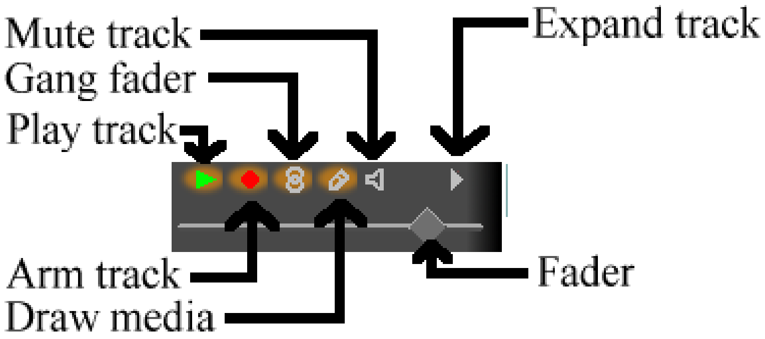
Next: LOADING FILES, Up: LOADING AND SAVING FILES

7.1 SUPPORTED FILE FORMATS

Here are most of the supported file formats and notes regarding their compression. You may be able to load other formats not described here.

The format of the file affects what Cinelerra does with it. Edit decision lists replace the project settings. Formats which contain media but no edit decisions just add data to the tracks. If your project sample rate is 48khz and you load a sound file with 96khz, you'll still be playing it at 48khz. If you load an EDL file at 96khz and the current project sample rate is 48khz, you'll change it to 96khz.

Some file formats are very slow to display on the timeline. These usually have video which is highly compressed. Drawing highly compressed video picons can be very slow. Disable picon drawing for these files with the **draw media** toggle to speed up operations.



Track attributes

Supported file formats are currently:

- WAV
- FLAC
- PCM

- AIFF
- AC3 audio

Next: MPEG-4 AUDIO, Up: SUPPORTED FILE FORMATS

7.1.1 QUICKTIME

Quicktime is not the standard for UNIX but we use it because it's well documented. All of the Quicktime movies on the internet are compressed. Cinelerra doesn't support most compressed Quicktime movies but does support some. If it crashes when loading a Quicktime movie, that means the format probably wasn't supported.

NOTES ON QUICKTIME ENCODING

Here are some notes regarding making Quicktime movies in Cinelerra:

Quicktime is a wrapper for 2 codecs, a video codec and an audio codec. The video and audio codecs are picked separately. The preferred encoding for Quicktime output is MPEG-4 Video and MPEG-4 Audio. This format plays in the commercial players for Windows and has good compression quality. For better compression, use H-264 Video. Unfortunately H-264 decoding is so slow it can't play very large frame sizes.

Cinelerra supports 2 nonstandard codecs: Dual MPEG-4 video and dual H.264 video. These won't play in anything but Cinelerra and XMovie. They are designed for movies where the frames have been divided into 2 fields, each field displayed sequentially. The dual codecs interleave 2 video streams to improve efficiency without requiring major changes to the player.

Next: IMAGE SEQUENCES, Previous: QUICKTIME, Up: SUPPORTED FILE FORMATS

7.1.2 MPEG-4 AUDIO

This is the same as Quicktime with MPEG-4 Audio as the audio codec.

Next: STILL IMAGES, Previous: MPEG-4 AUDIO, Up: SUPPORTED FILE FORMATS

7.1.3 IMAGE SEQUENCES

Rendering an image sequence is not the same as rendering a single image. When rendering an image sequence Cinelerra generates a table of contents file for the image sequence and makes a different image file for every timeline position. The table of contents can be loaded instead of the individual images to get better performance. To learn more about the different image formats supported in an image sequence, read about still images.

Next: AVI, Previous: IMAGE SEQUENCES, Up: SUPPORTED FILE FORMATS

7.1.4 STILL IMAGES

Rendering a single image causes the image file to be overwritten for every timeline position. No table of contents is created. When loaded, the image takes up one frame in length and doesn't change the project attributes.

Several still image formats not normally found in other programs are described here.

- OPEN EXR IMAGES
- RAW DIGITAL CAMERA IMAGES

Next: RAW DIGITAL CAMERA IMAGES, Up: STILL IMAGES

7.1.4.1 OPEN EXR IMAGES

You may not know about Open EXR. This format stores floating point RGB images. It also supports a small amount of compression. Projects which render to EXR should be in a floating point color model to take advantage of it See SETTING PROJECT ATTRIBUTES. Several compression options are available for EXR.

- **PIZ** Lossless wavelet compression. This is the best compression.
- **ZIP** Lossless gzip algorithm.
- **RLE** Lossless run length encoding. This is the fastest and worst compression.
- **PXR24** Lossy compression where the floating point numbers are converted to 24 bits and compressed with gzip.

Select **Use Alpha** if the project colormodel has an alpha channel and you want to retain it in the file. Otherwise the primary colors are multiplied by the alpha channel.

Previous: OPEN EXR IMAGES, Up: STILL IMAGES

7.1.4.2 RAW DIGITAL CAMERA IMAGES

RAW digital camera images are a special kind of image file which Cinelerra only imports. These must be processed in a floating point color space once they are on the timeline. Raw images from Canon cameras are the only ones tested. They need to have the **Linearize** effect applied to correct gamma. Because raw images take a long time to interpolate, they are usually viewed first in a proxy file and then touched up.

First apply the Linearize effect to a track of raw images and set it to **automatic** with **0.6** gamma. Then render the timeline to a Quicktime JPEG file. Append the Quicktime JPEG file in a new track and disable playback of the old track. Now the gamma corrected copy of each raw image can be previewed relatively fast in the same timeline position as the original image.

Next: MPEG FILES CONTAINING VIDEO, Previous: STILL IMAGES, Up: SUPPORTED FILE FORMATS

7.1.5 AVI

AVI with assorted audio and video codecs. Because AVI is so fragmented, your luck will vary.

Next: DVD MOVIES, Previous: AVI, Up: SUPPORTED FILE FORMATS

7.1.6 MPEG FILES CONTAINING VIDEO

MPEG files containing video can be loaded directly into Cinelerra. If the file is supported, a table of contents is built. If the file is unsupported, it usually crashes or shows very short tracks. Unfortunately, this method of loading MPEG files isn't good enough if you intend to use the files in a renderfarm.

To use MPEG files in a renderfarm you need to run **mpeg3toc** to generate a table of contents for the file, then load the table of contents. Mpeg3toc needs the absolute path of the MPEG file. If you don't use an absolute path, it assumes the MPEG file is in the same directory that Cinelerra is run from.

MPEG streams are structured into multiple tracks. Each track can be video or audio. Each audio track can have 1-6 channels. Cinelerra converts each channel of audio into a track.

NOTES ON MPEG VIDEO ENCODING

MPEG video encoding is done separately from MPEG audio encoding. In MPEG video there are 2 colormodels. The YUV 4:2:0 colormodel is encoded by a highly optimized version of mpeg2enc with presets for standard consumer electronics. In the process of optimizing mpeg2enc, they got rid of YUV 4:2:2 encoding. The YUV 4:2:2 colormodel is encoded by a less optimized version of mpeg2enc.

YUV 4:2:2 encoding was kept around because the NTSC version of DV video loses too much quality when transferred to YUV 4:2:0. This DV video must be transferred to YUV 4:2:2.

When encoding YUV 4:2:0, the bitrate parameter changes meaning depending on whether the bitrate or quantization is fixed. If the bitrate is fixed, it's the target bitrate. If the quantization is fixed, it's the maximum bitrate allowed. This is a quirk of the mpeg2enc version.

Next: MPEG 1 AUDIO, Previous: MPEG FILES CONTAINING VIDEO, Up: SUPPORTED FILE FORMATS

7.1.7 DVD MOVIES

DVD's are spit into a number of programs, each identified by a unique **IFO** file. If you want to load a DVD, find the corresponding **IFO** file for the program of interest. Load the IFO file directly and a table of contents will be built. Alternatively for renderfarm usage, a table of contents can be created separately.

Run

```
     mpeg3toc -v /cdrom/video_ts/vts_01_0.ifo dvd.toc
```

or something similar. Then load **dvd.toc**.

Next: OGG THEORA/VORBIS, Previous: DVD MOVIES, Up: SUPPORTED FILE FORMATS

7.1.8 MPEG 1 AUDIO

These are .mp2 and .mp3 files. If fixed bitrate, they can be loaded directly with no table of contents. Variable bitrate streams need to have a table of contents created with **mpeg3toc**.

Next: EDIT DECISION LIST, Previous: MPEG 1 AUDIO, Up: SUPPORTED FILE FORMATS

7.1.9 OGG THEORA/VORBIS

The OGG format is an antiquated but supposedly unpatented way of compressing audio and video. The quality isn't as good as H.264 or MPEG-4 Audio. In reality, anyone with enough money and desire can find a patent violation so the justification for OGG is questionable.

Previous: OGG THEORA/VORBIS, Up: SUPPORTED FILE FORMATS

7.1.10 EDIT DECISION LIST

Edit decision lists are generated by Cinelerra for storing projects. They end in .xml. They change project attributes when loaded.

Because edit decision lists consist of text, they can be edited in a text editor.

Next: LOADING THE BACKUP, Previous: SUPPORTED FILE FORMATS, Up: LOADING AND SAVING FILES

7.2 LOADING FILES

All data that you work with in Cinelerra is acquired either by **recording from a device** or by **loading from disk**. This section describes loading.

The loading and playing of files is just as you would expect. Just go to **file->Load**, select a file for loading, and hit **ok**. Hit the forward play button and it should start playing, regardless of whether a progress bar has popped up.

Another way to load files is to pass the filenames as arguments on the command line. This creates new tracks for every file and starts the program with all the arguments loaded.

If the file is a still image, the project's attributes are not changed and the first frame of the track becomes the image. If the file has audio, Cinelerra may build an index file for it to speed up drawing. You can edit and play the file while the index file is being built.

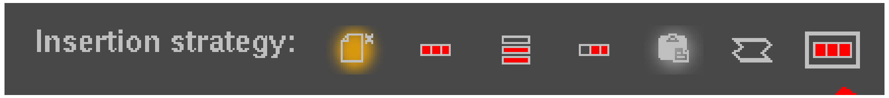
Next: LOADING MULTIPLE FILES, Up: LOADING FILES

7.2.1 INSERTION STRATEGY

Usually three things happen when you load a file. First the existing project is cleared from the screen, second the project's attributes are changed to match the file's, and finally the new file's tracks are created in the timeline.

But Cinelerra lets you change what happens when you load a file.

In the file selection box there is a range of options for **Insertion strategy**. Each of these options loads the file a different way.



- **Replace current project**

  All tracks in the current project are deleted and new tracks are created to match the source. Project attributes are only changed when loading XML. If multiple files are selected it adds new tracks for every file.

- **Replace current project and concatenate tracks**

  Same as replace current project except if multiple files are selected it concatenates the tracks of every file after the first.

- **Append in new tracks**

  The current project is not deleted and new tracks are created for the source.

- **Concatenate to existing tracks**

  The current project is not deleted and new files are concatenated to the existing tracks.

- **Paste at insertion point**

  The file is pasted in like a normal paste operation.

- **Create new resources only**

  The timeline is unchanged and new resources are created in the Resource Window.

- **Nested EDL**

  If the file is an EDL, the output of the EDL is pasted in like a media file. Nested EDLs have 1 video track & a number of audio tracks corresponding to the number of output channels. They allow larger sequences composed of many smaller sequences, transitions to be applied to the output of another EDL, & global processing on the output of an EDL without having to manipulate each track.

The insertion strategy is a recurring option in many of Cinelerra's functions. In each place the options do the same thing. With these options you can almost do all your editing by loading files.

If you load files by passing command line arguments to Cinelerra, the files are loaded with **Replace current project** rules.

Previous: INSERTION STRATEGY, Up: LOADING FILES

7.2.2 LOADING MULTIPLE FILES

In the file selection box go to the list of files. Select a file. Go to another file and select it while holding down **CTRL**. This selects one additional file. Go to another file and select it while holding down **SHIFT**. This selects every intervening file. This behavior is available in most every list box.

Select a bunch of mp3 files and **Replace current project and concatenate tracks** in the insertion strategy to create a song playlist.

Next: SAVING FILES, Previous: LOADING FILES, Up: LOADING AND SAVING FILES

7.3 LOADING THE BACKUP

There is one special XML file on disk at all times. After every editing operation Cinelerra saves the current project to a backup in **$HOME/.bcast/backup.xml**. In the event of a crash go to **file->load backup** to load the backup. It is important after a crash to reboot Cinelerra without performing any editing operations. Loading the backup should be the first operation or you'll overwrite the backup.

Next: RENDERING FILES, Previous: LOADING THE BACKUP, Up: LOADING AND SAVING FILES

7.4 SAVING FILES

When Cinelerra saves a file it saves an edit decision list of the current project but doesn't save any media. Go to **File->save as...**. Select a file to overwrite or enter a new file. Cinelerra automatically concatenates **.xml** to the filename if no **.xml** extension is given.

The saved file contains all the project settings and locations of every edit but instead of media it contains pointers to the original media files on disk.

For each media file the XML file stores either an absolute path or just the relative path. If the media is in the same directory as the XML file a relative path is saved. If it's in a different directory an absolute path is saved.

In order to move XML files around without breaking the media linkages you either need to keep the media in the same directory as XML file forever or save the XML file in a different directory than the media and not move the media ever again.

If you want to create an audio playlist and burn it on CD-ROM, save the XML file in the same directory as the audio files and burn the entire directory. This keeps the media paths relative.

XML files are useful for saving the current state before going to sleep and saving audio playlists but they're limited in that they're specific to Cinelerra. You can't play XML files in a dedicated movie player. Realtime effects in an XML file have to be resynthesized every time you play it back. The XML file also requires you to maintain copies of all the source assets on hard drives, which can take up space and cost a lot of electricity to spin. For a more persistent storage of the output there's rendering.

Previous: SAVING FILES, Up: LOADING AND SAVING FILES

7.5 RENDERING FILES

Rendering takes a section of the timeline, performs all the editing, effects and compositing, and stores it in a pure movie file. You can then delete all the source assets, play the rendered file in a movie player, or bring it back into Cinelerra for more editing. It's very difficult to retouch any editing decisions in the pure movie file, however, so keep the original assets and XML file around several days after you render it.

All rendering operations are based on a region of the timeline to be rendered. You need to define this region on the timeline. The navigation section describes methods of defining regions. See NAVIGATING THE PROJECT. The rendering functions define the region based on a set of rules. When a region is highlighted or in/out points are set, the affected region is rendered. When no region is highlighted, everything after the insertion point is rendered. Merely by positioning the insertion point at the beginning of a track and unsetting all in/out points, the entire track is rendered.

- SINGLE FILE RENDERING: Rendering a single file
- BATCH RENDERING: Rendering several files unattended
- THE RENDER FARM: Rendering using many computers
- COMMAND LINE RENDERING: Rendering from the command line without a GUI

Next: BATCH RENDERING, Up: RENDERING FILES

7.5.1 SINGLE FILE RENDERING

The fastest way to get media to disk is to use the single file rendering function.

Go to **File->render** to bring up the render dialog. Select the magnifying glass 🔍 to bring up a file selection dialog. This determines the filename to write the rendered file to and the encoding parameters.

In the render dialog select a format from the **File Format** menu. The format of the file determines whether you can render audio or video or both. Select the **Render audio tracks** toggle to generate audio tracks and **Render video tracks** to generate video tracks.

Select the wrench 🔧 next to each toggle to set compression parameters. If the file format can't store audio or video the compression parameters will be blank. If **Render audio tracks** or **Render video tracks** is selected and the file format doesn't support it, trying to render will pop up an error.

The **Create new file at each label** option causes a new file to be created when every label in the timeline is encountered. This is useful for dividing long audio recordings into individual tracks. When using the renderfarm, **Create new file at each label** causes one renderfarm job to be created at every label instead of using the internal load balancing algorithm to space jobs.

When **Create new file at each label** is selected, a new filename is created for every output file. If the filename given in the render dialog has a 2 digit number in it, the 2 digit number is overwritten with a different incremental number for every output file. If no 2 digit number is given, Cinelerra automatically concatenates a number to the end of the given filename for every output file.

In the filename **/hmov/track01.wav** the **01** would be overwritten for every output file. The filename **/hmov/track.wav**; however, would become **/hmov/track.wav001** and so on and so forth. Filename regeneration is only used when either renderfarm mode is active or creating new files for every label is active.

Finally the render dialog lets you select an insertion mode. The insertion modes are the same as with loading files. In this case if you select **insert nothing** the file will be written out to disk without changing the current project. For other insertion strategies be sure to prepare the timeline to have the output inserted at the right position before the rendering operation is finished. See EDITING. Editing describes how to cause output to be inserted at the right position.

It should be noted that even if you only have audio or only have video rendered, a **paste** insertion strategy will behave like a normal paste operation, erasing any selected region of the timeline and pasting just the data that was rendered. If you render only audio and have some video tracks armed, the video tracks will get truncated while the audio output is pasted into the audio tracks.

Next: THE RENDER FARM, Previous: SINGLE FILE RENDERING, Up: RENDERING FILES

7.5.2 BATCH RENDERING

If you want to render many projects to media files without having to repeatedly attend to the **Render** dialog, **batch rendering** is the function to use. In this function, you specify many EDL files to render and the unique output files for each. Then Cinelerra loads each EDL file and renders it automatically, without any user intervention. Each EDL file and its output to be rendered is called a **batch**. This allows a huge amount of media to be processed and greatly increases the value of an expensive computer.

The first thing to do when preparing to do batch rendering is define projects to be rendered. The batch renderer requires a separate EDL file for every batch to be rendered. Set up a project and define the region to be rendered either by highlighting it, setting in/out points around it, or positioning the insertion point before it. Then save the project as an EDL. Define as many projects as needed this way. The batch renderer takes the active region from the EDL file for rendering.

With all the EDL files prepared with active regions, go to **File->batch render**. This brings up the batch rendering dialog. The interface for batch rendering is a bit more complex than for single file rendering.

A list of batches must be defined before starting a batch rendering operation. The table of batches appears on the bottom of the batch render dialog and is called **batches to render**. Above this are the configuration parameters for a single batch.

Set the **output path**, **file format**, **Audio**, **Video**, and **Create new file at each label** parameters as if it was a single file. These parameters apply to only one batch. In addition to the standard rendering parameters, you must select the source EDL to use in the batch. Do this by setting the **EDL path**.

If the **batches to render** list is empty or nothing is highlighted, click **New** to create a new batch. The new batch will contain all the parameters you just set.

Repeatedly press the **New** button to create more batches with the same parameters. Highlight any batch and edit the configuration on the top of the batch render window. The highlighted batch is always synchronized to the information displayed.

Click and drag batches to change the order in which they're rendered. Hit **delete** to permanently remove the highlighted batch.

In the list box is a column which enables or disables the batch. This way batches can be skipped without being deleted. Click on the **Enabled** column in the list box to enable or disable a batch. If it is checked, the batch is rendered. If it is blank, the batch is skipped.

The other columns in the batch list are informative.

- **Output** The output path of the batch.
- **EDL** The source EDL of the batch.
- **Elapsed** The amount of time taken to render the batch if it is finished.

To start rendering from the first enabled batch, hit **Start**.

Once rendering, the main window shows the progress of the batch. Once the batch finishes, the elapsed column in the batch list is updated and the next batch is rendered until all the enabled batches are finished. The currently rendering batch is always highlighted red.

To stop rendering before the batches are finished without closing the batch render dialog, hit **Stop**.

To stop rendering before the batches are finished and close the batch render dialog, hit **Cancel**.

To exit the batch render dialog whether or not anything is being rendered, hit **Cancel**.

Next: COMMAND LINE RENDERING, Previous: BATCH RENDERING, Up: RENDERING FILES

7.5.3 THE RENDER FARM

When bicubic interpolation and HDTV was first done on Cinelerra, the time needed to produce the simplest output became unbearable even on the fastest dual 1.7Ghz Xeon of the time. Renderfarm support even in the simplest form brings HDTV times back in line with SD while making SD faster than realtime.

While the renderfarm interface isn't spectacular, it's simple enough to use inside an editing suite with less than a dozen nodes without going through the same amount of hassle you would with a several hundred node farm. Renderfarm is invoked transparently for all file->render operations when it is enabled in the preferences.

Cinelerra divides the selected region of the timeline into a certain number of jobs which are then dispatched to the different nodes depending on the load balance. The nodes process the jobs and write their output to individual files on the filesystem. The output files are not concatenated. It's important for all the nodes to have access to the same filesystem on the same mount point for assets.

If a node can't access an input asset it'll display error messages to its console but probably not die. If it can't access an output asset it'll cause the rendering to abort.

It should be noted that in the render dialog, the **Create new file at each label** option causes a new renderfarm job to be created at each label instead of by the load balancer. If this option is selected when no labels exist, only one job will be created.

A Cinelerra renderfarm is organized into a master node and any number of slave nodes. The master node is the computer which is running the GUI. The slave nodes are anywhere else on the network and are run from the command line. Run a slave node from the command line with

cinelerra -d

That is the simplest configuration. Type **cinelerra -h** to see more options. The default port number may be overridden by passing a port number after the -d.

Most of the time you'll want to bring in the rendered output and fine tune the timing on the timeline. Also some file formats like MPEG can't be direct copied. Because of this, the jobs are left in individual files.

You can load these by creating a new track and specifying **concatenate to existing tracks** in the load dialog. Files which support direct copy can be concatenated into a single file by rendering to the same file format with renderfarm disabled. Also to get direct copy, the track dimensions, output dimensions, and asset dimensions must be equal.

MPEG files or files which don't support direct copy have to be concatenated with a command line utility. MPEG files can be concatenated with **cat**.

Configuration of the renderfarm is described in the configuration chapter See RENDERFARM. The slave nodes traditionally read and write data to a common filesystem over a network, thus they don't need hard drives.

Ideally all the nodes on the renderfarm have similar CPU performance. Cinelerra load balances on a first come first serve basis. If the last segment is dispatched to the slowest node, all the fastest nodes may end up waiting for the slowest node to finish while they themselves could have rendered it faster.

Previous: THE RENDER FARM, Up: RENDERING FILES

7.5.4 COMMAND LINE RENDERING

The command line rendering facility consists of a way to load the current set of batch rendering jobs and process them without a GUI. This is useful if you're planning on crashing X repeatedly or want to do rendering on the other side of a low bandwidth network. You might have access to a supercomputer in India but still be stuck in America, exhiled you might say. A command line interface is ideal for this.

To perform rendering from the command line, first run Cinelerra in graphical mode. Go to **file->batch render**. Create the batches you intend to render in the batch window and close the window. This saves the batches in a file. Set up the desired renderfarm attributes in **settings->preferences** and exit Cinelerra. These settings are used the next time command line rendering is used.

On the command line run

cinelerra -r

to processes the current batch jobs without a GUI. Setting up all the parameters for this operation is hard. That's why the command line aborts if any output files already exist.

Other parameters exist for specifying alternative files for the preferences and the batches. Attempting to use anything but the defaults is very involved so it hasn't been tested.

Next: EDITING, Previous: LOADING AND SAVING FILES, Up: Top

8 NAVIGATING THE PROJECT

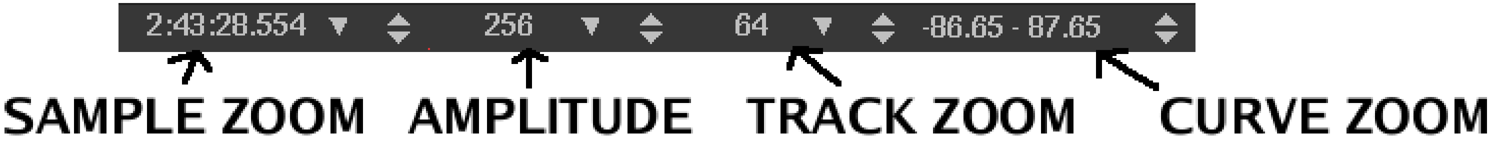
The thing you want to do most of the time is get to a certain time and place in the media. Internally the media is organized into tracks. Each track extends across time. Navigation involves both getting to a track and getting to a certain time in the track.

Next: NAVIGATING THE VIEWER AND COMPOSITOR, Up: NAVIGATING THE PROJECT

8.1 NAVIGATING THE PROGRAM WINDOW

The program window contains many features for navigation and displays the timeline as it is structured in memory: tracks stacked vertically and extending across time horizontall. The horizontal scroll bar allows you to scan across time. The vertical scroll bar allows you to scan across tracks.

Below the timeline you'll find the zoom panel. The zoom panel contains values for **sample zoom**, **amplitude**, **track zoom**, and **curve zoom**. These values in addition to the scrollbars are the main tools for positioning the timeline.



Changing the **sample zoom** causes the amount of time visible to change. **If your mouse has a wheel and it works in X11 go over the tumblers**

and use the wheel to zoom in and out.

The **amplitude** only affects audio. It determines how big the waveform is if the waveform is drawn.

The **track zoom** affects all tracks. It determines the height of each track. If you change the track zoom the amplitude zoom compensates so audio waveforms look proportional.

The **curve zoom** affects the curves in all the tracks. It determines the amplitude and offset of the curves. The tumbler affects curve amplitude but the only way to change curve offset is to use the **fit curves** button.

In addition to the graphical tools, you'll probably more often use the keyboard to navigate. Use **PAGE UP** and **PAGE DOWN** to scroll up and down the tracks.

Use the **LEFT** and **RIGHT** arrows to move across time in small increments. You'll often need to scroll beyond the end of the timeline but scrollbars won't let you do it. Instead use the **RIGHT** arrow to scroll past the end of timeline.

Use the **HOME** and **END** keys to instantly go to the beginning or end of the timeline. In **I-beam** mode, hold down shift while pressing **HOME** or **END** to select the region of the timeline between the insertion point and the key pressed.

Use the **UP** and **DOWN** arrows to change the sample zoom by a power of 2.

CTRL-UP and **CTRL-DOWN** cause the amplitude zoom to change.

CTRL-PGUP and **CTRL-PGDOWN** cause the track zoom to change.

ALT-UP and **ALT-DOWN** cause the curve amplitude to change.

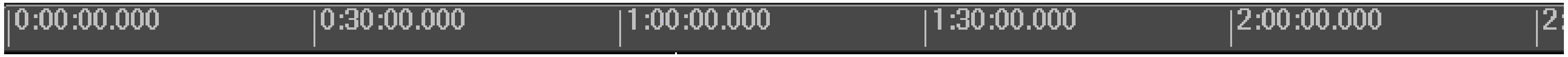
- THE INSERTION POINT
- THE IN/OUT POINTS
- USING LABELS IN THE PROGRAM WINDOW

Next: THE IN/OUT POINTS, Up: NAVIGATING THE PROGRAM WINDOW

8.1.1 THE INSERTION POINT

By default you'll see a flashing insertion point in the program window the first time you boot it up. This is where new media is pasted onto the timeline. It's also the starting point of all playback operations. When rendering, it defines the region of the timeline to be rendered.

The insertion point is normally moved by clicking inside the timebar. Any region of the timebar not obscured by labels and in/out points is a hotspot for repositioning the insertion point.

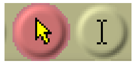


The main timebar

The insertion point also can be moved by clicking in the timeline itself, but not always. The insertion point has two modes of operation:

- drag and drop mode
- cut and paste mode

The mode of operation is determined by selecting the arrow or the i-beam in the buttonbar.


The editing mode buttons

If the arrow is highlighted it enables **drag and drop** mode. In drag and drop mode, clicking in the timeline doesn't reposition the insertion point. Instead it selects an entire edit. Dragging in the timeline repositions the edit, snapping it to other edit boundaries. This is normally useful for reordering audio playlists and moving effects around.

If the i-beam is highlighted it enables **cut and paste mode**. In cut and paste mode clicking in the timeline repositions the insertion point. Dragging in the timeline highlights a region. The highlighted region becomes the playback range during the next playback operation, the rendered range during the next render operation, and the region affected by cut and paste operations.

Shift-clicking in the timeline extends the highlighted region.

Double-clicking in the timeline selects the entire edit the cursor is over.

It should be noted that when moving the insertion point and selecting regions, the positions are either aligned to frames or aligned to samples. When editing video you'll want to align to frames. When editing audio you'll want to align to samples. This is set in **settings->align cursor on frames**.

If the highlighted region is the region affected by cut and paste operations, how do I cut and paste in **drag and drop** mode? In this case you need to set **in/out points** to define an affected region.

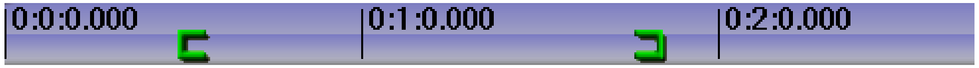
Next: USING LABELS IN THE PROGRAM WINDOW, Previous: THE INSERTION POINT, Up: NAVIGATING THE PROGRAM WINDOW

8.1.2 THE IN/OUT POINTS

In both editing modes you can set in/out points. The in/out points define the affected region. In drag and drop mode they are the only way to define an affected region. In both cut and paste mode and drag and drop mode the highlighted area overrides the in/out points. If a highlighted area and in/out points are set, the highlighted area is affected by editing operations and the in/out points are ignored. If no region is highlighted, the in/out points are used.

Normally, in/out points do not affect the playback region. Only if you hold down CTRL while issuing a playback command do the in/out points determine the playback region.

To set in/out points go to the timebar and position the insertion point somewhere. Hit the **in point button**. Go to a position after the in point and hit the **out point button**.



Timebar with in/out points set.

Select either the in point or the out point and the insertion point jumps to that location. After selecting an in point, if you hit the **in point button** the in point will be deleted. After selecting an out point, if you hit the **out point button** the out point will be deleted.

If you select a region somewhere else while in/out points already exist, the existing points will be repositioned when you hit the in/out buttons.

Shift-clicking on an in/out point extends the highlighted region to that point.

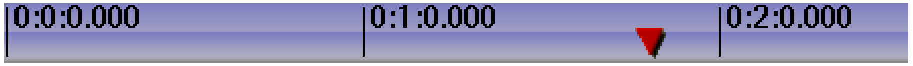
Instead of using the button bar you can use the **[** and **]** keys to toggle in/out points.

The insertion point and the in/out points allow you to define an affected region but they don't let you jump to exact points on the timeline very easily. For this purpose there are labels.

Previous: THE IN/OUT POINTS, Up: NAVIGATING THE PROGRAM WINDOW

8.1.3 USING LABELS IN THE PROGRAM WINDOW

Labels are an easy way to set exact locations on the timeline you want to jump to. When you position the insertion point somewhere and hit the **label button** a new label appears on the timeline.



Timebar with a label on it

No matter what the zoom settings are, clicking on the label positions the insertion point exactly where you set it. Hitting the label button again when a label is selected deletes it.

Shift-clicking on a label extends the highlighted region.

Double-clicking between two labels highlights the region between the labels.

Hitting the **l** key has the same effect as the label button.

If you hit the label button when a region is highlighted, two labels are toggled at each end of the highlighted region. If one end already has a label, then the existing label is deleted and a label is created at the opposite end.

Labels can reposition the insertion point when they are selected but they can also be traversed with the **label traversal** buttons. When a label is out of view, the label traversal buttons reposition the timeline so the label is visible. There are keyboard shortcuts for label traversal, too.

CTRL-LEFT repositions the insertion point on the previous label.

CTRL-RIGHT repositions the insertion point on the next label.

With label traversal you can quickly seek back and forth on the timeline but you can also select regions.

SHIFT-CTRL-LEFT extends the highlighted region to the previous label.

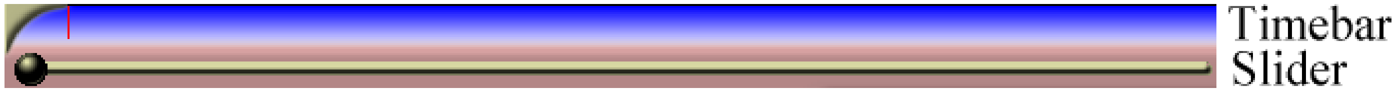
SHIFT-CTRL-RIGHT extends the highlighted region to the next label.

Manually hitting the label button or **l** key over and over again to delete a series of labels can get tedious. For deleting a set of labels, first highlight a region and second use the **Edit->Clear labels** function. If in/out points exist, the labels between the in/out points are cleared and the highlighted region ignored.

Next: NAVIGATING THE RESOURCES, Previous: NAVIGATING THE PROGRAM WINDOW, Up: NAVIGATING THE PROJECT

8.2 NAVIGATING THE VIEWER AND COMPOSITOR

The navigation features of the Viewer and Compositor behave very similarly. Each has a timebar and slider below the video output. The timebar and slider are critical for navigation.



The timebar represents the entire time covered by the program. When you define labels and in/out points it defines those, too. Finally the timebar defines a region known as the **preview region**.

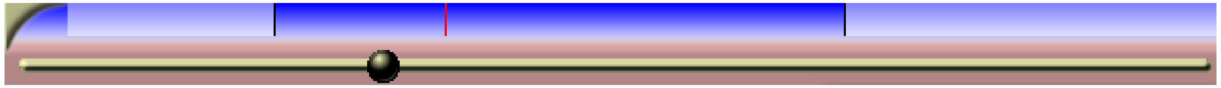
The **preview region** is the region of the timeline which the slider effects. The slider only covers the time covered by the preview region. By using a preview region inside the entire program and using the slider inside the preview region you can quickly and precisely seek in the compositor and viewer.

When you replace the current project with a file the preview region automatically resizes to cover the entire file. When you append data or change the size of the current project, the preview region stays the same size and shrinks. Therefore, you need to resize the preview region.

Load a file and then slide around it using the compositor slider. The insertion point in the main window follows the compositor. Move the pointer over the compositor's timebar until it turns into a left resize pointer. The click and drag right. The preview region should have changed and the slider resized proportionally.

Go to the right of the timebar until a right resize pointer appears. Drag left so the preview region shrinks.

Go to the center of the preview region in the timebar and drag it around to convince yourself if can be moved.



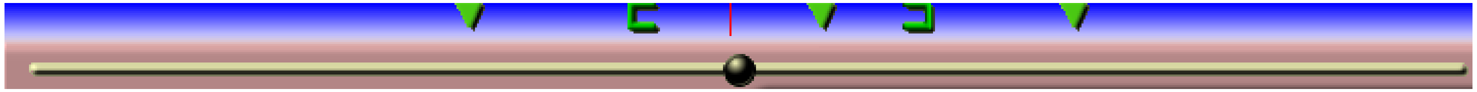
Preview region in compositor

If you go to the slider and slide it around with the preview region shrunk, you'll see the slider only affects the preview region. The timebar and slider in the viewer window work exactly the same.

Labels and in/out points are fully supported in the viewer and compositor. The only difference between the viewer and compositor is the compositor reflects the state of the program while the viewer reflects the state of a clip but not the program.

When you hit the **label button** in the compositor, the label appears both in the compositor timebar and the program timebar.

When you select a label or in/out point in the compositor, the program window jumps to that position.



Labels and in/out points in the viewer.

In the viewer and compositor, labels and in/out points are displayed in the timebar. Instead of displaying just a region of the program, the timebar displays the entire program here.

Like the Program window, the Compositor has a zoom capability. First, the pulldown menu on the bottom of the compositor window has a number of zoom options. When set to **Auto** the video is zoomed to match the compositor window size as closely as possible. When set to any other percentage, the video is zoomed a power of 2 and scrollbars can be used to scroll around the output. When the video is zoomed bigger than the window size, not only do scrollbars scan around it but **middle mouse button** dragging in the video output scans around it. This is exactly when The Gimp does.

Furthermore, the zoom 🔍 toggle causes the Compositor window to enter zoom mode. In zoom mode, clicking in the video output zooms in while **ctrl-clicking** in the video output zooms out. If you have a wheel mouse, rotating the wheel zooms in or out too.

Zooming in or out with the zoom tool does not change the rendered output, mind you. It's merely for scrutinizing video or fitting it in the desktop.

Next: USING THE TRANSPORT CONTROLS, Previous: NAVIGATING THE VIEWER AND COMPOSITOR, Up: NAVIGATING THE PROJECT

8.3 NAVIGATING THE RESOURCES

The resource window is divided into two areas. One area lists folders and another area lists folder contents. Going into the folder list and clicking on a folder updates the contents area with the contents of that folder.

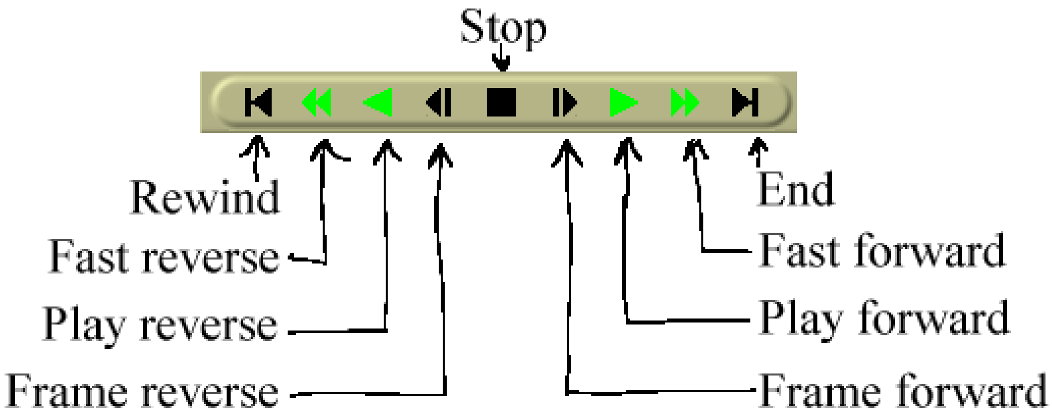
The folder and contents can be displayed as icons or text.

Right clicking in the folder or contents area brings up a menu containing formatting options. Select **Display text** to display a text listing. Select **Sort items** to sort the contents of the folder alphabetically.

Next: USING BACKGROUND RENDERING, Previous: NAVIGATING THE RESOURCES, Up: NAVIGATING THE PROJECT

8.4 USING THE TRANSPORT CONTROLS

Transport controls are just as useful in navigation as they are in playing back footage, hence they are described here in the navigation section. Each of the Viewer, Compositor, and Program windows has a transport panel.



The transport panel.

The transport panel is controlled by the keyboard as well as the graphical interface. For each of the operations it performs, the starting position is the position of the insertion point in the Program window and the slider in the Compositor window. The ending position is either the end or start of the timeline or the end or start of the selected region if there is one.

The orientation of the end or start depends on the direction of playback. If it's forward the end position is the end of the selected region. If it's backward the end position is the start of the selected region.

The insertion point moves to track playback. When playback stops, the insertion point stays where playback stopped. Thus, by playing back you change the position of the insertion point.

The keyboard interface is usually the fastest and has more speeds. The transport keys are arranged in a sideways **T** on the number pad.

- **+** Fast reverse
- **6** Normal reverse
- **5** Slow reverse
- **4** Frame reverse
- **1** Frame forward
- **2** Slow forward
- **3** Normal forward
- **Enter** Fast forward
- **0** Stop
- **Spacebar** Normal forward

Hitting any key on the keyboard twice pauses it.

When using frame advance functions the behavior may seem odd. If you frame advance forward and then frame advance backward, the displayed frame doesn't change. This is because the playback position isn't the frame but the time between two frames. The rendered frame is the area that the playback position crosses. When you increment the time between two frames by one and decrement it by one, you cross the same frame both times and so the same frame is displayed.

The transport behavior changes if you hold down CTRL when issuing any of the transport commands. This causes the starting point to be the in point if playing forward and the out point if playing backward. If playing forward, the out point becomes the ending point and if playing backward, the in point becomes the ending point. If no in/out points are specified, the behavior falls back to using the insertion point and track boundaries as the starting and ending points.

Previous: USING THE TRANSPORT CONTROLS, Up: NAVIGATING THE PROJECT

8.5 USING BACKGROUND RENDERING

Background rendering allows impossibly slow effects to play back in realtime shortly after the effect is pasted in the timeline. It continuously renders temporary output. When renderfarm is enabled, background rendering uses the renderfarm continuously. This way, any size video can be seen in realtime merely by creating a fast enough network with enough nodes.

Background rendering is enabled in settings->preferences->performance. It has one interactive function: **settings->set background render**. This sets the point where background rendering begins to where the in point is. If any video exists, a red bar appears in the time bar showing what has been background rendered.

It's often useful to insert an effect or a transition and then select settings->set background render right before the effect to preview it in full framerates.

Next: USING EFFECTS, Previous: NAVIGATING THE PROJECT, Up: Top

9 EDITING

Editing comprises both the time domain and the track domain. Since the timeline consists of a stack of tracks, you need to worry about how to sort and create tracks in addition to what time certain media appears on a track.

In the time domain, Cinelerra offers many ways to approach the editing process. The three main methods are two screen editing, drag and drop editing, and cut and paste editing.

There are several concepts Cinelerra uses when editing which apply to all the methods. The **timeline** is where all editing decisions are represented. This is a stack of tracks in the center of the main window. It can be scrolled up, down, left and right with the scrollbars on the right and bottom of it. It can also be scrolled up and down with a mouse wheel.

The **active region** is the range of time which is affected by editing commands on the timeline. The active region is determined first by the presence of in/out points in the timeline. If those don't exist the highlighted region is used. If no highlighted region exists the insertion point is used as the start of the active region. Some commands treat all the space to the right of the insertion point as active, like **Render**, while others treat the active length as 0 if no end point for the active region is defined.

Finally, editing decisions never affect source material. This is **non destructive editing** and it became popular with audio because it was much faster than if you had to copy all the media affected by an edit. Editing only affects pointers to source material, so if you want to have a media file at the end of your editing session which represents the editing decisions, you need to **render** it. See RENDERING FILES.

Every track on the timeline has a set of attributes on the left, the most important of which is the **arm track** attribute.

- THE PATCHBAY: Enabling different features on different tracks
- NUDGING TRACKS: Move entire tracks horizontally
- PANNING TRACKS: Changing the audio output channels
- AUTOMATIC TRACK PANNING: Panning tracks to common speaker arrangements
- STANDARD AUDIO MAPPINGS: Making audio panning that works on other players.
- MANIPULATING TRACKS: Moving whole tracks around
- TWO SCREEN EDITING: Using two video windows to edit
- DRAG AND DROP EDITING: Dragging objects to edit
- CUT AND PASTE EDITING: Editing media like text
- TRIMMING: Changing in and out points

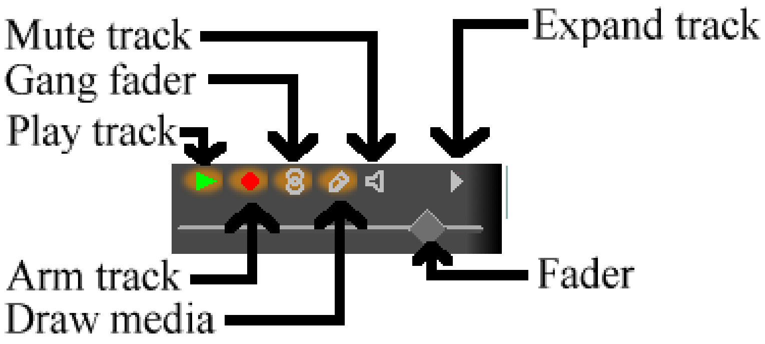
Next: NUDGING TRACKS, Up: EDITING

9.1 THE PATCHBAY

On the left of the timeline is a region affectionately known as the patchbay. The patchbay enables features specific to each track. All tracks have a text area for naming the track.

All tracks have an **expander** ▼ for viewing more options and for viewing the effects on the track. Click on the expander to expand or collapse the track. If it's pointing sideways, the track is collapsed. If it's pointing down, the track is expanded. The effects appear below the media for the track if they exist.

All tracks have the following row of toggles for several features.



Track attributes

If the toggle is colored, it is enabled. If the toggle is the background color of most of the windows, it is disabled. Click on the toggle to enable or disable the feature. Several mouse operations speed up the configuration of several tracks at a time.

Click on an attribute and drag across adjacent tracks to copy the same attribute to those tracks.

Hold down **shift** while clicking a track's attribute to enable the attribute in the current track and toggle the attribute in all the other tracks.

Hold down **shift** while clicking an attribute. Click until all the tracks except the selected one are disabled. Then drag the cursor over the adjacent track to enable the attribute in the adjacent track.

The other attributes affect the output of the track.

- **Play track** determines whether the track is rendered or not. If it's off, the track is not rendered. However, if the track is chained to any other tracks, the other tracks perform all the effects in the chained track, regardless of play status.

- **Arm track** determines whether the track is armed or not. Only the **armed tracks** are affected by editing operations. Make sure you have enough armed destination tracks when you paste or splice material or some tracks in the material will get left out.

  In addition to restricting editing operations, the armed tracks in combination with the active region determine where material is inserted when loading files. If the files are loaded with one of the insertion strategies which doesn't delete the existing project, the armed tracks will be used as destination tracks.

  Press **Tab** while the cursor is anywhere over a track to toggle the track arming status.

  Press **Shift-Tab** while the cursor is over a track to toggle the arming status of every other track.

- **Gang fader** causes the fader to track the movement of whatever other fader you're adjusting. A fader is only ganged if the **arm track** is also on. This is normally used to adjust audio levels on all the tracks simultaneously. Gang also causes **Nudge** parameters to synchronise across all the ganged tracks.

- **Draw media** determines if picons or waveforms are drawn on the track. By default, some file formats load with this off while other file formats load with it on. This depends on whether the file format takes a long time to draw on the timeline. Merely set it to on if you want to see picons for any file format.

- **Mute track** causes the output to be thrown away once the track is completely rendered. This happens whether or not **play track** is on. If the track is part of an effect chain, the output of the effect chain track is overlayed on the final output even though it's routed back to another track. Mute track is used to keep the effect chain track from overlapping the output of the source track.

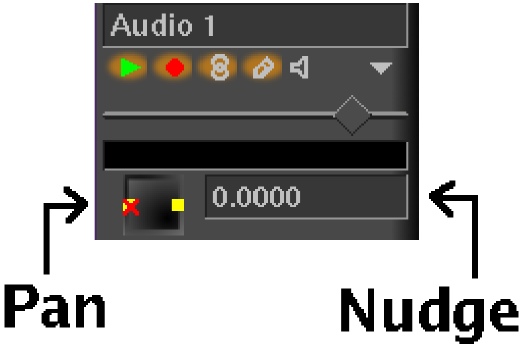
- **Fader** All tracks have a fader, but the units of each fader depend on whether it's audio or video. Click and drag the fader to fade the track in and out. If it is ganged to other tracks of the same media type, with the **arm** option enabled, the other faders should follow.

  Hold down **shift** and drag a fader to center it on 0.

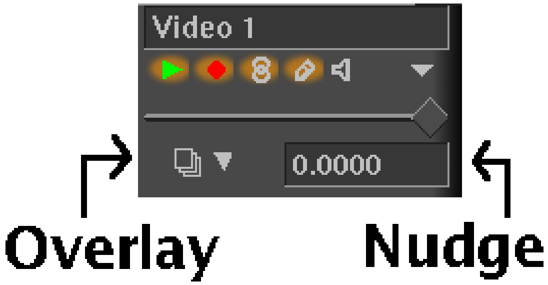
Next: PANNING TRACKS, Previous: THE PATCHBAY, Up: EDITING

9.2 NUDGING TRACKS

Each track has a nudge textbox in its patchbay. You may have to expand the track to see it. These are views of the patchbays when expanded.



Pan and nudge for an audio track.



Overlay mode and nudge for a video track.

The nudge is the amount the track is shifted left or right during playback. The track is not displayed shifted on the timeline, but it is shifted when it's played back. This is useful for synchronizing audio with video, creating fake stereo, or compensating for an effect which shifts time, all without tampering with any edits.

Merely enter in the amount of time to shift by to instantly shift the track. Negative numbers make the track play later. Positive numbers make the track play sooner. The nudge units are either **seconds** or the native units for the track. Select the units by **right clicking** on the nudge textbox and using the context sensitive menu.

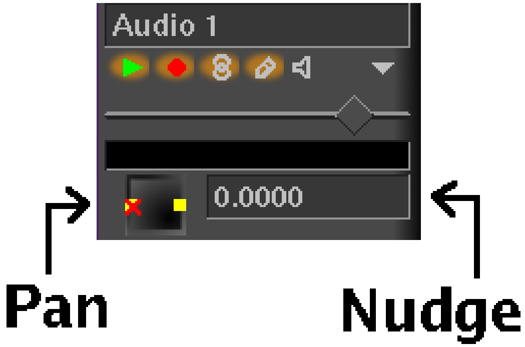
Nudge settings are ganged with the **Gang faders** toggle and the **Arm track** toggle.

Use the mouse wheel over the nudge textbox to increment and decriment it.

Next: AUTOMATIC TRACK PANNING, Previous: NUDGING TRACKS, Up: EDITING

9.3 PANNING TRACKS

Audio tracks have a panning box in their patchbay. It may have to be expanded to see it. The panning box is shown here.



Pan and nudge for an audio track.

Position the pointer in the panning box and click/drag to reposition the audio output among the speaker arrangement. The loudness of each speaker is printed during the dragging operation. The panning box uses a special algorithm to try to allow audio to be focused through one speaker or branched between the nearest speakers when more than 2 speakers are used.

Next: STANDARD AUDIO MAPPINGS, Previous: PANNING TRACKS, Up: EDITING

9.4 AUTOMATIC TRACK PANNING

Several convenience functions are provided for automatically setting the panning to several common standards. They are listed in the **Audio** menu. These functions only affect audio tracks with **recording** enabled.

Audio->Map 1:1 - This maps every track to its own channel and wraps around when all the channels are allocated. It's most useful for making 2 tracks with 2 channels map to stereo and for making 6 tracks with 6 channels map to a 6 channel soundcard.

Audio->Map 5.1:2 - This maps 6 tracks to 2 channels. The project should have 2 channels when using this function. Go to **Settings->format** to set the output channels to 2. This is most useful for downmixing 5.1 audio to stereo.

Next: MANIPULATING TRACKS, Previous: AUTOMATIC TRACK PANNING, Up: EDITING

9.5 STANDARD AUDIO MAPPINGS

Although Cinelerra lets you map any audio track to any speaker, there are standard mappings you should use to ensure the media can be played back elsewhere. Also, most audio encoders require the audio tracks to be mapped to standard speaker numbers or they won't work.

In the **channel position** widget See SETTING PROJECT ATTRIBUTES, the channels are numbered to correspond to the output tracks they are rendered to. For stereo, the source of channel 1 needs to be the left track and the source of channel 2 needs to be the right track.

For 5.1 surround sound, the sources of the 6 channels need to be in the order of center, front left, front right, back left, back right, low frequency effects. If the right tracks aren't mapped to the right speakers, most audio encoders won't encode the right information if they encode anything at all. The low frequency effects track specifically can't store high frequencies in most cases.

Next: TWO SCREEN EDITING, Previous: STANDARD AUDIO MAPPINGS, Up: EDITING

9.6 MANIPULATING TRACKS

Tracks in Cinelerra either contain audio or video. There is no special designation for tracks other than the type of media they contain. When you create a new project, it contains a certain mumber of default tracks. You can still add or delete tracks from a number of menus. The **Tracks** menu contains a number of options for dealing with multiple tracks simultaneously. Each track itself has a popup menu which affects one track.

Bring up the popup menu by moving over a track and right clicking. The popup menu affects the track whether it's armed or not.

Move up and **move down** moves the one track up or down in the stack. **Delete track** deletes the track.

Operations in the **Tracks** menu affect only tracks which are armed.

Move tracks up and **Move tracks down** shift all the armed tracks up or down the stack.

Delete tracks deletes the armed tracks.

Delete last track deletes the last track, whether it's armed or not. Holding down the **d** key quickly deletes all the tracks.

Concatenate tracks is more complicated. It takes every **playable** track and concatenates it to the end of the first **armed tracks**. If there are two armed tracks followed by two playable tracks, the concatenate operation puts the two playable tracks after the two armed tracks. If there are three playable tracks instead, two tracks are put after the armed tracks and a third track is put on the end of the first armed track. The destination track wraps around until all the playable tracks are concatenated.

Finally, you'll want to create new tracks. The **Audio** and **Video** menus each contain an option to add a track of their specific type. In the case of audio, the new track is put on the bottom of the timeline and the output channel of the audio track is incremented by one. In the case of video, the new track is put on the top of the timeline. This way, video has a natural compositing order. New video tracks are overlayed on top of old tracks.

Next: DRAG AND DROP EDITING, Previous: MANIPULATING TRACKS, Up: EDITING

9.7 TWO SCREEN EDITING

This is the fastest way to construct a program out of movie files. The idea consists of viewing a movie file in one window and viewing the program in another window. Sections of the movie file are defined in one window and transferred to the end of the program in the other window.

The way to begin a two screen editing session is to load some resources. In **file->load** load some movies with the insertion mode **create new resources**. You want the timeline to stay unchanged while new resources are brought in. Go to the Resource Window and select the **media** folder. The newly loaded resources should appear. Drag a resource from the media side of the window over the Viewer window.

There should be enough armed tracks on the timeline to put the sections of source material that you want. If there aren't, create new tracks or arm more tracks.

In the viewer window seek to the starting point of a clip you want to use. Use either the **slider** or the **transport controls**. Use the **preview region** to narrow down the search. Set the starting point with the **in point button**.

Seek to the ending point of the clip you want to use. Set the ending point with the **out point button**. The two points should now appear on the timebar and define a clip.

There are several things you can do with the clip now.

- Splice inserts the clip in the timeline, pushing everything back. If an **in point** or **out point** exists on the timeline it's inserted there, otherwise it's inserted after the insertion point. After that, the insertion point moves to the end of the clip. If there is no in/out point, the insertion point will be used as the next splice location. This way you can continuously build up the program by splicing.
- Overwrite overwrites the region of the timeline with the clip. If an **in point** or **out point** exists on the timeline it's overwritten there, otherwise it's overwritten after the insertion point. If a region is highlighted or both in and out points exist the difference between the active region and the clip length is deleted.
- Create a clip generates a new clip for the resource window containing the affected region but doesn't change the timeline. Every clip has a title and a description. These are optional.
- Copy behaves the same as in cut and paste editing.

Two screen editing can be done purely by keybard shortcuts. When you move the pointer over any button a tooltip should appear, showing what key is bound to that button. In the Viewer window, the number pad keys control the transport and the **[ ] v** keys perform in/out points and splicing.

Next: CUT AND PASTE EDITING, Previous: TWO SCREEN EDITING, Up: EDITING

9.8 DRAG AND DROP EDITING

The answer is yes, you can you create a bunch of clips and drag them on the timeline. You can also drag edits around the timeline.

Load some files using **file->load**. Set the insertion mode to **Create new resources**. This loads the files into the Resource Window. Create some audio and video tracks on the timeline using the video and audio menus.

Open the **Media** folder in the resource window. Drag a media file from the resource window to the timeline. If the media has video, drag it onto a video track. If the media is pure audio, drag it onto an audio track.

Cinelerra fills out the audio and video tracks below the dragging cursor with data from the file. This affects what tracks you should create initially and which track to drag the media onto. If the media has one video track and two audio tracks, you'll need one video track and two audio tracks on the timeline and the media should be dragged over the first video track. If the media has audio only you'll need one audio track on the timeline for every audio track in the media and the media should be dragged over the first audio track.

When dragging, the media snaps to the start of track if the track is empty. If there are edits on the track, the media snaps to the nearest edit boundary.

You can also drag multiple files from the resource window. Either draw a box around the files, use SHIFT, or use CTRL when selecting files. When you drop the files in the timeline, they are concatenated. The behavior of SHIFT and CTRL changes depending on if the resources are in text or icons.

To display the resources as text or icons, right click inside the media list. Select either **display icons** or **display text** to change the list format.

When displaying text in the resource window **SHIFT-clicking** on media files extends the number of highlighted selections. **CTRL-clicking** on media files in text mode selects additional files one at a time.

When displaying icons in the resource window **SHIFT-clicking** or **CTRL-clicking** selects media files one at a time.

In addition to dragging media files, if you create clips and open the **clip** folder you can drag clips on the timeline.

In the timeline there is further dragging functionality. To enable the dragging functionality of the timeline, select the arrow toggle . Move over an edit and drag it. If more than one track is armed, Cinelerra will drag any edits which start on the same position as the edit the cursur is currently over. During a dragging operation the edit snaps to the nearest boundary.

Dragging edits around the timeline allows you to sort music playlists, sort movie scenes, and give better NAB demos but not much else.

Next: TRIMMING, Previous: DRAG AND DROP EDITING, Up: EDITING

9.9 CUT AND PASTE EDITING

This is the traditional method of editing in audio editors. In the case of Cinelerra, you either need to start a second copy of Cinelerra and copy from one copy to the other, copy from different tracks in the same copy, or load a media file into the Viewer and copy from there.

Load some files onto the timeline. To perform cut and paste editing select the i-beam toggle. Select a region of the timeline and select the cut button to cut it. Move the insertion point to another point in the timeline and select the paste button. Assuming no in/out points are defined on the timeline this performs a cut and paste operation.

If in/out points are defined, the insertion point and highlighted region are overridden by the in/out points for clipboard operations. Thus, with in/out points you can perform cut and paste in drag and drop mode as well as cut and paste mode.

When editing audio, it is customary to cut from one part of a waveform into the same part of another waveform. The start and stop points of the cut are identical in each waveform and might be offset slightly, while the wave data is different. It would be very hard to highlight one waveform to cut it and highlight the second waveform to paste it without changing the relative start and stop positions.

One option for simplifying this is to open a second copy of Cinelerra, cutting and pasting to transport media between the two copies. This way two highlighed regions can exist simultanously.

Another option is to set in/out points for the source region of the source waveform and set labels for the destination region of the destination waveform. Perform a cut, clear the in/out points, select the region between the labels, and perform a paste.

A final operation in cut and paste editing is the **edit->clear** operation. If a region is highlighted or in/out points exist, the affected region is cleared by **edit->clear**. But if the insertion point is over an edit boundary and the edits on each side of the edit boundary are the same resource, the edits are combined into one edit comprised by the resource. The start of this one edit is the start of the first edit and the end of this one edit is the end of the second edit. This either results in the edit expanding or shrinking.

Previous: CUT AND PASTE EDITING, Up: EDITING

9.10 TRIMMING

With some edits on the timeline it's possible to do trimming. By trimming you shrink or grow the edit boundaries by dragging them. In either drag and drop mode or cut and paste mode, move the cursor over an edit boundary until it changes shape. The cursor will either be an expand left or an expand right. If the cursor is an expand left, the dragging operation affects the beginning of the edit. If the cursor is an expand right, the dragging operation affects the end of the edit.

When you click on an edit boundary to start dragging, the mouse button number determines which dragging behavior is going to be followed. 3 possible behaviors are bound to mouse buttons in the interface preferences. See INTERFACE.

The effect of each drag operation not only depends on the behavior button but whether the beginning or end of the edit is being dragged. When you release the mouse button, the trimming operation is performed.

In a **Drag all following edits** operation, the beginning of the edit either cuts data from the edit if you move it forward or pastes new data from before the edit if you move it backward. The end of the edit pastes data into the edit if you move it forward or cuts data from the end of the edit if you move it backward. All the edits thereafter shift. Finally, if you drag the end of the edit past the start of the edit, the edit is deleted.

In a **Drag only one edit** operation, the behavior is the same when you drag the beginning or end of an edit. The only difference is none of the other edits in the track shift. Instead, anything adjacent to the current edit expands or shrinks to fill gaps left by the drag operation.

In a **Drag source only** operation, nothing is cut or pasted. If you move the beginning or end of the edit forward, the source reference in the edit shifts forward. If you move the beginning or end of the edit backward, the source reference shifts backward. Where the edit appears in the timeline remains the same but the source shifts.

For all file formats besides still images, the extent of the trimming operation is clamped to the source file length. Attempting to drag the start of the edit beyond the start of the source clamps it to the source start.

In all trimming operations, all edits which start on the same position as the cursor when the drag operation begins are affected. Unarm tracks to prevent edits from getting affected.

Next: SETTING PROJECT ATTRIBUTES, Previous: EDITING, Up: Top

10 USING EFFECTS

It would be sufficient to perform all changes to the timeline using editing operations, but this isn't very extensible. Certain timeline changes should produce a different effect in the output without involving a unique procedure to apply each change. This is why we have effects.

Effects fall into three categories, and each effect in a category is applied using the same procedure.

Next: RENDERED EFFECTS, Up: USING EFFECTS

10.1 REALTIME EFFECTS

These are layered under the track they apply to. They process the track when the track is played back, with no permanent storage of the output except when the project is rendered.

APPLYING REALTIME EFFECTS

All the realtime effects are listed in the resource window, divided into two groups: audio effects and video effects. Audio effects should be dragged from the resource window onto audio tracks. Video effects should be dragged onto video tracks.

If there is data on the destination track, the effect is applied to the entire track. If there is no data on the track the effect is deleted. Finally, if a region of the track is selected the effect is pasted into the region, regardless of whether there is data.

Some of the effects don't process data but synthesize data. In the case of a synthesis effect, you'll want to select a region of the track so the dragging operation pastes it without deleting it.

When dragging more than one effect onto a track, you'll see the effects layering from top to bottom, on the bottom of the track. When the track is played back, effects are processed from top to bottom. The output of the top effect becomes the input of the bottom effect and so on and so forth.

In addition to dragging from the resource window, there are 2 other methods of applying them:

- **APPLYING FROM THE TRACK POPUP MENU:**

  Right click on a track and select **Attach effect** from the popup. The attach effect dialog gives you more control than pure dragging and dropping. For one thing, the attach effect dialog lets you attach two more types of effects: shared effects and shared tracks. Select a plugin from the **Plugins** column and hit **Attach** under the plugins column to attach it. The effect is the same as if the effect was dragged from the resource window.

- **APPLYING FROM THE AUDIO AND VIDEO MENUS:**

  Select **Audio->Attach effect...** or **Video->Attach effect** to attach a realtime effect to all the recordable tracks simultaneously. The advantage with this is most of the time you want to attach the same effect to all the audio tracks and the other two methods require repeating the same work for every track.

  The menu interface has an option called **Attach single standalone and share others**. Enable this to make the first track get a standalone effect and to have the other tracks share the standalone effect. Most of the time, you want this to be on.

When an effect exists under a track, it most often needs to be configured. Go to the effect and right click on it to bring up the effect popup. In the effect popup is a **show** option. The show option causes the GUI for the effect to appear under the cursor. Most effects have GUI's but some don't. If the effect doesn't have a GUI, nothing pops up when the **show** option is selected. When you tweek parameters in the effect GUI, the parameters normally effect the entire duration of the effect.

Next: EDITING REALTIME EFFECTS, Up: REALTIME EFFECTS

10.1.1 REALTIME EFFECT TYPES

The two other effect types supported by the Attach Effect dialog are recycled effects. In order to use a recycled effect, three requiremenets must be met:

- There must be other effects in the timeline.
- The other effects must be of the same type as the track you're attaching an effect to. If the track is an audio track, the effects must be audio effects. If the track is a video track, the effects must be video effects.
- The insertion point or selected region must start inside the other effects.

In the case of a shared effect, these conditions must be true. In the case of a shared track, there merely must be another track on the timeline of the same type as the track you're applying an effect to. If you right clicked on a video track to attach an effect, there won't be anything in the **shared tracks** column if no other video track exists. If you right clicked on an audio track there won't be anything in the shared track column if no other audio track exists.

If shared effects or shared tracks are available, they appear in the **shared effects** and **shared tracks** columns. The **attach** button under each column causes anything highlighted in the column to be attached under the current track.

Shared effects and shared tracks allow very unique things to be done. In the case of a shared effect, the shared effect is treated like a copy of the original effect except in the shared effect the GUI can't be brought up. All configuration of the shared effect is determined by the GUI of the original effect and only the GUI of the original effect can be brought up.

When a shared effect is played back, it's processed just like a normal effect except the configuration is copied from the original effect. Some effects detect when they are being shared, like the reverb effects and the compressor. These effects determine what tracks are sharing them and either mix the two tracks together or use one track to stage some value. The reverb mixes tracks together to simulate ambience. The compressor uses one of the sharing tracks as the trigger.

When an original track has a **shared track** as one of its effects, the shared track itself is used as a realtime effect. This is more commonly known as **bouncing tracks** but Cinelerra achieves the same operation by attaching shared tracks. The fade and any effects in the shared track are applied to the original track. Once the shared track has processed the data, the original track performs any effects which come below the shared track and then composites it on the output.

In addition, once the shared track has processed the output of the original track like a realtime effect, the shared track mixes itself into the output with it's settings for pan, mode, and projector. Thus, two tracks are mixing the same data on the output. Most of the time you don't want the shared track to mix the same data as the original track on the output. You want it to stop right before the mixing stage and give the data back to the original track. Do this by enabling the 🔈 mute toggle next to each track for whom you don't want to mix on the output.

Suppose you were making video and you did want the shared track to composite the original track's data on the output a second time. In the case of video, the video from the shared track would always appear under the video from the original track, regardless of whether it was on top of the original track. This is because shared tracks are composited in order of their attachment. Since it's part of the original track it has to be composited before the original track is composited.

Previous: REALTIME EFFECT TYPES, Up: REALTIME EFFECTS

10.1.2 EDITING REALTIME EFFECTS

Many operations exist for manipulating effects once they are in the timeline. Because mixing effects and media is such complex business, the methods used in editing effects aren't as concise as cutting and pasting. Some of the editing happens by dragging in/out points, some of the editing happens through popup menus, and some of it happens by dragging effects.

Normally when you edit tracks, the effects follow the editing decisions. If you cut from a track, the effect shrinks. If you drag edit in/out points, the effect changes length. This behavior can be disabled by selecting **Settings->edit effects** in the project window. This decouples effects from editing operations, but what if you just want to edit the effects?

Move the timeline cursor over the effect borders until it changes to a resize left or resize right icon. In this state, if you drag the end of the effect, it performs an edit just like dragging the end of a track does.

The three editing behaviors of track trimming apply to effect trimming and they are bound to the mouse buttons that you set in **interface preferences**. See INTERFACE. When you perform a trim edit on an effect, the effect boundary is moved by dragging on it. Unlike track editing, the effect has no source length. You can extend the end of an effect as much as desired without being limited.

Also unlike track editing, the starting position of the drag operation doesn't bind the edit decision to media. The media the effect is bound to doesn't follow effect edits. Other effects; however, do follow editing decisions made on an effect. If you drag the end of an effect which is lined up to effects on other tracks, the effects on the other tracks will be edited while the media stays the same.

What happens if you trim the end of an effect in, leaving a lot of unaffected time near the end of the track? When you drag an effect in from the Resource Window you can insert the effect in the portion of the row unoccupied by the trimming operation. Realtime effects are organized into rows under the track. Each row can have multiple effects.

In some cases you'll want a trimming operation to change only one row of effects. This can be achieved by first positioning the insertion point on the start or end of the effect. Then press **shift** while beginning the trimming operation. This causes the operation to change only one row of effects.

In addition to trimming, you can move effects up or down. Every track can have a stack of effects under it. By moving an effect up or down you change the order in which effects are processed in the stack. Go to an effect and right click to bring up the effect menu. The **Move up** and **Move down** options move the effect up or down.

When you're moving effects up or down, be aware that if they're shared as **shared effects**, any references will be pointing to a different effect after the move operation.

Finally, there's dragging of effects. Dragging effects works just like dragging edits. You must select the arrow to enter drag and drop mode before dragging effects. The effects snap to media boundaries, effect boundaries, and tracks. Be aware if you drag a reference to a shared effect, the reference will usually point to the wrong effect afterwards.

Right click on an effect to bring up a menu for the effect. Select **attach...** to change the effect or change the reference if it is a shared effect.

Next: TRANSITIONS, Previous: REALTIME EFFECTS, Up: USING EFFECTS

10.2 RENDERED EFFECTS

Another type of effect is performed on a section of the track and the result stored somewhere before it is played back. The result is usually pasted into the track to replace the original data.

The rendered effects are not listed in the resource window but instead are accessed through the **Audio->Render effect** and **Video->Render effect** menu options. Each of these menu options brings up a dialog for the rendered effect. Rendered effects apply to only one type of track, either audio or video. If no tracks of the type exist, an error pops up.

A region of the timeline to apply the effect to must be defined before selecting **Render effect...**. If no in/out points and no highlighted region exists, the entire region after the insertion point is treated as the affected region. Otherwise, the region between the in/out points or the highlighted region is the affected region.

Secondly, the tracks to apply the rendered affect to need to be **armed**. All other tracks are ignored.

Finally, the rendered affect processes certain track attributes when it reads its input data but not others. Transitions in the affected track are applied. Nudge is not and effects are not. This allows the new data to be pasted into the existing position without changing the nudge value.

In the render effect dialog is a list of all the realtime and all the rendered effects. The difference here is that the realtime effects are rendered to disk and not applied under the track. Highlight an effect in the list to designate it as the one being performed.

Define a file to render the effect to in the **Select a file to render to** box. The 🔍 magnifying glass allows file selection from a list.

Select a file format which can handle the track type. The 🔧 wrench allows configuration specific to the file format.

There is also an option for creating a new file at each label. If you have a CD rip on the timeline which you want to divide into different files, the labels would become dividing points between the files if this option were selected. When the timeline is divided by labels, the effect is re-initialized at every label. Normalize operations take the peak in the current file and not in the entire timeline.

Finally there is an insertion strategy just like in the render dialog. It should be noted that even though the effect applies only to audio or video, the insertion strategy applies to all tracks just like a clipboard operation.

When you click **OK** in the effect dialog, it calls the GUI of the effect. If the effect is also a realtime effect, a second GUI appears to prompt for acceptance or rejection of the current settings. After accepting the settings, the effect is processed.

Next: LADSPA EFFECTS, Previous: RENDERED EFFECTS, Up: USING EFFECTS

10.3 TRANSITIONS

When one edit ends and another edit begins, the default behaviour is to have the first edit's output immediately become the output of the second edit when played back. Transitions are a way for the first edit's output to become the second edit's output with different variations.

Cinelerra supports audio and video transitions, all of which are listed in the resource window. Transitions may only apply to the matching track type. Transitions under **audio transitions** can only apply to audio tracks. Transitions under **video transitions** can only apply to video tracks.

Load a video file and cut a section from the center so the edit point is visible on the timeline. Go the resource window and click on the **Video transitions** folder. Drag a transition from the transition list onto the second video edit on the timeline. A box highlights over where the transition will appear. Releasing it over the second edit applies the transition between the first and second edit.

You can now scrub over the transition with the transport controls and watch the output in the **Compositor window**. Scrubbing with the insertion point doesn't normally show transitions because the transition durations are usually too short. The exact point in time when the transition takes effect isn't straightforward. It starts when the second edit begins and lasts a certain amount of time into the second edit. Therefore, the first asset needs to have enough data after the edit point to fill the transition into the second edit.

Once the transition is in place, it can be edited similarly to an effect. Move the pointer over the transition and right click to bring up the transition menu. The **show** option brings up specific parameters for the transition in question if there are any. The **length** option adjusts the length of the transition in seconds. Once these two parameters are set, they are applied to future transitions until they are changed again. Finally, the **detach** option removes the transition from the timeline.

Dragging and dropping transitions from the Resource window to the Program window can be really slow and tiring. Fortunately, once you drag a transition from the Resource window, the **U** and **u** keys will paste the same transition. The **U** key pastes the last video transition and the **u** key pastes the last audio transition on all the recordable tracks. If the insertion point or in point is over an edit, the beginning of the edit is covered by the transition.

It should be noted that when playing transitions from the timeline to a hardware accelerated video device, the hardware acceleration will usually be turned off momentarily during the transition and on after the transition in order to render the transition. Using an unaccelerated video device for the entire timeline normally removes the disturbance.

Next: EFFECT PRESETS, Previous: TRANSITIONS, Up: USING EFFECTS

10.4 LADSPA EFFECTS

LADSPA effects are supported in realtime and rendered mode for audio. The LADSPA plugins you get from the internet vary in quality. Most can't be tweeked in realtime very easily and work better when rendered. Some crash and some can only be applied to one track due to a lack of reentrancy. Although Cinelerra implements the LADSPA interface as accurately as possible, multiple tracks of realtime, simultaneous processing go beyond the majority of LADSPA users. LADSPA effects appear in the audio folder as the hammer and screwdriver, to signify that they are Plugins for Linux Audio Developers.

LADSPA Effects are enabled merely by setting the **LADSPA_PATH** environment variable to the location of your LADSPA plugins or putting them in the **/usr/lib/cinelerra** directory.

Previous: LADSPA EFFECTS, Up: USING EFFECTS

10.5 EFFECT PRESETS

Save and recall all the settings for an effect by using the **presets** window. Bring up the effect context menu by right clicking on the effect on the timeline. Go to **Presets...** to bring up the window. Save all the settings to a preset by entering a title in **Preset title** and clicking **save**. Recall the settings in a preset by highlighting it and clicking **Apply**. Delete a preset by highlighting it and clicking **Delete**.

Next: COMPOSITING, Previous: USING EFFECTS, Up: Top

11 SETTING PROJECT ATTRIBUTES

When you play media files in Cinelerra, the media files have a certain number of tracks, a certain frame size, a certain sample size, and so on and so forth. No matter what the media file has; however, it is still played back according to the project attributes. If an audio file's samplerate is different than the project attributes, it is resampled. If a video file's frame size is different than the project attributes, it is composited on a black frame, either cropped or bordered with black.

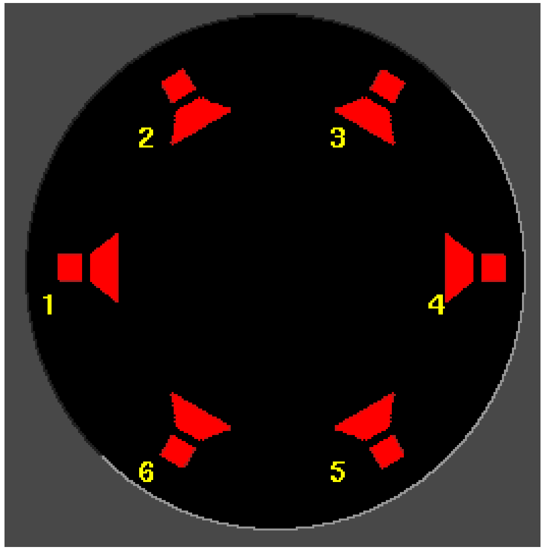
The project attributes are adjusted in **Settings->Set Format** and in to a more limited extent in **File->New**. When you adjust project settings in **file->new** a new timeline is created with no data. Every timeline created from this point uses the same settings. When you adjust settings in **settings->format**, the timeline is not recreated with no data but every timeline created from this point uses the same settings.

In addition to the traditional settings for sample rate, frame rate, frame size, Cinelerra uses some unusual settings like **channel positions, color model, and aspect ratio.**

Next: COLOR MODEL, Up: SETTING PROJECT ATTRIBUTES

11.1 AUDIO CHANNEL POSITIONS

The currently enabled audio channels and their positions in the user interface boxes are displayed in the channel position widget.



The channels are numbered. When rendered, the output from channel 1 is rendered to the first output track in the file or the first soundcard channel of the soundcard. Later channels are rendered to their successively numbered output tracks.

The audio channel locations correspond to where in the panning widgets each of the audio outputs is. The closer the panning position is to one of the audio outputs, the more signal that speaker gets. Click on a speaker icon and drag to change the audio channel location.

The speakers can be in any orientation. A different speaker arrangement is stored for every number of audio channels since normally you don't want the same speaker arrangement for different numbers of channels.

Channel positions is the only setting which doesn't affect the output necessarily. Click on a speaker icon and drag to change the position of a channel. It is merely a convenience so when more than 2 channels are used, the pan controls on the timeline can distinguish between them. It has nothing to do with the actual arrangement of speakers.

But different channels can be positioned very close together to make them have the same output.

Next: ASPECT RATIO, Previous: AUDIO CHANNEL POSITIONS, Up: SETTING PROJECT ATTRIBUTES

11.2 COLOR MODEL

Color model is very important for video playback because video has the disadvantage of being very slow. Although it isn't noticable, audio intermediates contain much more information than the audio on disk and the audio which is played. Audio always uses the highest bandwidth intermediate because it's fast.

Video intermediates must use the least amount of data for the required quality because it's slow, but video intermediates still use a higher bandwidth color model than video which is stored and video which is played. This allows more processing to be done with less destruction of the original data.

The video is stored on disk in one colormodel, normally compressed using a YUV derivative. When played back, Cinelerra decompresses it from the file format directly into the format of the output device. If effects are processed, the decompression is into an intermediate colormodel first and the intermediate colormodel is then converted to the format of the output device. The selection of intermediate colormodel determines how accurate and fast the effects are.

Cinelerra colormodels are described using a certain packing order of components and a certain number of bits for each component. The packing order is printed on the left and the bit allocation is printed on the right.

- **RGB-888**

  This allocates 8 bits for the R, G, and B channels and no alpha. This is normally used for uncompressed media with low dynamic range.

- **RGBA-8888**

  This allocates an alpha channel to the 8 bit RGB colormodel. It's used for overlaying multiple tracks.

- **YUV-888**

  This allocates 8 bits for Y, U, and V. This is used for low dynamic range operations in which the media is compressed in the YUV color space. Most compressed media is in YUV and this allows it to be processed fast with the least color degradation.

- **YUVA-8888**

  This allocates an alpha channel to the 8 bit YUV colormodel for transparency.

- **RGB-Float**

  This allocates a 32 bit float for the R, G, and B channels and no alpha. This is used for high dynamic range processing with no transparency.

- **RGBA-Float** This adds a 32 bit float for alpha to RGB-Float. This is used for high dynamic range processing with transparency.

In order to do effects which involve alpha channels, a colormodel with an alpha channel must be selected. These are RGBA8888, YUVA8888, and RGBA Float. The 4 channel colormodels are notoriously slower than 3 channel colormodels, with the slowest being RGBA Float. Some effects, like fade, work around the need for alpha channels while other effects, like chromakey, require an alpha channel to do anything, so it's a good idea to try the effect without alpha channels to see if it works before settling on an alpha channel and slowing it down.

The YUV colormodels are usually faster than RGB colormodels when using compressed footage. They also destroy fewer colors than RGB colormodels. If footage stored as JPEG or MPEG is processed many times in RGB, the colors will fade while they won't if processed in YUV.

Years of working with high dynamic range footage have shown floating point RGB to be the best format for high dynamic range. While 16 bit integers were used in the past, these were too lossy and slow for the amount of improvement.

RGB float doesn't destroy information when used with YUV source footage. It also supports brightness above 100%. Be aware that some effects, like Histogram, still clip above 100% when in floating point.

Previous: COLOR MODEL, Up: SETTING PROJECT ATTRIBUTES

11.3 ASPECT RATIO

Aspect ratio determines the shape of the video output when using the X11 video output. The numbers in each direction can be any floating point number. When drawn on the screen, video pixels are stretched to match the aspect ratio.

Some file formats, like MPEG video, write the project aspect ratio to the file.

Next: KEYFRAMES, Previous: SETTING PROJECT ATTRIBUTES, Up: Top

12 COMPOSITING

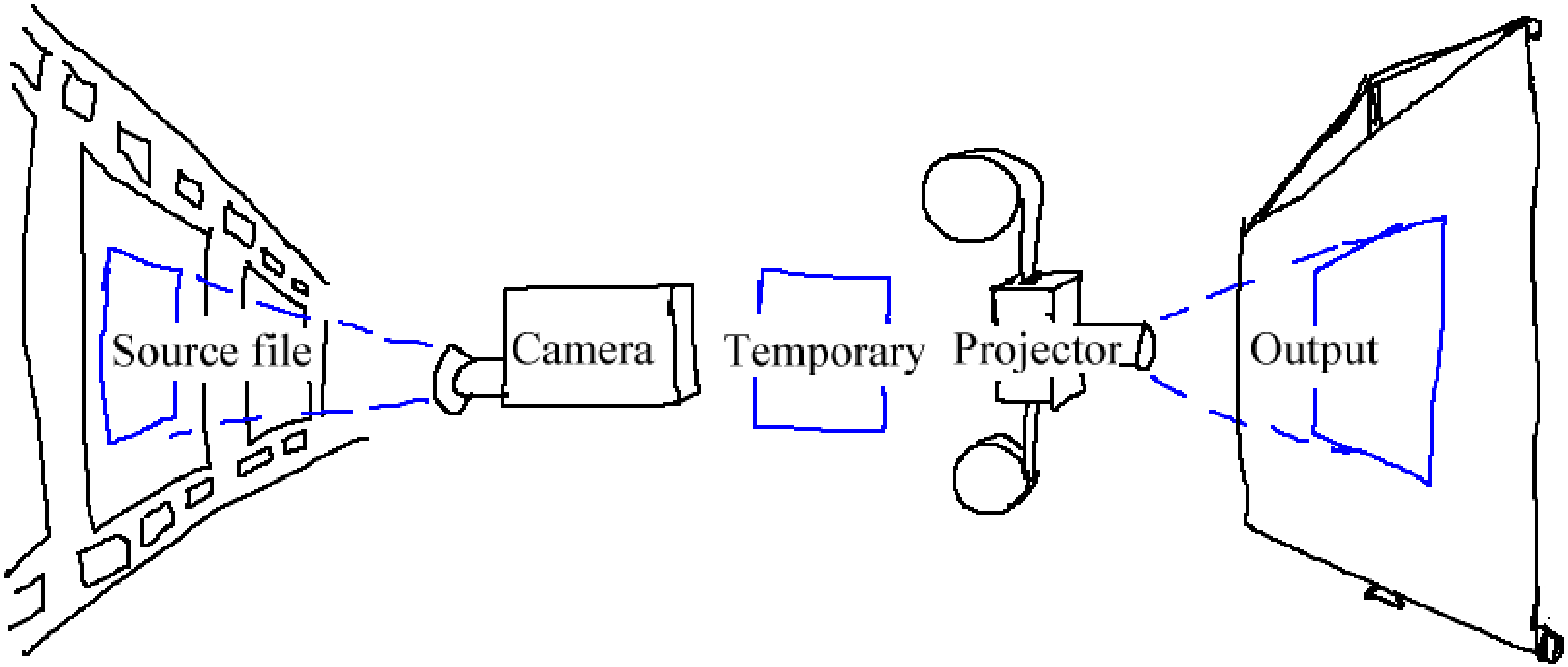
A large amount of Cinelerra's binary size is directed towards compositing. When you remove the letterboxing from a widescreen show, you're compositing. Changing the resolution of a show, making a split screen, and fading in and out among other things are all compositing operations in Cinelerra. Cinelerra detects when it's in a compositing operation and plays back through the compositing engine only then. Otherwise, it uses the fastest decoder available in the hardware.

Compositing operations are done on the timeline and in the Compositor window. Shortcuts exist in the Resource window for changing some compositing attributes. Once some video files are on the timeline, the compositor window is a good place to try compositing.

Next: MASKS, Up: COMPOSITING

12.1 THE CAMERA AND PROJECTOR

In the compositor window, the most important functions are the ✥ camera button and the ✥ projector button. These control operation of the camera and projector. Inside Cinelerra's compositing pipeline, the camera determines where in the source video the temporary is copied from. The projector determines where in the output the temporary is copied to. The temporary is a frame of video in Cinelerra's memory where all graphics processing is done. Each track has a different temporary which is defined by the track size. By resizing the tracks you can create splitscreens, pans, and zooms.



Visual representation of the compositing pipeline.

When editing the camera and projector in the compositing window, the first track with **record** enabled is the track affected. Even if the track is completely transparent, it's still the affected track. If multiple video tracks exist, the easiest way to select one track for editing is to **shift-click** on the record icon of the track. This solos the track.

When the **projector** button is enabled in the compositor window, you're in projector editing mode. A guide box appears in the video window. Dragging anywhere in the video window causes the guide box to move, hopefully along with the video. **shift-dragging** anywhere in the video window causes the guide box to shrink and grow along with the video. Once you've positioned the video with the projector, you're ready to master the camera.

Select the camera button to enable camera editing mode. In this mode, the guide box shows where the camera position is in relation to past and future camera positions but not where it is in relation to the source video. Dragging the camera box in the compositor window doesn't move the box but instead moves the location of the video inside the box.

For example, when you drag the camera left, the video moves right. When you drag the camera up, the video moves down. When you shift-drag the camera, the effect is the same as if you zoomed in or out of the source. The intention of the camera is to produce still photo panning, while the intention of the projector is to composite several sources in the same scene.

In the compositing window, there is a popup menu of options for the camera and projector. Right click over the video portion of the compositing window to bring up the menu.

- Reset Camera causes the camera to return to the center position.
- Reset Projector causes the projector to return to the center.

The camera and projector have shortcut operations neither in the popup menu or represented in video overlays. These are accessed in the **Tool window**. Most operations in the Compositor window have a tool window which is enabled by activating the ? question mark.

In the case of the camera and projector, the tool window shows x, y, and z coordinates. By either tumbling or entering text directly, the camera and projector can be precisely positioned. 9 justification types are also defined for easy access. A popular justification operation is upper left projection after image reduction. This is used when reducing the size of video with aspect ratio adjustment.

The translation effect allows simultaneous aspect ratio conversion and reduction but is easier to use if the reduced video is put in the upper left of the temporary instead of in the center. The track size is set to the original size of the video and the camera is centered. The output size is set to the reduced size of the video. Without any effects, this produces just the cropped center portion of the video in the output.

The translation effect is dropped onto the video track. The input dimensions of the translation effect are set to the original size and the output dimensions are set to the reduced size. To put the reduced video in the center section that the projector shows would require offsetting **out x and out y** by a complicated calculation. Instead, we leave **out x and out y** at 0 and use the projector's tool window.

Merely by selecting left justify and top justify, the projector displays the reduced image from the top left corner of the temporary in the center of the output.

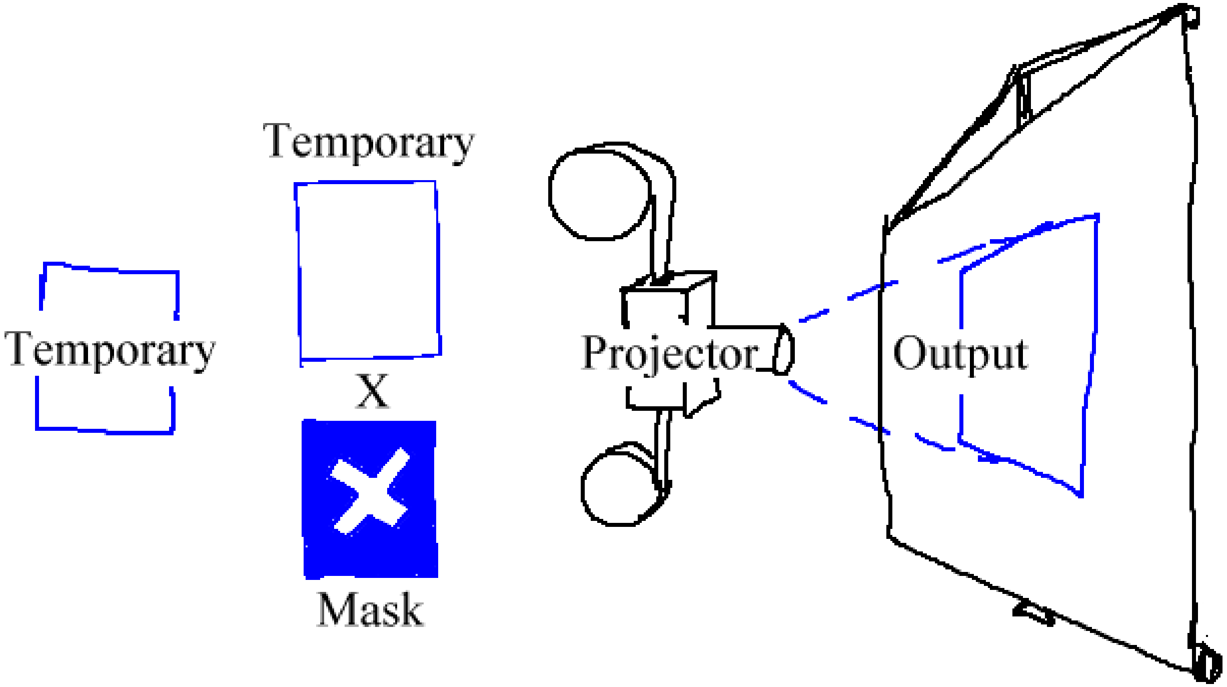
Next: CROPPING, Previous: THE CAMERA AND PROJECTOR, Up: COMPOSITING

12.2 MASKS

Masks select a region of the video for either displaying or hiding. Masks are also used in conjunction with another effect to isolate the effect to a certain region of the frame. A copy of one video track may be delayed slightly and unmasked in locations where the one copy has interference but the other copy doesn't. Color correction may be needed in one section of a frame but not another. A mask can be applied to just a section of the color corrected track while the vanilla track shows through. Removal of boom microphones, airplanes, and housewives are other mask uses.

The order of the compositing pipeline affects what can be done with masks. Mainly, masks are performed on the temporary after effects and before the projector. This means multiple tracks can be bounced to a masked track and projected with the same mask.

Our compositing pipeline graph now has a masking stage. There are 8 possible masks per track. Each mask is defined separately, although they each perform the same operation, whether it's addition or subtraction.



Compositing pipeline with masks

To define a mask, go into the Compositor window and enable the **mask** toggle. Now go over the video and click-drag. Click-drag again in another part of the image to create each new point of the mask. While it isn't the conventional bezier curve behavior, this masking interface performs in realtime what the effect of the mask is going to be. Creating each point of the mask expands a rubber band curve.

Once points are defined, they can be moved by **ctrl-dragging** in the vicinity of the corner. This; however, doesn't smooth out the curve. The in-out points of the bezier curve are accessed by **shift-dragging** in the vicinity of the corner. Then **shift-dragging** near the in or out point causes the point to move.

Finally, once you have a mask, the mask can be translated in one piece by **alt-dragging** the mask. Mask editing in Cinelerra is identical to how The Gimp edits masks except in this case the effect of the mask is always on.

The masks have many more parameters which couldn't be represented with video overlays. These are represented in the tool window for masks. Selecting the ? question mark when the mask toggle is highlighted brings up the mask options.

The **mode** of the mask determines if the mask removes data or makes data visible. If the mode is subtractive, the mask causes video to disappear. If the mode is additive, the mask causes video to appear and everything outside the mask to disappear.

The **value** of the mask determines how extreme the addition or subtraction is. In the subtractive mode, higher values subtract more alpha. In the additive mode, higher values make the region in the mask brighter while the region outside the mask is always hidden.

The mask number determines which one of the 8 possible masks we're editing. Each track has 8 possible masks. When you click-drag in the compositor window, you're only editing one of the masks. Change the value of **mask number** to cause another mask to be edited. The previous mask is still active but only the curve overlay for the currently selected mask is visible.

When multiple masks are used, their effects are ORed together. Every mask in a single track uses the same value and mode.

The edges of a mask are hard by default but this rarely is desired. The **feather** parameter determines how many pixels to feather the mask. This creates softer edges but takes longer to render.

Finally, there are parameters which affect one point on the current mask instead of the whole mask. These are **Delete, x, y**. The active point is defined as the last point dragged in the compositor window. Any point can be activated merely by **ctrl-clicking** near it without moving the pointer. Once a point is activated, **Delete** deletes it and **x, y** allow repositioning by numeric entry.

Next: SAFE REGIONS, Previous: MASKS, Up: COMPOSITING

12.3 CROPPING

Cropping changes the value of the output dimensions and the projector to reduce the visible picture area. Enable the ✎ crop toggle and the ? tool window in the **compositing window** to perform cropping.

This draws a rectangle over the video. Click-drag anywhere in the video to start a new rectangle. Click-drag over any corner of the rectangle to reposition the corner.

Alt-click in the cropping rectangle to translate the rectangle to any position without resizing it.

The tool window allows text entry of the coordinates and executes the cropping operation. When the rectangle is positioned, hit the **do it** button in the tool window to execute the cropping operation.

Next: OVERLAY MODES, Previous: CROPPING, Up: COMPOSITING

12.4 SAFE REGIONS

On consumer displays the borders of the image are cut off and within the cutoff point is a region which isn't always square like it is in the compositor window. The borders are intended for scratch room and vertical blanking data. You can show where these borders are by enabling the ▣ safe regions toggle. Keep titles inside the inner rectangle and keep action inside the outer rectangle.

Next: TRACK AND OUTPUT SIZES, Previous: SAFE REGIONS, Up: COMPOSITING

12.5 OVERLAY MODES

Every video track has an overlay mode, accessible by expanding the track. The overlay mode is a pulldown menu on the left under the fader. When collapsed, it displays an icon representing the current overlay mode.

Select the ▼ expand track toggle to view all the options for a video track if you can't see the overlay mode. The overlay mode of video tracks is **normal** by default. Select other modes by clicking the overlay button and selecting an item from the popup menu.

Overlay modes are processed inside the projector stage of compositing. The different modes are summarized below.

- **Normal** uses a traditional Porter-Diff equation to blend tracks with alpha. When no alpha exists in the project color model, the new track always replaces the output.
- **Addition** In this mode, whatever is in the output is added to the current track. The result is blended based on the current track's alpha onto the output.
- **Subtraction** In this mode, the current track is subtracted from the output and the result is alpha blended onto the output.
- **Multiply** is the most useful operation. The current track is multiplied by the output and the result blended onto the output. Usually a black and white image with no alpha channel or a white title on a black image is used as the current track. With the multiply operation, only the output portions under the white area show.
- **Divide** divides the current track by the output and the result is blended into the output. It usually results in overloaded levels.
- **Replace** does no blending and overwrites the output with the current track.

Previous: OVERLAY MODES, Up: COMPOSITING

12.6 TRACK AND OUTPUT SIZES

The size of the temporary and the size of the output in our compositing pipeline are independant and variable. This fits into everything covered so far. The camera's viewport is the temporary size. Effects are processed in the temporary and are affected by the temporary size. Projectors are rendered to the output and are affected by the output size. If the temporary is smaller than the output, the temporary is bordered by blank regions in the output. If the temporary is bigger than the output, the temporary is cropped.

The temporary size is defined as the track size. Each track has a different size. Right click on a track to bring up the track's menu. Select **Resize Track** to resize the track to any arbitrary size. Alternatively you can select **Match output size** to make the track the same size as the output.

The output size is set in either **New** when creating a new project or **Settings->Format**. In the Resource window there is another way to change the output size. Right click on a video asset and select **Match project size** to conform the output to the asset. When new tracks are created, the track size always conforms to the output size specified by these methods.

Next: CAPTURING MEDIA, Previous: COMPOSITING, Up: Top

13 KEYFRAMES

When you change the fade, camera, projector, or other parameters for a track, they stay by default the same for the entire durection of the timeline. Setting static parameters isn't very useful sometimes. Normally you need to move the camera around over time or change mask positions. Masks need to follow objects. We create dymanic changes by defining keyframes. A keyframe is a certain point in time when the settings for one operation change. In Cinelerra, there are keyframes for almost every compositing parameter and effect parameter.

Whenever you adjust any parameter, the value is stored in a keyframe. If the value is stored in a keyframe, why doesn't it always change? The keyframe it is stored in by default is known as the **default keyframe**. The default keyframe applies to the entire duration if no other keyframes are present. The default keyframe is not drawn anywhere because it always exists. The only way change occurs over time is if non-default keyframes are created.

Display keyframes for any parameter by using the **view** menu. A faster way to toggle multiple keyframe types is to bring up **window->overlays**. This window allows toggling of every parameter in the view menu. When keyframes are selected, they are drawn on the timeline over the tracks they apply to.

Keyframes come in many forms: curves, toggles, modes, and so on. How to handle the different types of keyframes is described here.

- CURVE KEYFRAMES: Using rubber band curves
- CHANGING BEZIER & LINEAR MODE: Change curves from linear to curved
- SNAPPING TO NEIGHBOR KEYFRAMES
- NAVIGATING CURVE KEYFRAMES
- TOGGLE KEYFRAMES
- AUTOMATIC KEYFRAMES
- COMPOSITOR KEYFRAMES
- EDITING KEYFRAMES: Moving keyframes around
- KEYFRAME SPANNING: How to change 1 parameter in many keyframes simultaneously

Next: CHANGING BEZIER & LINEAR MODE, Up: KEYFRAMES

13.1 CURVE KEYFRAMES

Many parameters are stored in rubber band curves. Go to **view->fade** or **view->...zoom** to show curves on the timeline for those parameters. In either arrow editing mode or i-beam editing mode, move the cursor over the curves in the timeline until it changes shape. Then merely by clicking and dragging on the curve you can create a keyframe at the position.

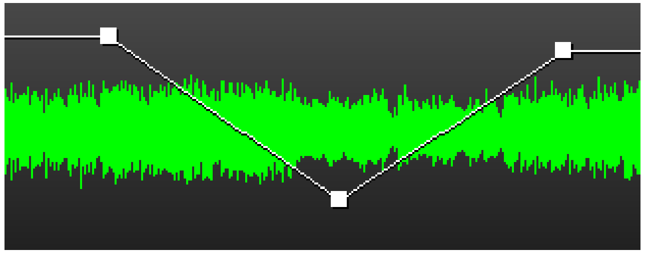
After the keyframe is created, click drag on it again to reposition it. When you click-drag a second keyframe on the curve, it creates a smooth ramp.

Next: SNAPPING TO NEIGHBOR KEYFRAMES, Previous: CURVE KEYFRAMES, Up: KEYFRAMES

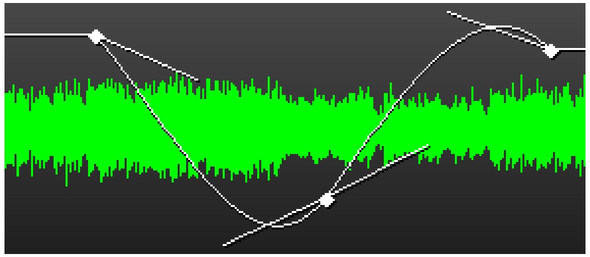
13.2 CHANGING BEZIER & LINEAR MODE

The curve keyframes have bezier and linear modes. In linear mode, the keyframe looks like a square and the lines emanating from it are straight. In bezier mode, the keyframe is rounded and has 2 control lines in addition to the rubber band curve lines.

These are keyframes in linear mode.



These are keyframes in bezier mode.



Change the mode of an existing keyframe by right clicking on it to bring up the context menu and selecting **make linear** or **make bezier**.

Change the mode of several keyframes by highlighting the entire region of the timeline and selecting **Keyframes->change to linear** or **Keyframes->change to bezier**.

When keyframes are created, they can be linear or bezier by default. Change the default mode by checking or unchecking **Keyframes->create bezier**.

For bezier keyframes, **ctrl-dragging** on the control lines of a keyframe changes the value of either the input control or the output control. Without **ctrl** the cursor only affects the central keyframe. This affects the sharpness of the curve. The input and output controls can only be moved vertically.

If the control lines aren't visible, **ctrl-drag** on the left or right of the keyframe.

Next: NAVIGATING CURVE KEYFRAMES, Previous: CHANGING BEZIER & LINEAR MODE, Up: KEYFRAMES

13.3 SNAPPING TO NEIGHBOR KEYFRAMES

shift-drag on a curve keyframe to make the keyframe snap to the value of either the next or previous keyframe, depending on which exists. This lets you set a constant curve value without having to copy the next or previous keyframe.

Next: TOGGLE KEYFRAMES, Previous: SNAPPING TO NEIGHBOR KEYFRAMES, Up: KEYFRAMES

13.4 NAVIGATING CURVE KEYFRAMES

There isn't much room on the timeline for a wide range of curve values. You need to zoom the curves in and out vertically to have any variability. This is done by 2 tools: the automation fit button ⌶ and automation zoom menu .

The automation fit button scales and offsets the vertical range so the selected curve area appears in the timeline. If a region of the timeline is highlighted by the cursor, only that region is scaled. In/out points don't affect the zoomed region. **Alt-f** also performs automation fitting.

The automation zoom menu manually changes the vertical scaling of the curves in multiples of 2. Click on its tumbler to change the zoom. **Alt-Up and Alt-Dn** change the automation zoom from the keyboard.

Next: AUTOMATIC KEYFRAMES, Previous: NAVIGATING CURVE KEYFRAMES, Up: KEYFRAMES

13.5 TOGGLE KEYFRAMES

Mute is the only toggle keyframe. Mute keyframes determine where the track is processed but not rendered to the output. Click-drag on these curves to create a keyframe. Unlike curves, the toggle keyframe has only two values: on or off. Ctrl and shift do nothing on toggle keyframes.

Next: COMPOSITOR KEYFRAMES, Previous: TOGGLE KEYFRAMES, Up: KEYFRAMES

13.6 AUTOMATIC KEYFRAMES

You may have noticed when a few fade curves are set up, moving the insertion point around the curves causes the faders to reflect the curve value under the insertion point. This isn't just to look cool. The faders themselves can set keyframes in automatic keyframe mode. Automatic keyframe mode is usually more useful than dragging curves.

Enable automatic keyframe mode by enabling the automatic keyframe toggle . In automatic keyframe mode, every time you tweek a keyframeable parameter it creates a keyframe on the timeline. Since automatic keyframes affect many parameters, it's best enabled just before you need a keyframe and disabled immediately thereafter.

It's useful to go into the **View** menu and make the desired parameter visible before performing a change. The location where the automatic keyframe is generated is under the insertion point. If the timeline is playing back during a tweek, several automatic keyframes will be generated as you change the parameter.

When automatic keyframe mode is disabled, a similarly strange thing happens. Adjusting a parameter adjusts the keyframe immediately preceeding the insertion point. If two fade keyframes exist and the insertion point is between them, changing the fader changes the first keyframe.

There are many parameters which can only be keyframed in automatic keyframe mode. These are parameters for which curves would take up too much space on the track or which can't be represented easily by a curve.

Effects are only keyframable in automatic mode because of the number of parameters in each individual effect.

Camera and projector translation can only be keyframed in automatic keyframe mode while camera and projector zoom can be keyframed with curves. It is here that we conclude the discussion of compositing, since compositing is highly dependant on the ability to change over time.

Next: EDITING KEYFRAMES, Previous: AUTOMATIC KEYFRAMES, Up: KEYFRAMES

13.7 COMPOSITOR KEYFRAMES

Camera and projector translation is represented by two parameters: x and y. Therefore it is cumbersome to adjust with curves. Cinelerra solves this problem by relying on automatic keyframes. With a video track loaded, move the insertion point to the beginning of the track and enable automatic keyframe mode.

Move the projector slightly in the compositor window to create a keyframe. Then go forward several seconds. Move the projector a long distance to create another keyframe and emphasize motion. This creates a second projector box in the compositor, with a line joining the two boxes. The joining line is the motion path. If you create more keyframes, more boxes are created. Once all the desired keyframes are created, disable automatic keyframe mode.

Now when scrubbing around with the compositor window's slider, the video projection moves over time. At any point between two keyframes, the motion path is read for all time before the insertion point and green for all time after the insertion point. It's debatable if this is a very useful feature but it makes you feel good to know what keyframe is going to be affected by the next projector tweek.

Click-drag when automatic keyframes are off to adjust the preceeding keyframe. If you're halfway between two keyframes, the first projector box is adjusted while the second one stays the same. Furthermore, the video doesn't appear to move in step with the first keyframe. This is because, halfway between two keyframes the projector translation is interpolated. In order to set the second keyframe you'll need to scrub after the second keyframe.

By default the motion path is a straight line, but it can be curved with control points. **Ctrl-drag** to set either the in or out control point of the preceeding keyframe. Once again, we depart from The Gimp because **shift** is already used for zoom. After the in or out control points are extrapolated from the keyframe, **Ctrl-dragging** anywhere in the video adjusts the nearest control point. A control point can be out of view entirely yet still controllable.

When editing the camera translation, the behavior of the camera boxes is slightly different. Camera automation is normally used for still photo panning. The current camera box doesn't move during a drag, but if multiple keyframes are set, every camera box except the current keyframe appears to move. This is because the camera display shows every other camera position relative to the current one.

The situation becomes more intuitive if you bend the motion path between two keyframes and scrub between the two keyframes. The division between red and green, the current position between the keyframes, is always centered while the camera boxes move.

Next: KEYFRAME SPANNING, Previous: COMPOSITOR KEYFRAMES, Up: KEYFRAMES

13.8 EDITING KEYFRAMES

Keyframes can be shifted around and moved between tracks on the timeline using similar cut and paste operations to editing media. Only the keyframes selected in the **view** menu are affected by keyframe editing operations, however.

The most popular keyframe editing operation is replication of some curve from one track to the other, to make a stereo pair. The first step is to solo the source track's record ● patch by **shift-clicking** on it. Then either set in/out points or highlight the desired region of keyframes. Go to **keyframes->copy keyframes** to copy them to the clipboard. Solo the destination track's record ● patch by **shift-clicking** on it and go to **keyframes->paste keyframes** to paste the clipboard.

The media editing commands are mapped to the keyframe editing commands by using the **shift** key instead of just the keyboard shortcut.

This leads to the most complicated part of keyframe editing, the default keyframe. Remember that when no keyframes are set at all, there is still a default keyframe which stores a global parameter for the entire duration. The default keyframe isn't drawn because it always exists. What if the default keyframe is a good value which you want to transpose between other non-default keyframes? The **keyframes->copy default keyframe** and **keyframes->paste default keyframe** allow conversion of the default keyframe to a non-default keyframe.

Keyframes->copy default keyframe copies the default keyframe to the clipboard, no matter what region of the timeline is selected. The **keyframes-**

>paste keyframes function may then be used to paste the clipboard as a non-default keyframe.

If you've copied a non-default keyframe, it can be stored as the default keyframe by calling **keyframes->paste default keyframe**. After using paste default keyframe to convert a non-default keyframe into a default keyframe, you won't see the value of the default keyframe reflected until all the non-default keyframes are removed.

Finally, there is a convenient way to delete keyframes besides selecting a region and calling **keyframes->clear keyframes**. Merely click-drag a keyframe before its preceeding keyframe or after its following keyframe on the track.

Previous: EDITING KEYFRAMES, Up: KEYFRAMES

13.9 KEYFRAME SPANNING

To change a single parameter in multiple keyframes without changing the other parameters, highlight a region on the timeline and adjust the parameter. Instead of a new keyframe being created, the existing keyframes are modified and only the changed parameter is modified.

It doesn't matter if auto keyframe is enabled. It only works when the keyframe stores multiple parameters. Only mask and effect keyframes do this. Other types of keyframes are generated as usual.

Next: IMPROVING PERFORMANCE, Previous: KEYFRAMES, Up: Top

14 CAPTURING MEDIA

Ideally, all media would be stored on hard drives, CD-ROM, flash, or DVD and loading it into Cinelerra would be a matter of loading a file. In reality, very few sources of media can be accessed like a filesystem but instead rely on tape transport mechanisms and dumb I/O mechanisms to transfer the data to computers. These media types are imported into Cinelerra through the Record dialog.

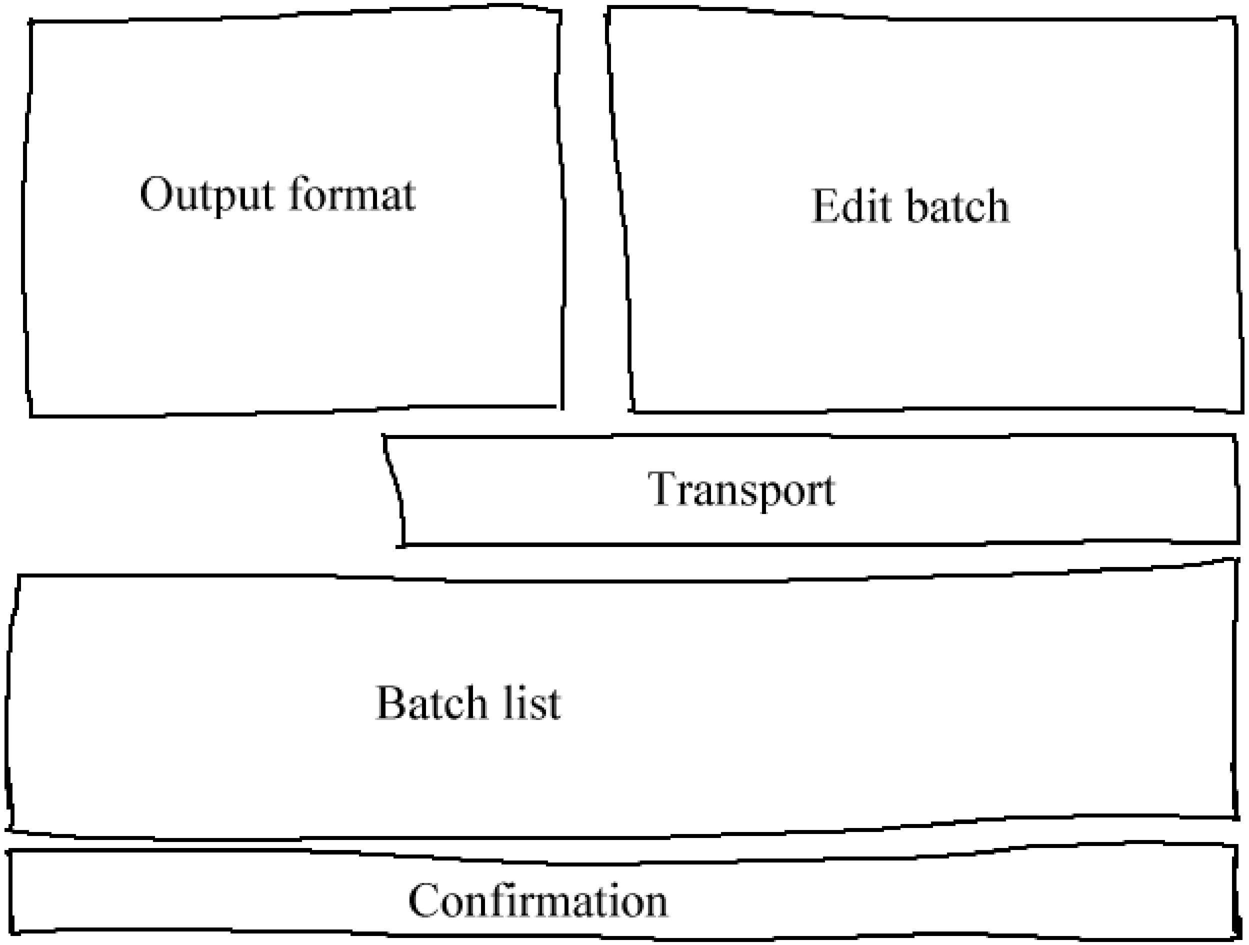
The first step in recording is to configure the input device. In **Settings->preferences** are a number of recording parameters described in configuration See RECORDING. These parameters apply to recording no matter what the project settings are, because the recording parameters are usually the maximum capability of the recording hardware while project settings come and go.

Go to **File->record** to record a dumb I/O source. This prompts for an output format much like rendering does. Once that's done, the record window and the record monitor pop up.

The record window has discrete sections. While many parameters change depending on if the file has audio or video, the discrete sections are always the same.

- The output format area describes the format of the output file and the current position within it.

- The edit batch area lets you change parameters in the current batch.
- The transport controls start and stop recording different ways.
- The batch list displays all the defined batches.
- The confirmation area lets you determine how the output files are imported into the timeline and quit.



Recording window areas

Recording in Cinelerra is organized around batches. A batch essentially defines a distinct output file for the recording. For now you can ignore the batch concept entirely and record merely by hitting the record button ● .

The record button opens the current output file if it isn't opened and writes captured data to it. Use the stop button to stop the recording. Recording can be resumed with the record button without erasing the file at this point. In the case of a video file, there is a single frame record button which records a single frame.

When enough media is recorded, choose an insertion method from the **Insertion Strategy** menu and hit **close**.

- BATCHES
- EDITING TUNER INFORMATION

Next: EDITING TUNER INFORMATION, Up: CAPTURING MEDIA

14.1 BATCHES

Now we come to the concept of batches. Batches try to make the dumb I/O look more like a filesystem. Batches are traditionally used to divide tape into different programs and save the different programs as different files instead of recording straight through an entire tape. Because of the high cost of developing frame-accurate deck control mechanisms, the only use of batches now is recording different programs during different times of day. This is still useful for recording TV shows or time lapse movies as anyone who can't afford proper appliances knows.

The record window supports a list of batches and two recording modes: interactive and batch recording. Interactive recording happens when the record button is pressed. Interactive recording starts immediately and uses the current batch to determine everything except start time. By default, the current batch is configured to behave like tape.

Batch recording happens when the **start** button is pressed. In batch recording, the **start time** is the time the batch starts recording.

First, you'll want to create some batches. Each batch has certain parameters and methods of adjustment.

- **On** determines whether the batch is included in batch recording operations. Click the list row under **On** to enable or disable batches.
- **Path** is the file the batch is going to be recorded to. The filename specified in the record dialog is the name of the first batch, to simplify interactive recording, but the filename may be changed in the record window for any batch in the **edit batch** area.
- **News** shows whether the file exists or not. This is a very important attribute since there is no confirmation dialog if the file exists. The first time you hit record, the file is opened. If the file exists at this point it's erased. News says **File exists** if it exists and **OK** if it doesn't. Every time you resume recording in the same batch, the news should say **Open**, indicating the file is already opened and won't be erased in the next record button press.

  If you change out of the current batch after recording, the file is closed. Next time you change into the batch, the file will be erased.

- **Start time** is the 24 hour time of day the batch will start recording if in batch mode. The start time may become a time of tape and reel number if deck control is implemented but for now it's a time of day.
- **Duration** is the length of the batch. It only has meaning if the **Mode** of the batch is **Timed**. Once the recording length reaches **duration** the recording stops, whether in interactive or batch mode.
- **Source** has meaning only when the capturing hardware has multiple sources. Usually the source is a tuner channel or input. When the current batch

finishes and the next batch begins recording, the source is changed to what the next batch is set to. This way multiple TV stations can be recorded at different times.

The record window has a notion of the **current batch**. The current batch is not the same as the batch which is highlighted in the batch list. The current batch text is colored red in the batch list. The highlighted batch is merely displayed in the edit batch section for editing.

By coloring the current batch red, any batch can be edited by highlighting it, without changing the batch to be recorded.

All recording operations take place in the current batch. If there are multiple batches, highlight the desired batch and hit **activate** to make it the current batch. If the **start** button is pressed, the current batch flashes to indicate it's waiting for the start time in batch mode. If the **record** button is pressed, the current batch is recorded immediately in interactive mode.

In batch and interactive recording modes, when the current batch finishes recording the next batch is activated and performed. All future recording is done in batch mode. When the first batch finishes, the next batch flashes until its start time is reached.

Interrupt either the batch or the interactive operation by hitting the stop button.

Finally there is the ⏮ rewind button. In either interactive or batch recording, the rewind button causes the current batch to close its file. The next recording operation in the current batch deletes the file.

Previous: BATCHES, Up: CAPTURING MEDIA

14.2 EDITING TUNER INFORMATION

Sometimes in the recording process and the configuration process, you'll need to define and select tuner channels to either record or play back to. In the case of the Video4Linux and Buz recording drivers, tuner channels define the source. When the Buz driver is also used for playback, tuner channels define the destination.

Defining tuner channels is accomplished by pushing the 📡 channel button. This brings up the channel editing window. In this window you add, edit, and sort channels. Also, for certain video drivers, you can adjust the picture quality.

The **add** operation brings up a channel editing box. The title of the channel appears in the channel list. The source of the channel is the entry in the physical tuner's frequency table corresponding to the title.

Fine tuning in the channel edit dialog adjusts the physical frequency slightly if the driver supports it. The norm and frequency table together define which frequency table is selected for defining sources. If the device supports multiple inputs, the input menu selects these.

To sort channels, highlight the channel in the list and push **move up** or **move down** to move it.

Once channels are defined, the **source** item in the record window can be used to select channels for recording. The same channel selecting ability also exists in the record monitor window. Be aware channel selections in the record monitor window and the record window are stored in the current batch.

For some drivers an option to **swap fields** may be visible. These drivers don't get the field order right every time without human intervention. Toggle this to get the odd and even lines to record in the right order.

Next: TROUBLESHOOTING, Previous: CAPTURING MEDIA, Up: Top

15 IMPROVING PERFORMANCE

Let's get one thing perfectly clear. Linux is not a very good desktop. It's a server. Most of what you'll find on modern Linux distributions are faceless, network-only programs strategicly designed to counteract one Microsoft server feature or another and not to perform very well at user interaction. There are a number of parameters on Linux, which ordinary people can adjust to make it behave more like a thoroughbred in desktop usage.

Next: ENLARGING SOUND BUFFERS, Up: IMPROVING PERFORMANCE

15.1 DISABLING SWAP SPACE

On systems with lots of memory, Cinelerra sometimes runs better without a swap space. If you have 4 GB of RAM, you're probably better off without a swap space. If you have 512MB of RAM, you should keep the swap. If you want to do recording, you should probably disable swap space in any case. There's a reason for this. Linux only allows half the available memory to be used. Beyond that, it starts searching for free pages to swap, in order to cache more disk access. In a 4 GB system, you start waiting for page swaps after using only 2 GB.

The question then is how to make Linux run without a swap space. Theoretically it should be a matter of running

```
    swapoff -a
```

Unfortunately, without a swap space the **kswapd** tasklet normally spins at 100%. To eliminate this problem, edit **linux/mm/vmscan.c**. In this file, put a line saying **return 0;** before it says

```
        /*
         * Kswapd main loop.
         */
```

Then recompile the kernel.

Next: FREEING MORE SHARED MEMORY, Previous: DISABLING SWAP SPACE, Up: IMPROVING PERFORMANCE

15.2 ENLARGING SOUND BUFFERS

In order to improve realtime performance, the audio buffers for all the Linux sound drivers were limited from 128k to 64k. For recording audio and video simultaneously and for most audio recording this causes dropouts. Application of low latency and preemtible kernel patches make it possible to record more audio recordings but it doesn't improve recording video with audio. This is where you need to hack the kernel.

To see if your sound buffers are suitable, run the included **soundtest** program with nothing playing or recording. This allocates the largest possible buffers and displays them. If the **TOTAL BYTES AVAILABLE** is under 131072, you need to see about getting the buffers enlarged in the driver. While many drivers differ, we have a hack for at least one driver.

This only applies to the OSS version of the Soundblaster Live driver. Since every sound card and every sound driver derivative has a different implementation you'll need to do some searching for other sound cards. Edit **linux/drivers/sound/emu10k1/audio.c**

Where is says

```
     if (bufsize >= 0x10000)
```

change it to say

```
     if (bufsize > 0x40000)
```

Where is says

```
                for (i = 0; i < 8; i++)
                        for (j = 0; j < 4; j++)
```

change it to say

```
                for (i = 0; i < 16; i++)
                        for (j = 0; j < 4; j++)
```

In **linux/drivers/sound/emu10k1/hwaccess.h**

Change

#define MAXBUFSIZE 65536

to

#define MAXBUFSIZE 262144

Finally, in **linux/drivers/sound/emu10k1/cardwi.h**

#define WAVEIN_MAXBUFSIZE 65536

to

#define WAVEIN_MAXBUFSIZE 262144

Then recompile the kernel modules.

Next: SPEEDING UP THE HARD DRIVE, Previous: ENLARGING SOUND BUFFERS, Up: IMPROVING PERFORMANCE

15.3 FREEING MORE SHARED MEMORY

The Linux kernel only allows 32MB of shared memory to be allocated by default. This needs to be increased to do anything useful. Run the following command:

echo "0x7fffffff" > /proc/sys/kernel/shmmax

Next: DISABLING CRON, Previous: FREEING MORE SHARED MEMORY, Up: IMPROVING PERFORMANCE

15.4 SPEEDING UP THE HARD DRIVE

This is a very popular command sequence among Linux gurus, which is not done by default on Linux distributions.

hdparm -c3 -d1 -u1 -k1 /dev/hda

-c3 puts the hard drive into 32 bit I/O with sync. This normally doesn't work due to inept kernel support for most IDE controllers. If you get lost interrupt or SeekComplete errors, quickly use **-c0** instead of **-c3** in your command.

-d1 enables DMA of course. This frees up the CPU partially during data transfers.

-u1 allows multiple interrupts to be handled during hard drive transactions. This frees up even more CPU time.

-k1 prevents Linux from resetting your settings in case of a glitch.

Next: REDUCING USB MOUSE SENSITIVITY, Previous: SPEEDING UP THE HARD DRIVE, Up: IMPROVING PERFORMANCE

15.5 DISABLING CRON

Linux runs some daily operations like compressing man pages. These may be acceptable background tasks while compiling or word processing but not while playing video. Disable these operations by editing **/etc/rc.d/init.d/anacron**.

Put **exit** before the first line not beginning in #.

In **/etc/rc.d/init.d/crond** put **exit** before the first line not beginning in #. Then make like Win 2000 and reboot.

You can't use the **at** command anymore, but who uses that command anyways?

Next: ASSORTED X TWEEKS, Previous: DISABLING CRON, Up: IMPROVING PERFORMANCE

15.6 REDUCING USB MOUSE SENSITIVITY

Gamers like high resolution mice, but this can be painful for precisely positioning the mouse on a timeline or video screen. XFree86 once allowed you to reduce PS/2 mouse sensitivity using commands like **xset m 1 1** but you're out of luck with USB mice or KVM's.

We have a way to reduce USB mouse sensitivity but it requires editing the kernel source code. Even though USB mice have been supported for years, the kernel source code for USB mice is constantly being rewritten. These instructions were relevant for 2.6.12.3. Edit **/usr/src/linux/drivers/input/mousedev.c**.

After the line saying

```
struct mousedev_hw_data {
```

put

```
#define DOWNSAMPLE_N 100
#define DOWNSAMPLE_D 350
int x_accum, y_accum;
```

Next, the section which says something like:

```
switch (code) {
        case REL_X:     mousedev->packet.dx += value; break;
        case REL_Y:     mousedev->packet.dy -= value; break;
        case REL_WHEEL: mousedev->packet.dz -= value; break;
     }
```

must be replaced by

```
        switch (code) {
                        case REL_X:
                                mousedev->packet.x_accum += value * DOWNSAMPLE_N;
                                mousedev->packet.dx += (int)mousedev->packet.x_accum / (int)DOWNSAMPLE_D;
                                mousedev->packet.x_accum -= ((int)mousedev->packet.x_accum / (int)DOWNSAMPLE_D) * (int)DOWNSAMPLE_D;
                                break;
                        case REL_Y:
                                mousedev->packet.y_accum += value * DOWNSAMPLE_N;
                                mousedev->packet.dy -= (int)mousedev->packet.y_accum / (int)DOWNSAMPLE_D;
                                mousedev->packet.y_accum -= ((int)mousedev->packet.y_accum / (int)DOWNSAMPLE_D) * (int)DOWNSAMPLE_D;
                                break;
                        case REL_WHEEL: mousedev->packet.dz -= value; break;
        }
```

Change the value of **DOWNSAMPLE_N** to change the mouse sensitivity.

Next: SPEEDING UP THE FILE SYSTEM, Previous: REDUCING USB MOUSE SENSITIVITY, Up: IMPROVING PERFORMANCE

15.7 ASSORTED X TWEEKS

XFree86 by default can't display Cinelerra's advanced pixmap rendering very fast. The X server stalls during list box drawing. Fix this by adding a line to your XF86Config* files.

In the **Section "Device"** area, add a line saying:

Option "XaaNoOffscreenPixmaps"

and restart the X server.

Screen blanking is really annoying, unless you're fabulously rich and can afford to leave your monitor on 24 hours a day without power saving mode. In **/etc/X11/xinit/xinitrc** put

```
     xset s off
```

```
xset s noblank
```

before the first **if** statement.

How about those windows keys which no Linux distribution even thinks to use. You can make the window keys provide ALT functionality by editing **/etc/X11/Xmodmap**. Append the following to it.

```
keycode 115 = Hyper_L
keycode 116 = Hyper_R
add mod4 = Hyper_L
add mod5 = Hyper_R
```

The actual changes to a window manager to make it recognize window keys for ALT are complex. In **FVWM** at least, you can edit **/etc/X11/fvwm/system.fvwm2rc** and put

```
Mouse 0 T A move-and-raise-or-raiselower
#Mouse 0 W M move
Mouse 0 W 4 move
Mouse 0 W 5 move
Mouse 0 F A resize-or-raiselower
Mouse 0 S A resize-or-raiselower
```

in place of the default section for moving and resizing. Your best performance is going to be on FVWM. Other window managers seem to slow down video with extra event trapping and aren't as efficient in layout.

Next: IMPROVING ZORAN VIDEO, Previous: ASSORTED X TWEEKS, Up: IMPROVING PERFORMANCE

15.8 SPEEDING UP THE FILE SYSTEM

You'll often store video on an expensive, gigantic disk array separate from your boot disk. You'll thus have to manually install an EXT filesystem on this disk array, using the **mke2fs** command. By far the fastest file system is

```
mke2fs -i 65536 -b 4096 my_device
tune2fs -r0 -c10000 my_device
```

This has no journaling, reserves as few blocks as possible for filenames, and accesses the largest amount of data per block possible. A slightly slower file system, which is easier to recover after power failures is

```
mke2fs -j -i 65536 -b 4096 my_device
tune2fs -r0 -c10000 my_device
```

This adds a journal which slows down the writes but makes us immune to power failures.

Previous: SPEEDING UP THE FILE SYSTEM, Up: IMPROVING PERFORMANCE

15.9 IMPROVING ZORAN VIDEO

Video recorded from the ZORAN inputs is normally unaligned or not completely encoded on the right. This can be slightly compensated by adjusting parameters in the driver sourcecode.

In **/usr/src/linux/drivers/media/video/zr36067.c** the structures defined near line 623 affect alignment. At least for NTSC, the 2.4.20 version of the driver could be improved by changing

```
    static struct tvnorm f60ccir601 = { 858, 720, 57, 788, 525, 480, 16 };
```

to

```
    static struct tvnorm f60ccir601 = { 858, 720, 57, 788, 525, 480, 17 };
```

In **/usr/src/linux/drivers/media/video/bt819.c** more structures near line 76 affect alignment and encoding.

For NTSC

```
    {858 - 24, 2, 523, 1, 0x00f8, 0x0000},
```

could be changed to

```
    {868 - 24, 2, 523, 1, 0x00f8, 0x0000},
```

Adjusting these parameters may or may not move your picture closer to the center. More of the time, they'll cause the driver to lock up before capturing the first frame.

15.9.1 NEW IN 2.6.5

In the 2.6 kernels, the video subsystem was rewritten again from scratch. To adjust the Zoran parameters go to **drivers/media/video/zoran_card.c** and look for a group of lines like

```
    static struct tvnorm f50sqpixel = { 944, 768, 83, 880, 625, 576, 16 };
    static struct tvnorm f60sqpixel = { 780, 640, 51, 716, 525, 480, 12 };
    static struct tvnorm f50ccir601 = { 864, 720, 75, 804, 625, 576, 18 };
    static struct tvnorm f60ccir601 = { 858, 720, 57, 788, 525, 480, 16 };
```

```
static struct tvnorm f50ccir601_lml33 = { 864, 720, 75+34, 804, 625, 576, 18 };
static struct tvnorm f60ccir601_lml33 = { 858, 720, 57+34, 788, 525, 480, 16 };

/* The DC10 (57/16/50) uses VActive as HSync, so HStart must be 0 */
static struct tvnorm f50sqpixel_dc10 = { 944, 768, 0, 880, 625, 576, 0 };
static struct tvnorm f60sqpixel_dc10 = { 780, 640, 0, 716, 525, 480, 12 };

/* FIXME: I cannot swap U and V in saa7114, so i do one
 * pixel left shift in zoran (75 -> 74)
 * (Maxim Yevtyushkin <max@linuxmedialabs.com>) */
static struct tvnorm f50ccir601_lm33r10 = { 864, 720, 74+54, 804, 625, 576, 18 };
static struct tvnorm f60ccir601_lm33r10 = { 858, 720, 56+54, 788, 525, 480, 16 };
```

These seem to control the image position. At least for the LML33 the following definition for **f60ccir601_lml33** does the trick.

```
static struct tvnorm f60ccir601_lml33 = { 858, 720, 67+34, 788, 525, 480, 13 };
```

Next: SECRETS OF CINELERRA, Previous: IMPROVING PERFORMANCE, Up: Top

16 TROUBLESHOOTING

Next: DRAGGING IN AND OUT POINTS DOESN'T WORK, Up: TROUBLESHOOTING

16.1 BUZ DRIVER CRASHES

First, Zoran capture boards must be accessed using the **Buz** video driver in **Preferences->Recording** and **Preferences->Playback**. Some performance tweeks are available in another section. See IMPROVING PERFORMANCE.

Once tweeked, the Buz driver seems to crash if the number of recording buffers is too high. Make sure **Preferences->Recording->Frames to buffer in device** is below 10.

Next: LOCKING UP WHEN LOADING FILES, Previous: BUZ DRIVER CRASHES, Up: TROUBLESHOOTING

16.2 DRAGGING IN AND OUT POINTS DOESN'T WORK

Sometimes there will be two edits really close together. The point selected for dragging may be next to the indended edit on an edit too small to see at the current zoom level. Zoom in horizontally.

Next: SYNCHRONIZATION LOST WHILE RECORDING, Previous: DRAGGING IN AND OUT POINTS DOESN'T WORK, Up: TROUBLESHOOTING

16.3 LOCKING UP WHEN LOADING FILES

The most common reason loading files locks up is because the codec isn't supported. Another reason is because Cinelerra is building picons for the Resources window. If you load a large number of images, it needs to decompress every single image to build a picon. Go into settings->preferences->interface and disable **Use thumbnails in resource window** to skip this process.

Next: APPLYING LINEARIZE FOLLOWED BY BLUR DOESN'T WORK, Previous: LOCKING UP WHEN LOADING FILES, Up: TROUBLESHOOTING

16.4 SYNCHRONIZATION LOST WHILE RECORDING

If the framerate of the recording is much lower than the framerate of the source, the video will accumulate in the recording buffers over time while the audio and video are well out of sync. Decrease the **number of frames to buffer in the device** in **preferences->recording** so the excess frames are dropped instead of buffered.

Previous: SYNCHRONIZATION LOST WHILE RECORDING, Up: TROUBLESHOOTING

16.5 APPLYING LINEARIZE FOLLOWED BY BLUR DOESN'T WORK

The linearize effect uses the pow function while the blur effect uses a number of exp functions in the math library. For some reason, using the pow function breaks later calls to the exp functions in the math library. You need to apply linearize after blur to get it to work.

Next: SECRETS OF CINELERRA EFFECTS, Previous: TROUBLESHOOTING, Up: Top

17 SECRETS OF CINELERRA

In this section, you'll find ways to apply Cinelerra to common problems. Other sections are arranged in order of the tools and what the tools are used for. This section is arranged in order of the problems and what tools are used to solve the problems.

Next: ANALOG TV CLEANING, Up: SECRETS OF CINELERRA

17.1 DOLBY PRO LOGIC ENCODING

Dolby pro logic is an easy way to output 6 channel audio from a 2 channel soundcard with degraded but useful results. Rudimentary Dolby pro logic encoding can be achieved with clever usage of the effects.

Create 2 audio tracks with the same audio. Apply **invert audio** to one track. The signal comes out of the back speakers.

Create a single audio track with monaural audio of a different source. Center it in the **pan** control. The signal comes out of the center speaker.

Create other tracks with different signals and pan them left or right to put signals in the front left or right speaker.

Finally, if a copy of the signal in the back speakers is desired in any single front speaker, the signal in the back speakers must be delayed by at least 0.05 seconds and a single new track should be created. Pan the new track to orient the signal in the front speakers.

If the same signal is desired in all the speakers except the center speaker, delay the back speakers by 0.5 seconds and delay either the front left or front right by 0.2 seconds.

If you want to hear something from the subwoofer, create a new track, select a range, drop a synthesizer effect, and set the frequency below 60 Hz. The subwoofer merely plays anything below around 60Hz.

Other tricks you can perform to separate the speakers are parametric equalization to play only selected ranges of frequencies through different speakers and lowpass filtering to play signals through the subwoofer.

Next: DEFEATING INTERLACING, Previous: DOLBY PRO LOGIC ENCODING, Up: SECRETS OF CINELERRA

17.2 ANALOG TV CLEANING

Unless you live in a rich nation like China or are a terrorist, you probably record analog TV more than you record digital TV. The picture quality on analog TV is horrible but you can do things in Cinelerra to make it look more like it did in the studio.

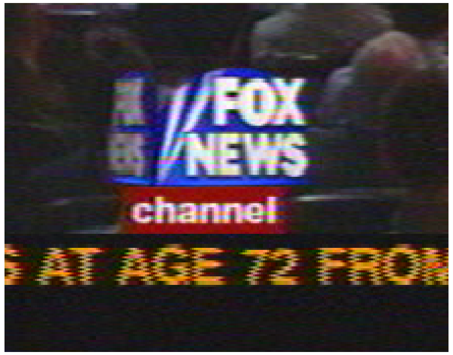
First, when capturing the video, capture it in the highest resolution possible. For Europeans it's 720x576 and for Americans it's 720x480. Don't bother adjusting the brightness or contrast in the recording monitor, although maxing out the color is useful. Capture it using MJPEG or uncompressed Component Video if possible. If those are too demanding, then capture it using JPEG. RGB should be a last resort.

Now on the timeline use **Settings->Format** to set a YUV colorspace. Drop a **Downsample** effect on the footage. Set it for

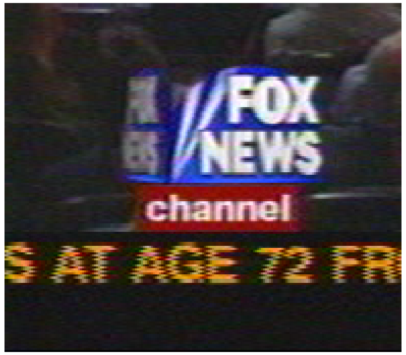
```
Horizontal:        2
Horizontal offset: 0
Vertical:          2
Vertical offset:   0

      red
  x   green
  x   blue
      alpha
```

Use the camera tool to shift the picture up or down a line to remove the most color interference from the image. This is the difference we're looking for:



Before



After

If you have vertical blanking information or crawls which constantly change in each frame, block them out with the **Mask** tool. This improves compression ratios.

This is about all you can do without destroying more data than you would naturally lose in compression. The more invasive cleaning techniques involve deinterlacing.

Next: MAKING VIDEO LOOK LIKE FILM, Previous: ANALOG TV CLEANING, Up: SECRETS OF CINELERRA

17.3 DEFEATING INTERLACING

Interlacing is done on most video sources because it costs too much to build progressive scanning cameras and progressive scanning CRT's. Many a consumer has been dissapointed to spend 5 paychecks on a camcorder and discover what horrible jagged images it produces on a computer monitor.

As for progressive scanning camcorders, forget it. Cost factors are probably going to keep progressive scanning cameras from ever equalling the spatial resolution of interlaced cameras. Interlacing is here to stay. That's why they made deinterlacing effects in Cinelerra.

We don't believe there has ever been a perfect deinterlacing effect. They're either irreversible or don't work. Cinelerra cuts down the middle by providing deinterlacing tools that are irreversible sometimes and don't work sometimes but are neither one or the other.

Line Doubling

This one is done by the **Deinterlace** effect when set to **Odd lines** or **Even lines**. When applied to a track it reduces the vertical resolution by 1/2 and gives you progressive frames with stairstepping. This is only useful when followed by a scale effect which reduces the image to half its size.

Line averaging

The **Deinterlace** effect when set to **Average even lines** or **Average odd lines** does exactly what line doubling does except instead of making straight copies of the lines it makes averages of the lines. This is actually useful for all scaling.

There's an option for adaptive line averaging which selects which lines to line average and which lines to leave interlaced based on the difference between the lines. It doesn't work.

Inverse Telecine

This is the most effective deinterlacing tool when the footage is an NTSC TV broadcast of a film. See INVERSE TELECINE.

Time base correction

The first three tools either destroy footage irreversibly or don't work sometimes. **Time base correction** is last because it's the perfect deinterlacing tool. It leaves the footage intact. It doesn't reduce resolution, perceptually at least. It doesn't cause jittery timing.

The **Frames to Fields** effect converts each frame to two frames, so it must be used on a timeline whose project frame rate is twice the footage's frame rate. In the first frame it puts a line averaged copy of the even lines. In the second frame it puts a line averaged copy of the odd lines. When played back at full framerates it gives the illusion of progressive video with no loss of detail.

Best of all, this effect can be reversed with the **Fields to frames** effect. That one combines two frames of footage back into the one original interlaced frame of half the framerate.

Be aware that frames to fields inputs frames at half the framerate as the project. Effects before frames to fields process at the reduced framerate.

Unfortunately, the output of **Frames to Fields** can't be compressed as efficiently as the original because it introduces vertical twitter and a super high framerate.

Interlaced 29.97fps footage can be made to look like film by applying **Frames to Fields** and then reducing the project frame rate of the resulting 59.94fps footage to 23.97fps. This produces no timing jitter and the occasional odd field gives the illusion of more detail than there would be if you just line averaged the original.

HDTV exceptions

1920x1080 HDTV is encoded a special way. If it's a broadcast of original HDTV film, an inverse telecine works fine. If it's a rebroadcast of a 720x480 source, you need to use a time base and line doubling algorithm to deinterlace it, See 1080 TO 480.

Next: CLEARING OUT HAZE, Previous: DEFEATING INTERLACING, Up: SECRETS OF CINELERRA

17.4 MAKING VIDEO LOOK LIKE FILM

Video sweetening is constantly getting better. Lately the best thing you can do for dirt cheap consumer camcorder video is to turn it into progressive 24fps output. While you can't really do that, you can get pretty close for the money. Mind you, this procedure can degrade high quality video just as easily as it improves low quality video. It should only be used for low quality video.

- Step 1 - Set project framerate to twice the video framerate.
- Step 2 - Apply a **Sharpen** effect. Set it to sharpness: 25, no interlacing, and horizontal only.
- Step 3 - Drop a **Frame to Fields** effect on the same track. Set Average Empty Rows on and play through the video a few times to figure out which field is first. If the wrong field is first, the motion is shaky. Secondly, any editing in the doubled frame rate may now screw up the field order. We're still figuring out the easiest way to support warnings for field glitches but for now you need to go back to the normal framerate to do editing or play test to make sure the fields are right.
- Step 4 - Render just the video to the highest quality file possible.
- Step 5 - Import the video back to a new track. Set the project framerate to 24. The new track should now display more filmish and sharper images than the original footage.

This entire procedure could be implemented in one nonrealtime effect, but the biggest problem with that is you'll most often want to keep the field based output and the 24fps output for posterity. A nonrealtime effect would require all that processing just for the 24fps copy. Still debating that one.

Next: MAKING A DVD, Previous: MAKING VIDEO LOOK LIKE FILM, Up: SECRETS OF CINELERRA

17.5 CLEARING OUT HAZE

Let's face it, if you're employed you live in Silicon Valley. As such you probably photograph a lot of haze and never see blue sky ever. Even if you can afford to briefly go somewhere where there is blue sky, horizon shots usually can stand for more depth. This is what the **gradient effect** is for.

Drop the gradient effect on hazy tracks. Set the following parameters:

```
Angle: 0
Inner radius: 0
Outer radius: 40
Inner color: blue 100% alpha
Outer color: blue 0% alpha
```

It's important to set the 0% alpha color to blue even though it's 0% alpha. The color of the outer alpha is still interpolated with the inner color. This is a generally applicable setting for the gradient. Some scenes may work better with orange or brown for an evening feel.

Next: MAKING A RINGTONE, Previous: CLEARING OUT HAZE, Up: SECRETS OF CINELERRA

17.6 MAKING A DVD

A single chapter DVD

Make a single chapter DVD by rendering video to an MPEG video file. The video should be 720x480, 29.97fps. The aspect ratio should be 16x9 or 4x3.

Use the YUV 4:2:0 color model and DVD preset. Set the bitrate to the desired bitrate. It's not clear exactly what other parameters the MPEG encoder uses in the DVD preset but we've enabled the following:

```
Derivative: MPEG-2
Fixed bitrate
I frame distance: 15
P frame distance: 0
Sequence start codes in every GOP
```

Render the audio to an AC3 audio file. Any bitrate can be used.

Dvdrtools must be downloaded to generate the actual DVD filesystem. The actual usage of dvdrtools changes frequently but currently it involves the mkisofs and ifogen programs. Mkisofs is built automatically in dvdrtools but ifogen may have to be built manually by entering the **video** directory and running **make ifogen**. Mkisofs and ifogen must be put into /usr/bin manually.

Also, the **mplex** program from **mjpegtools** must be installed. The mjpegtools package is built in the hvirtual distribution and the mplex utility may be extracted from there.

Given the files audio.ac3 and video.m2v, rendered by Cinelerra, the following commands pack them into a dvd readable by commercial appliances.

```
mplex -M -f 8 -o final.mpg audio.ac3 video.m2v
mkdir -p dvd/VIDEO_TS
```

```
     ifogen final.mpg -o dvd
     ifogen -T -o dvd
     mkisofs -dvd-video -udf -o dvd.iso dvd/
```

Chapters may be set with the following:

ifogen -o dvd –chapters=0021.788,0047.447,0077.043 final.mpg

Replace the chapter times.

dvd.iso can be burned directly to a DVD with the following:

```
     dvdrecord -ignsize -dao -v dev=/dev/hdc fs=67108864 dvd.iso
```

The argument to dev= is the IDE device of the DVD drive. Burning DVD's through SCSI is currently not supported.

Next: TIME STRETCHING AUDIO, Previous: MAKING A DVD, Up: SECRETS OF CINELERRA

17.7 MAKING A RINGTONE

This is how we made ringtones for the low end Motorola V180's and it'll probably work with any new phone. Go to **File->Load files...** and load a sound file with Insertion strategy: **Replace current project**. Go to **Settings->Format** change **Channels** to 1 and **Samplerate** to 16000 or 22050.

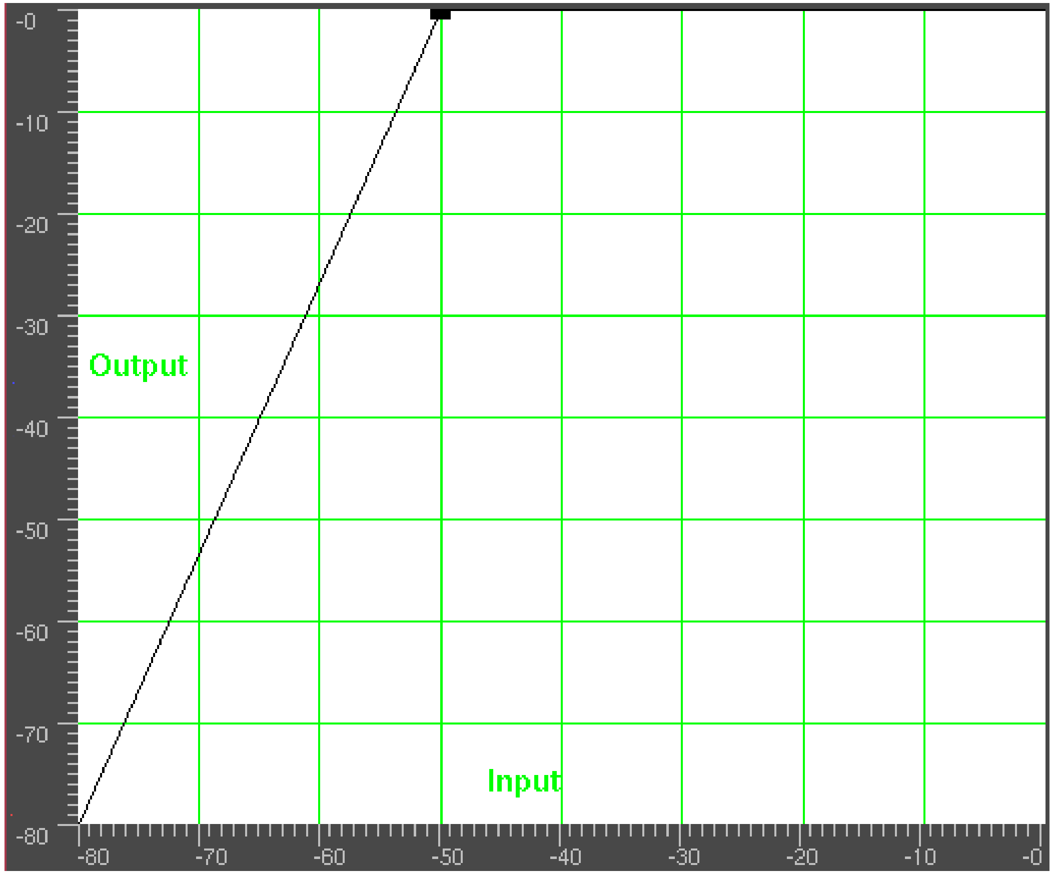
Either highlight a region of the timeline or set in/out points to use for the ringtone. To improve sound quality on the cell phone, you need the maximum amplitude in as many parts of the sound as possible. Right click on track Audio 1 and select **Attach effect...**. Highlight the **Compressor** effect and hit **Attach** in the attachment popup.

Make sure the insertion point or highlighted area is in the region with the Compressor effect. Right click on track Audio 2 and select **Attach effect...**. Highlight **Audio 1: Compressor** and hit **Attach**. Click the Audio1 Compressor's magnifying glass 🔍 to bring up the compressor GUI.

Set the following parameters:

```
     Reaction secs: -0.1
     Decay secs: 0.1
     Trigger Type: Total
     Trigger: 0
     Smooth only: No
```

Click **Clear** to clear the graph. Click anywhere in the grid area and drag a new point to 0 Output and -50 Input. The graph should look like this.



Go to **File->Render**. Specify the name of an mp3 file to output to. Set the file format to **MPEG Audio**. Click the wrench for Audio and set **Layer** to **III** and **Kbits per second** to **24** or **32**. Check **Render audio tracks** and uncheck **Render video tracks**. Hit OK to render the file.

The resulting .mp3 file must be uploaded to a web server. Then, the phone's web browser must download the .mp3 file directly from the URL. There also may be a size limit on the file.

Next: PITCH SHIFTING AUDIO, Previous: MAKING A RINGTONE, Up: SECRETS OF CINELERRA

17.8 TIME STRETCHING AUDIO

It may appear that time stretching audio is a matter of selecting a region of the audio tracks, enabling recording for the desired tracks, going to **Audio->Render Effect**, and applying **Time Stretch**. In actuality there are 3 audio effects for time stretching: **Time Stretch**, **Resample**, and **Asset info dialog**.

Time Stretch applies a fast fourier transform to try to change the duration without changing the pitch, but this introduces windowing artifacts to the audio. It's only useful for large changes in time because obvious changes in duration make windowing artifacts less obtrusive.

For smaller changes in duration, in the range of 5%, **Resample** should be used. This changes the pitch of the audio but small enough changes aren't noticable. Resample doesn't introduce any windowing artifacts, so this is most useful for slight duration changes where the listener isn't supposed to know what's going on.

Another way to change duration slightly is to go to the **Resources** window, highlight the **media** folder, right click on an audio file, click on **Info**. Adjust the sample rate in the **Info** dialog to adjust the duration. This method also requires left clicking on the right boundary of the audio tracks and dragging left or right to correspond to the length changes.

Previous: TIME STRETCHING AUDIO, Up: SECRETS OF CINELERRA

17.9 PITCH SHIFTING AUDIO

Like the time stretching methods, there are three pitch shifting methods: **Pitch shift**, **Resample**, and **Asset info dialog**. Pitch shift is a realtime effect which can be dragged and dropped onto recordable audio tracks. Pitch shift uses a fast fourier transform to try to change the pitch without changing the duration, but this introduces windowing artifacts.

Because the windowing artifacts are less obtrusive in audio which is obvously pitch shifted, Pitch shift is mainly useful for extreme pitch changes. For mild pitch changes, use **Resample** from the **Audio->Render Effect** interface. Resample can change the pitch within 5% without a noticable change in duration.

Another way to change pitch slightly is to go to the **Resources** window, highlight the **media** folder, right click on an audio file, click on **Info**. Adjust the sample rate in the **Info** dialog to adjust the pitch. This method also requires left clicking on the right boundary of the audio tracks and dragging left or right to correspond to the length changes.

Next: PLUGIN AUTHORING, Previous: SECRETS OF CINELERRA, Up: Top

18 SECRETS OF CINELERRA EFFECTS

Most effects in Cinelerra can be figured out just by using them and tweeking. Here are brief descriptions of effects which you might not utilize fully by mere experimentation.

- 1080 TO 480: How to convert HDTV into SD
- CHROMA KEY: Create transparency based on color similarities.
- COMPRESSOR: How to reduce the dynamic range of audio.
- DECIMATE: How to reduce frame rates by eliminating similar frames.
- DEINTERLACE: How to convert interlaced video to progressive video.
- DIFFERENCE KEY: Create transparency based on color differences.
- FIELDS TO FRAMES: How to recover interlaced video from bobbed video

- FREEZE FRAME: How to stop action in the timeline.
- HISTOGRAM: How to change the mapping of different brightness values.
- INVERSE TELECINE: How to convert pulled down frames to progressive frames.
- INTERPOLATE VIDEO: How to create the illusion of higher framerates.
- LENS: Correcting spherical aberration
- LINEARIZE: Fix gamma in raw camera images
- LIVE AUDIO: Pass audio from the soundcard directly to the timeline.
- LIVE VIDEO: Pass video from the capture card directly to the timeline.
- LOOP: How to loop regions of the timeline.
- MOTION: Motion tracking with rotation.
- MOTION 2 POINT: Motion and rotation tracking from translation only.
- REFRAMERT: Changing the number of frames in a sequence.
- REFRAME: Changing the number of frames in a sequence with rendering.
- RESAMPLE: Change the number of samples in a sequence with rendering.
- REVERSE VIDEO/AUDIO: How to play regions in reverse.
- SWAP FRAMES: Fixing temporal field order
- THRESHOLD: How to get monochrome out of a region of the image.
- TIME AVERAGE: How to stack images.
- TITLER: How to add text to a track from inside Cinelerra.
- VIDEO SCOPE: How to view the dynamic range of intensity and hue.

Next: CHROMA KEY, Up: SECRETS OF CINELERRA EFFECTS

18.1 1080 TO 480

Most TV broadcasts are recieved with a 1920x1080 resolution but originate from a 720x480 source at the studio. It's a waste of space to compress the entire 1920x1080 if the only resolvable details are 720x480. Unfortunately resizing 1920x1080 video to 720x480 isn't as simple as shrinking it.

At the TV station the original 720x480 footage was first converted to fields of 720x240. Each field was then scaled up to 1920x540. The two 1920x540 fields were finally combined with interlacing to form the 1920x1080 image. This technique allows a consumer TV to display the resampled image without extra circuitry to handle 720x480 interlacing in a 1920x1080 image.

If you merely deinterlaced the 1920x1080 images, you would end up with resolution of 720x240. The **1080 to 480** effect properly extracts two 1920x540 size fields from the image, resizes them separately, and combines them again to restore a 1920x480 interlaced image. The **scale** effect must then be applied to reduce the horizontal size to 960 or 720 depending on the original aspect ratio.

The tracks to which **1080 to 480** is applied need to be at 1920x1080 resolution. The project settings in **settings->format** should be at least 720x480 resolution.

The effect doesn't know if the first row in the 1920x1080 image belongs to the first row of the 720x480 original. You have to specify what the first row is in the effect configuration.

The output of this effect is a small image in the middle of the original 1920x1080 frame. Use the projector to center the output image in the playback.

Finally, once you have 720x480 interlaced video you can either apply **frames to fields** of **inverse telecine** to further recover original progressive frames.

Next: COMPRESSOR, Previous: 1080 TO 480, Up: SECRETS OF CINELERRA EFFECTS

18.2 CHROMA KEY

This effect erases pixels which match the selected color. They are replaced with black if there is no alpha channel and transparency if there is an alpha channel. The selection of color model is important to determine the behavior.

Chroma key uses either the lightness or the hue to determine what is erased. **Use value** singles out only the lightness to determine transparency. Select a center color to erase using the **Color** button. Alternatively a color can be picked directly from the output frame by first using the **color picker** in the compositor window and then selecting the **Use color picker** button. This sets the chroma key color to the current color picker color.

Be aware that the output of the chroma key is fed back to the compositor, so selecting a color again from the compositor will use the output of the chroma key effect. The chroma key should be disabled when selecting colors with the color picker.

If the lightness or hue is within a certain threshold it's erased. Increasing the threshold determines the range of colors to be erased. It's not a simple on/off switch, however. As the color approaches the edge of the threshold, it gradually gets erased if the slope is high or is rapidly erased if the slope is low. The slope as defined here is the number of extra values flanking the threshold required to go from opaque to transparent.

Normally threshold is very low when using a high slope. The two parameters tend to be exclusive because slope fills in extra threshold.

The slope tries to soften the edges of the chroma key but it doesn't work well for compressed sources. A popular softening technique is to use a maximum slope and chain a blur effect below the chroma key effect to blur just the alpha.

Next: DECIMATE, Previous: CHROMA KEY, Up: SECRETS OF CINELERRA EFFECTS

18.3 COMPRESSOR

Contrary to computer science experience, the audio compressor does not reduce the amount of data required to store the audio. The audio compressor reduces the dynamic range of the audio. In Cinelerra the compressor actually performs the function of an expander and compressor.

The compressor works by calculating the maximum sound level within a certain time period of the current position. The maximum sound level is taken as the input sound level. For every input sound level there is an output sound level specified by the user. The gain at the current position is adjusted so the maximum sound level in the time range is the user specified value.

The compressor has a graph which correlates every input sound level to an output level. The horizontal direction is the input sound level in dB. The vertical direction is the ouptut sound level in dB. The user specifies output sound levels by creating points on the graph. Click in the graph to create a point. If 2 points exist, drag one point across another point to delete it. The most recent point selected has its vales displayed in textboxes for more precise adjustment.

To make the compressor reduce the dynamic range of the audio, make all the output values greater than the input values except 0 db. To make the compressor expand the dynamic range of the audio, make all the output values except 0 db less than the input values. The algorithm currently limits all sound levels above 0 db to 0 db so to get an overloaded effect put a gain effect before the compressor to reduce all the levels and follow it with another gain effect to amplify all the levels back over 0 db.

Reaction secs: This determines where in relation to the current position the maximum sound level is taken and how fast the gain is adjusted to reach that peak. It's notated in seconds. If it's negative the compressor reads ahead of the current position to get the future peak. The gain is ramped to that peak over one reaction time. This allows it to hit the desired output level exactly when the input peak occurs at the current position.

If the reaction time is positive the compressor scans only the current position for the gain and ramps gain over one reaction time to hit the desired output level. It hits the output level exactly one reaction time after detecting the input peak.

Decay secs: If the peak is higher than the current level, the compressor ramps the gain up to the peak value. Then if a future peak is less than the current peak it ramps the gain down. The time taken to ramp the gain down can be greater than the time taken to ramp the gain up. This ramping down time is the decay seconds.

Trigger type: The compressor is a multichannel effect. Several tracks can share one compressor. How the signal from many tracks is interpreted is determined by the trigger type.

The **Trigger** trigger type uses the value supplied in the **Trigger** textbox as the number of the track to use as input for the compressor. This allows a track which isn't even heard to determine the loudness of the other tracks.

The **Maximum** trigger takes the loudest track and uses it as the input for the compressor.

The **Total** trigger type adds the signals from all the tracks and uses the total as the input for the compressor. This is the most natural sounding compression and is ideal when multiple tracks are averaged into single speakers.

Trigger: The compressor is a multichannel effect. Several tracks can share one compressor. Normally only one track is scanned for the input peak. This track is specified by the **Trigger**. By sharing several tracks and playing with the trigger value, you can make a sine wave on one track follow the amplitude of a drum on another track for example.

Smooth only: For visualizing what the compressor is doing to the soundlevel, this option causes it to replace the soundwave with just the current peak value. It makes it very easy to see how **reaction secs** affects the detected peak values.

Next: DEINTERLACE, Previous: COMPRESSOR, Up: SECRETS OF CINELERRA EFFECTS

18.4 DECIMATE

This effect drops frames from a track which are most similar in order to reduce the frame rate. This is usually applied to a DVD to convert the 29.97 fps video to the 23.97 fps film rate but this decimate effect can take any input rate and convert it to any lower output rate.

The output rate of **decimate** is the project frame rate. The input rate is set in the **decimate** user interface. To convert 29.97fps progressive video to 23.97fps film, apply a decimate effect to the track. Set the decimate input rate to 29.97 and the project rate to 23.97.

Be aware every effect layered before decimate processes video at the decimate input rate and every effect layered after decimate processes video at the project frame rate. Computationally intensive effects should come below decimate.

Next: DIFFERENCE KEY, Previous: DECIMATE, Up: SECRETS OF CINELERRA EFFECTS

18.5 DEINTERLACE

The deinterlace effect has evolved over the years to deinterlacing and a whole lot more. In fact two of the deinterlacing methods, **Inverse Telecine** and **Frames to Fields**, are separate effects. The deinterlace effect offers several variations of line replication to eliminate comb artifacts in interlaced video. It also has some line swapping tools to fix improperly captured video or make the result of a reverse effect display fields in the right order.

Next: FIELDS TO FRAMES, Previous: DEINTERLACE, Up: SECRETS OF CINELERRA EFFECTS

18.6 DIFFERENCE KEY

The differency key creates transparency in areas which are similar between 2 frames. The Difference key effect must be applied to 2 tracks. One track contains the action in front of a constant background and another track contains the background with nothing in front of it. Apply the difference key to the track with the action and apply a shared copy of it to the track with the background. The track with the background should be muted and underneath the track with the action and the colormodel should have an alpha channel.

Pixels which are different between the background and action track are treated as opaque. Pixels which are similar are treated as transparent. Change **threshold** in the differency key window to make more pixels which aren't the same color transparent. Change **slope** to change the rate at which the transparency tapers off as pixels get more different.

The slope as defined here is the number of extra values flanking the threshold required to go from opaque to transparent. A high slope is more useful with a low threshold because slope fills in extra threshold.

Use value causes the intensity of pixels to be compared instead of the color.

Applying a blur to the top track with just the alpha channel blurred can soften the transparency border.

Next: FREEZE FRAME, Previous: DIFFERENCE KEY, Up: SECRETS OF CINELERRA EFFECTS

18.7 FIELDS TO FRAMES

This effects reads frames at twice the project framerate, combining 2 input frames into a single interlaced output frame. Effects preceeding **fields to frames** process frames at twice the project frame rate. Each input frame is called a field.

Fields to frames needs to know what field corresponds to what lines in the output frame. The easiest way to figure it out is to try both options in the window. If the input fields are the result of a line doubling process like **frames to fields**, the wrong setting results in blurrier output. If the input fields are the result of a standards conversion process like **1080 to 480**, the wrong setting won't make any difference.

The debobber which converts 720x480 interlaced into 1920x1080 interlaced or 1280x720 progressive seems to degrade the vertical resolution to the point that it can't be recovered.

Next: HISTOGRAM, Previous: FIELDS TO FRAMES, Up: SECRETS OF CINELERRA EFFECTS

18.8 FREEZE FRAME

In its simplest form, highlight a region of the track to freeze, drop the freeze frame effect on the highlighted region, and the lowest numbered frame in the affected area will play throughout the entire region.

Freezeframe has an **enabled** option which can be keyframed. Regions of a freeze frame effect which are enabled repeat the lowest numbered frame since the last keyframe. This has unique possibilities.

If a freeze frame effect has a keyframe in the middle of it set to **enabled**, the frame in the middle is repeated in the entire effect.

If a freeze frame effect has several keyframes, each set to **enabled**, every time a keyframe is encountered the frame under it becomes the frozen one.

If a freeze frame effect alternates between **enabled** and **disabled**, each time an **enabled** keyframe is encountered the frame under it is replicated until the next **disabled** keyframe. The disabled regions play through.

Next: INVERSE TELECINE, Previous: FREEZE FRAME, Up: SECRETS OF CINELERRA EFFECTS

18.9 HISTOGRAM

This shows the number of occurances of each color on a histogram plot.

It is always performed in floating point RGB regardless of the project colorspace. The histogram has two sets of transfer parameters: the input transfer and the output transfer.

4 histograms are possible in the histogram viewer. The red, green, blue histograms show the input histograms for red, green, blue and multiply them by an input transfer to get the output red, green, blue. Then the output red, green, blue is scaled by an output transfer. The scaled red, green, blue is converted into a value and plotted on the value histogram. The value histogram thus changes depending on the settings for red, green, blue. The value transfers are applied uniformly to R, G, B after their color transfers are applied.

Select which transfer to view by selecting one of the channels on the top of the histogram.

The input transfer is defined by a graph overlaid on the histogram. The horizontal direction corresponds to every possible input color. The vertical direction corresponds to the output color for every input color. Video entering the histogram is first plotted on the histogram plot, then it is translated so output values now equal the output values for each input value on the input graph.

The input graph is edited by adding and removing any number of points. Click and drag anywhere in the input graph to create a point and move it. Click on an existing point to make it active and move it. The active point is always indicated by being filled in. The active point's input and output color are given in text boxes on top of the window. The input and output color of the point can be changed through these text boxes.

Points can be deleted by first selecting a point and then dragging it to the other side of an adjacent point. They can also be deleted by selecting them and hitting **delete**.

After the input transfer, the image is processed by the output transfer. The output transfer is simply a minimum and maximum to scale the input colors to. Input values of 100% are scaled down to the output's maximum. Input values of 0% are scaled up to the output minimum.

Input values below 0 are always clamped to 0 and input values above 100% are always clamped to 100%. Click and drag on the output gradient's triangles to change it. It also has textboxes to enter values into.

Enable the **automatic** toggle to have the histogram calculate an automatic input transfer for the red, green, blue but not the value. It does this by scaling the middle 99% of the pixels to take 100% of the histogram width. The number of pixels permitted to pass through is set by the **Threshold** textbox. A threshold of 0.99 scales the input so 99% of the pixels pass through. Smaller thresholds permit fewer pixels to pass through and make the output look more contrasty.

Automatic input transfer is calculated for the R, G, and B channels but not the value.

PLOT HISTOGRAM

SPLIT OUTPUT

Next: INTERPOLATE VIDEO, Previous: HISTOGRAM, Up: SECRETS OF CINELERRA EFFECTS

18.10 INVERSE TELECINE

This is the most effective deinterlacing tool when the footage is a video transfer of a film. Here the film was converted from 24fps to 60fps. Then the 60fps was downsampled to 30fps by extracting odd and even lines and interlacing the lines. The IVTC effect is primarily a way to convert interlaced video to progressive video. It undoes three patterns of interlacing.

```
A AB BC CD D
AB CD CD DE EF
Automatic
```

The first two options are fixed patterns and affected by the **pattern offset** and **odd field first** parameters. The last option creates several combinations of lines for each frame and picks the most progressive combination. It's a brute force algorithm.

This technique doesn't rely on a pattern like other techniques and is less destructive but the timing is going to be jittery because of the lack of a frame rate reduction. In order to smooth out the timing, you need to follow inverse telecine with a decimate effect.

Next: LENS, Previous: INVERSE TELECINE, Up: SECRETS OF CINELERRA EFFECTS

18.11 INTERPOLATE VIDEO

The interpolate video effect tries to create the illusion of a higher frame rate from source footage of very low framerates by averaging frames over time. It averages two input frames for each output frame. The input frames are at different times, resulting in a dissolve for all output frames between the input frames. There are two ways of specifying the input frames. You can specify an input frame rate which is lower than the project frame rate. This causes input frames to be taken at even intervals,

You can also specify keyframe locations as the positions of the input frames. In this mode the output frame rate is used as the input frame rate and you just create keyframes wherever you want to specify an input frame.

Next: LINEARIZE, Previous: INTERPOLATE VIDEO, Up: SECRETS OF CINELERRA EFFECTS

18.12 LENS

The lens affect stretches or shrinks to convert lens distorted images to rectilinear images. The most common use is converting fish eye lenses to rectilinear lenses. It is also useful for star tracking.

R, G, B, A Field of view: These determine how much the image is stretched in each channel.

Lock: This causes changes to 1 channel to affect all the channels. This is normally the desired behavior.

Aspect Ratio: This changes the amount of stretching done in the X axis vs the Y axis. To crop less data from stretched images, this allows more stretching to be done on 1 axis without creating black borders in the other axis.

Radius: This determines the size of the stretched region. While adjusting the **field of view**, black borders may appear. Adjust the **radius** to shrink or expand the output so black borders are out of frame.

Center X, Y: The center of the stretched region. This is only useful if the image was previously translated by the software so the center of the lens is now off center.

Draw center: This is a visual aid when adjusting the **Center X, Y** but doesn't affect the results.

Mode: The type of stretching algorithm.

- **Sphere shrink:** This is for making an image look like it's mapped to a sphere.
- **Sphere expand:** This is for unmapping an image mapped to a sphere and flattening it.
- **Rectilinear Stretch:** This is for flattening a fish eye lens.
- **Rectilinear Shrink:** This is for making something flat look like it was taken by a fish eye lens.

Next: LIVE AUDIO, Previous: LENS, Up: SECRETS OF CINELERRA EFFECTS

18.13 LINEARIZE

Raw camera images store colors in a logarithmic scale. The blacks in these images are nearly 0 and the whites are supposed to be infinity. The graphics card and most video codecs store colors in a linear scale but Cinelerra keeps raw camera images in their original logarithmic scale when it renders them. This is necessary because the raw image parser can't always decode the proper gamma values for the images. It also does its processing in 16 bit integers, which takes away a lot of information.

The linearize effect converts the logarithmic colors to linear colors through a gamma value and a maximum value. The gamma value determines how steep the output curve is and the maximum value is where 1.0 in the output corresponds to maximum brightness in the input.

The linearize effect has 2 more parameters to simplify gamma correction. The **automatic** option causes it to calculate **max** from the histogram of the image. Use this when making a preview of a long list of images since it changes for every image.

The **use color picker** option uses the value currently in the color picker to set the **max** value. Note that every time you pick a color from the compositor window, you need to hit **use color picker** to apply the new value.

Next: LIVE VIDEO, Previous: LINEARIZE, Up: SECRETS OF CINELERRA EFFECTS

18.14 LIVE AUDIO

This effect reads audio directly from the soundcard input. It replaces any audio on the track so it's normally applied to an empty track.

To use Live Audio, highlight a horizontal region of an audio track or define in and out points. Then drop the Live Audio effect into it. Create extra tracks and attach shared copies of the first Live Audio effect to the other tracks to have extra channels recorded.

Live Audio uses the sound driver selected in **Settings->Preferences->Playback->Audio Out** for recording, but unlike recording it uses the **playback buffer size** as the recording buffer size and it uses the **project sample rate** as the sampling rate.

These settings are critical since some sound drivers can't record in the same sized buffer they play back in. Live audio has been most reliable when ALSA is the recording driver and the playback fragment size is 2048.

Drop other effects after Live Audio to process soundcard input in realtime.

Now the bad news. With live audio there is no readahead so effects like compressor will either delay if they have readahead enabled or playback will underrun.

Another problem is sometimes the recording clock on the soundcard is slightly slower than the playback clock. The recording eventually falls behind and playback sounds choppy.

Finally, live audio doesn't work in reverse.

Next: LOOP, Previous: LIVE AUDIO, Up: SECRETS OF CINELERRA EFFECTS

18.15 LIVE VIDEO

This effect reads video directly from the capture card input. It replaces any video on the track so it's normally applied to an empty track. The configuration for the capture card is taken from the recording preferences. Go to **Settings->Preferences->Recording** to set up the capture card.

Go to the **Video In** section where it says **Record driver**. It must be set to either **Video4Linux2** or **IEC 61883**. Other video drivers haven't been tested with Live Video and probably won't work.

For live video, the selection for **File Format** and **Video** needs to be set to a format the timeline can use. The file format must be **Quicktime for Linux** and video recording must be enabled for it. Click on the wrench 🔧 to set the video compression.

The video compression depends on the recording driver. For the **Video4Linux2** recording driver, the compression must be **Motion JPEG A**. For the **IEC 61883** driver, the compression must be **DV**. This gets the driver to generate output in a colormodel that the timeline can use.

Some cards provide color and channel settings. Live video takes the color settings from the values set in the **Video In** window. Go to **File->Record** to bring up the recording interface and the Video In window. Values set in the **Video in** window are used by **Live Video**. Any channels the capture card supports need to be configured in the **Video in** interface since the same channels are used by the **Live Video** effect.

With the video recording configured, highlight a horizontal region of a video track or define in and out points. Then drop the Live Video effect into it. Drop other effects after Live Video to process the live video in realtime. For best results, you should use OpenGL and a video card which supports GL shading language. Go to **Settings->Preferences->Playback->Video Out** to enable the OpenGL driver.

Only one Live Video effect can exist at any time on the timeline. It can't be shared by more than one track.

Next: MOTION, Previous: LIVE VIDEO, Up: SECRETS OF CINELERRA EFFECTS

18.16 LOOP

Sections of audio or video can be looped by dropping a **loop** effect on them. Contrary to the the **settings->loop playback** option, the loop effects can be rendered where the **settings->loop playback** option can not be. The loop effects are also convenient for short regions.

The loop effects have one option: the number of **frames** or **samples** to loop. This specifies the length of the region to loop starting from either the beginning of the effect or the latest keyframe. The region is replicated for the entire effect.

Every time a keyframe is set in a loop effect, the keyframe becomes the beginning of the region to loop. Setting several keyframes in succession causes several regions to loop. Setting a single keyframe causes the region after the keyframe to be looped throughout the effect, no matter where the keyframe is. The end of an effect can be looped from the beginning by setting the keyframe near the end.

Next: MOTION 2 POINT, Previous: LOOP, Up: SECRETS OF CINELERRA EFFECTS

18.17 MOTION

The motion tracker is almost a complete application in itself. The motion tracker tracks two types of motion: translation and rotation. It can track both simultaneously or one only. It can do 1/4 pixel tracking or single pixel tracking. It can stabilize motion or cause one track to follow the motion of another track.

Although the motion tracker is applied as a realtime effect, it usually must be rendered to see useful results. The effect takes a long time to precisely detect motion.

The motion tracker works by using one region of the frame as the region to track. It compares this region between 2 frames to calculate the motion. This region can be defined anywhere on the screen. Once the motion between 2 frames has been calculated, a number of things can be done with that motion vector. It can be scaled by a user value and clamped to a maximum range. It can be thrown away or accumulated with all the motion vectors leading up to the current position.

To save time the motion result can be saved for later reuse, recalled from a previous calculation, or discarded.

The motion tracker has a notion of 2 tracks, the master layer and the target layer. The master layer is where the comparison between 2 frames takes place. The target layer is where motion is applied either to track or compensate for the motion in the master layer.

The intricacies of motion tracking are enough to sustain entire companies and build careers around. The motion tracker in Cinelerra isn't as sophisticated as some world class motion trackers but it's enough to sweeten some camcorder footage.

Here is a brief description of the motion tracking parameters:

- **Track translation:** Enables translation operations. The motion tracker tracks X and Y motion in the master layer and adjusts X and Y motion in the target layer.
- **Translation block size:** For the translation operations, a block is compared to a number of neighboring blocks to find the one with the least difference. The size of the block to search for is given by this parameter.
- **Translation search radius:** The size of the area to scan for the translation block.
- **Translation search steps:** Ideally the search operation would compare the translation block with every other pixel in the translation search radius. To speed this operation up, a subset of the total positions is searched. Then the search area is narrowed and rescanned by the same number of search steps until the motion is known to 1/4 pixel accuracy.
- **Block X, Y:** These coordinates determine the center of the translation block based on percentages of the width and height of the image. The center of the block should be part of the image which is visible at all times.
- **Maximum absolute offset:** In **track previous frame** and **previous frame same block** modes, the motion detected between every frame is accumulated to form an absolute motion vector for the entire sequence. The amount of motion detected by the motion tracker is unlimited if this is 100. If it's under 100 the amount of motion is limited to that percentage of the image size. The value must be smaller for larger **translation block sizes** so there is enough area under the block to sense motion with.
- **Settling speed** In **track previous frame** and **previous frame same block** modes, the motion detected between every frame is accumulated to form an absolute motion vector for the entire sequence. To keep the absolute motion from exceeding limits, it can be automatically reset over time by the settling speed. If the settling speed is 100 the absolute vector resets to 0 after every frame. If the settling speed is less than 100 the absolute vector is reduced slightly before the next frame is added.
- **Track rotation:** Enables rotation operations. The motion tracker tracks rotation in the master layer and adjusts rotation in the target layer.
- **Rotation block size:** For rotation operations a single block is compared to equally sized blocks, each rotated by a different amount. This is the size of the rotation block.
- **Rotation search radius:** This is the maximum angle of rotation from the starting frame the rotation scanner can detect. The rotation scan is from this angle counterclockwise to this angle clockwise. Thus the rotation search radius is half the total range scanned.
- **Rotation search steps:** Ideally every possible angle would be tested to get the rotation. To speed up the rotation search, the rotation search radius is divided into a finite number of angles and only those angles compared to the starting frame. Then the search radius is narrowed and an equal number of angles is compared in the smaller radius until the highest possible accuracy is achieved.

  Normally you need one search step for every degree scanned. Since the rotation scanner scans the rotation search radius in two directions, you need two steps for every degree in the search radius to search the complete range.

- **Draw vectors:** When translation is enabled, 2 boxes are drawn on the frame. One box represents the translation block. Another box outside the translation block represents the extent of the translation search radius. In the center of these boxes is an arrow showing the translation between the 2 master frames.

When rotation is enabled a single box the size of the rotation block is drawn rotated by the amount of rotation detected.

- **Track single frame:** When this option is used the motion between a single starting frame and the frame currently under the insertion point is calculated. The starting frame is specified in the **Frame number** blank. The motion calculated this way is taken as the absolute motion vector. The absolute motion vector for each frame replaces the absolute motion vector for the previous frame. Settling speed has no effect on it since it doesn't contain any previous motion vectors. Playback can start anywhere on the timeline since there is no dependance on previous results.
- **Track previous frame:** Causes only the motion between the previous frame and the current frame to be calculated. This is added to an absolute motion vector to get the new motion from the start of the sequence to the current position. After every frame processed this way, the block position is shifted to always cover the same region of the image. Playback must be started from the start of the motion effect in order to accumulate all the necessary motion vectors.
- **Previous frame same block:** This is useful for stabilizing jerky camcorder footage. In this mode the motion between the previous frame and the current frame is calculated. Instead of adjusting the block position to reflect the new location of the image, like Track Previous Frame does, the block position is unchanged between each frame. Thus a new region is compared for each frame.
- **Master layer:** This determines the track which supplies the starting frame and ending frame for the motion calculation. If it's **Bottom** the bottom track of all the tracks sharing this effect is the master layer. The top track of all the tracks is the target layer.
- **Calculation:** This determines whether to calculate the motion at all and whether to save it to disk. If it's **Don't Calculate** the motion calculation is skipped. If it's **Recalculate** the motion calculation is performed every time each frame is rendered. If it's **Save** the motion calculation is always performed but a copy is also saved. If it's **Load**, the motion calculation is loaded from a previous save calculation. If there is no previous save calculation on disk, a new motion calculation is performed.
- **Action:** Once the motion vector is known this determines whether to move the target layer opposing the motion vector or following the motion vector. If it's **Do Nothing** the target layer is untouched. If it's **Track...** the target layer is moved by the same amount as the master layer. This is useful for matching titles to objects in the frame. If it's **Stabilize...** the target layer is moved opposite to the motion vector. This is useful for stabilizing an object in the frame. The motion operations can be accurate to single pixels or subpixels by changing the action setting.

Next: 2 PASS MOTION TRACKING, Up: MOTION

18.17.1 SECRETS OF MOTION TRACKING

Since it is a very slow effect, there is a method to applying the motion tracker to get the most out of it. First disable playback for the track to do motion tracking on. Then drop the effect on a region of video with some motion to track. Then rewind the insertion point to the start of the region. Set **Action** -> **Do Nothing**. Set **Calculation** -> **Don't calculate**. Enable **Draw vectors**. Then enable playback of the track to see the motion tracking areas.

Enable which of **translation motion** or **rotation motion** vectors you want to track. By watching the compositor window and adjusting the **Block x,y** settings, center the block on the part of the image you want to track. Then set search radius, block size, and block coordinates for translation and rotation.

Once this is configured, set the calculation to **Save coords** and do test runs through the sequence to see if the motion tracker works and to save the motion vectors. Once this is done, disable playback for the track, disable **Draw vectors**, set the motion action to perform on the target layer and change the calculation to **Load coords**. Finally enable playback for the track.

When using a single starting frame to calculate the motion of a sequence, the starting frame should be a single frame with the least motion to any of the other frames. This is rarely frame 0. Usually it's a frame near the middle of the sequence. This way the search radius need only reach halfway to the full extent of the motion in the sequence.

If the motion tracker is used on a render farm, **Save coords** and **previous frame** mode won't work. The results of the save coords operation are saved to the hard drives on the render nodes, not the master node. Future rendering operations on these nodes will process different frames and read the wrong coordinates from the node filesystems. The fact that render nodes only visualize a portion of the timeline also prevents **previous frame** from working since it depends on calculating an absolute motion vector starting on frame 0.

Next: USING BLUR TO IMPROVE MOTION TRACKING, Previous: SECRETS OF MOTION TRACKING, Up: MOTION

18.17.2 2 PASS MOTION TRACKING

The method described above is 2 pass motion tracking. One pass is used just to calculate the motion vectors. A second pass is used to apply the motion vectors to the footage. This is faster than a single pass because errors in the motion vector calculation can be discovered quickly.

This also allows the motion tracking to use a less demanding colormodel like RGB888 in the scanning step and a more demanding colormodel like RGB Float in the action step. The scanning step takes much longer than action.

This suffers the disadvantage of not being practical for extremely long sequences where some error is acceptable and the picture quality is lousy to begin with, like stabilizing camcorder footage.

The slower method is to calculate the motion vectors and apply them simultaneously. This method can use one track as the motion vector calculation track and another track as the target track for motion vector actions. This is useful for long sequences where some error is acceptable.

Next: USING HISTOGRAM TO IMPROVE MOTION TRACKING, Previous: 2 PASS MOTION TRACKING, Up: MOTION

18.17.3 USING BLUR TO IMPROVE MOTION TRACKING

With extremely noisy or interlaced footage, applying a blur effect before the motion tracking can improve accuracy. Either save the motion vectors in a **tracking pass** and disable the blur for the **action pass** or apply the blur just to the **master layer**.

Next: INTERPOLATING MOTION BETWEEN FRAMES, Previous: USING BLUR TO IMPROVE MOTION TRACKING, Up: MOTION

18.17.4 USING HISTOGRAM TO IMPROVE MOTION TRACKING

A histogram is almost always applied before motion tracking to clamp out noise in the darker pixels. Either save the motion vectors in a **tracking pass** and disable the histogram for the **action pass** or apply the histogram just to the **master layer**.

Next: FILLING IN THE BLACK AREAS, Previous: USING HISTOGRAM TO IMPROVE MOTION TRACKING, Up: MOTION

18.17.5 INTERPOLATING MOTION BETWEEN FRAMES

The motion tracker can simulate higher frame rates than the media frame rate by interpolating the motion. Interpolation is enabled with the **maximum absolute offset** and **settling speed** options.

First, go to **Settings->Format** in the main window and set the **video frame rate** to a number higher than the media frame rate.

In the **Motion** window, select a tracking option which accumulates motion. This is either **Track previous frame** or **Previous frame same block**. These cause the **maximum absolute offset** and **settling speed** options to take effect.

maximum absolute offset must be set to the maximum motion to be accumulated as a percentage of the video size. A value of 50 limits the motion to 50% of the video size. 50 works well. The value must be smaller for larger **translation block sizes** so there is enough area under the block to sense motion with.

settling speed must be set to the rate at which the accumulated motion resets to 0 over time. The reset happens whether or not any motion was detected, so when the project frame rate is higher than the media frame rate, the frames between media frames regress towards the center. For interpolated motion, the **settling speed** value should be small, so the movement is smooth. 3 works well.

Previous: INTERPOLATING MOTION BETWEEN FRAMES, Up: MOTION

18.17.6 FILLING IN THE BLACK AREAS

Stabilization always creates black borders in the track resolution. One solution is to shrink the project resolution so the borders are always cropped off the output. Another solution is to apply a **Time Average** effect after stabilization.

Configure **Time Average** the following way:

- **Frame count:** 1
- **Accumulate sequence again:** No
- **Replace:** Yes
- **Threshold:** 1
- **Border:** 4

This makes new frames replace only the pixels in the previous frames where there is new data. The black areas in new frames don't replace previous data so the previous data shows through and fills them in.

Next: REFRAMERT, Previous: MOTION, Up: SECRETS OF CINELERRA EFFECTS

18.18 MOTION 2 POINT

The 2 point motion tracker is the same as using 2 of the translation motion trackers to track 2 points. It doesn't have a rotation tracker. Instead, it uses the angle between the 2 translation points to determine rotation. The 2 points can be enabled separately.

If 1 point is enabled, only translation is tracked.

If 2 points are enabled, translation is tracked by point 1 and rotation is tracked by point 2. Stabilization is performed with point 1 as the center.

The other parameters for the 2 point tracker are the same as the single point tracker. In addition, the 2 point tracker supports **TRANSLATION SEARCH OFFSET**.

TRANSLATION SEARCH OFFSET forces the motion search to look in a region other than directly next to the translation block position. The **translation search offset** is added to the new search result, giving contiguous motion results throughout any changes in translation search area.

This is useful if the camera position changed in the middle of a sequence of images but the subject stayed the same. Offset the translation search area when the camera position changes and the detected motion stays contiguous through the entire sequence.

2 point tracking works best if the points don't change shape between frames. It is more prone to rotation errors than single point motion tracking if the points change shape. 2 point tracking is mainly used for tracking stars.

Use the smallest search blocks possible since larger blocks are harder to compare when they're rotated.

Next: REFRAME, Previous: MOTION 2 POINT, Up: SECRETS OF CINELERRA EFFECTS

18.19 REFRAMERT

ReframeRT changes number of frames in a sequence of video directly from the timeline. It has 2 modes, selected by the 2 toggles in the GUI.

Stretch mode multiplies the current frame number of its output by the scale factor to arrive at the frame to read from its input. If its current output frame is #55 and the scale factor is 2, frame #110 is read from its input. The stretch mode has the effect of changing the length of output video by the inverse of the scale factor. If the scale factor is greater than 1, the output will end before the end of the sequence on the timeline. If it's less than 1, the output will end after the end of the sequence on the timeline. The ReframeRT effect must be lengthened to the necessary length to accomodate the scale factor. Change the length of the effect by clicking on the endpoint of the effect and dragging.

Although stretch mode changes the number of the frame read from its input, it doesn't change the frame rate of the input. Effects before ReframeRT assume the same frame rate as ReframeRT.

Downsample mode doesn't change the length of the output sequence. It multiplies the frame rate of the output by the scale factor to arrive at a frame rate rate to read the input. This has the effect of replicating the input frames so that they only change at the scaled frame rate when sent to the output. It doesn't change the length of the sequence. If the scale factor is 0.5 and the output frame rate is 30 fps, only 15 frames will be shown per second and the input will be read at 15 fps. Downsample is only useful for scalefactors below 1, hence the name downsample.

Downsample mode changes the frame rate of the input as well as the number of the frame to read, so effects before ReframeRT see the frame rate * the scale factor as their frame rate. If the scale factor is 2 and the output frame rate is 30, the input frame rate will be 60 and the input frame number will by doubled. This won't normally do anything but some input effects may behave differently at the higher frame rate.

Next: RESAMPLE, Previous: REFRAMERT, Up: SECRETS OF CINELERRA EFFECTS

18.20 REFRAME

This does exactly the same thing as **ReframeRT** in **Stretch** mode. It multiplies the output frame number by the scale factor to arrive at the input frame number and changes the length of the sequence. Unlike ReframeRT, this must run from the **Video** menu and render its output.

Be aware **Reframe** doesn't write the scaled frame rate as the frame rate of the rendered file. It produces a file of scaled length and equal frame rate as the project. The new length is 1/scale factor as big as the original sequence.

Next: REVERSE VIDEO/AUDIO, Previous: REFRAME, Up: SECRETS OF CINELERRA EFFECTS

18.21 RESAMPLE

This multiplies the number of each output sample by a scale factor to arrive at the number of the input sample. The output file's sample rate is set to the project sample rate but its length is changed to reflect the scaled number of samples. It also filters the resampled audio to remove aliasing.

If the scale factor is 2, every 2 input samples will be reduced to 1 output sample and the output file will have half as many samples as the input sequence. If it's 0.5, every 0.5 input samples will be stretched to 1 output sample and the output file will have twice as many samples as the input sequence.

Next: SWAP FRAMES, Previous: RESAMPLE, Up: SECRETS OF CINELERRA EFFECTS

18.22 REVERSE VIDEO/AUDIO

Media can be reversed on the timeline in realtime. This isn't to be confused with using the reverse playback on the transport. The reverse effects reverse the region covered by the effect regardless of the transport direction. Apply **reverse audio** to an audio track and play it backwards. The sound plays forward.

The region to be reversed is first determined by what part of the track the effect is under and second by the locations of keyframes in the effect. The reverse effects have an **enabled** option which allows you to set keyframes. This allows may possibilities.

Every **enabled** keyframe is treated as the start of a new reversed region and the end of a previous reversed region. Several **enabled** keyframes in succession yield several regions reversed independant of each other. An **enabled** keyframe followed by a **disabled** keyframe yields one reversed region followed by a forward region.

Finally, be aware when reversing audio that the waveform on the timeline doesn't reflect the actual reversed output.

Next: THRESHOLD, Previous: REVERSE VIDEO/AUDIO, Up: SECRETS OF CINELERRA EFFECTS

18.23 SWAP FRAMES

This is normally used on interlaced video which has been converted to fields. One set of lines becomes one frame and the other set of lines becomes the next frame. Now the frame rate is double and is showing fields of the original video sequentially. The fields may be out of order, which is what **SWAP FRAMES** can correct.

Next: TIME AVERAGE, Previous: SWAP FRAMES, Up: SECRETS OF CINELERRA EFFECTS

18.24 THRESHOLD

Threshold converts the image to pure luminance. Then luminance values below and above the threshold range are converted to black and luminance values inside the threshold range are converted to white. The threshold window shows a histogram of luminance values for the current frame. Click dragging inside the histogram creates a range to convert to white. Shift-clicking extends one border of this range. Values for the threshold range can also be specified in the text boxes.

This effect is basically a primitive luminance key. A second track above the track with the threshold effect can be multiplied, resulting in only the parts of the second track within the threshold being displayed.

Next: TITLER, Previous: THRESHOLD, Up: SECRETS OF CINELERRA EFFECTS

18.25 TIME AVERAGE

Time average is one effect which has many uses besides creating nifty trail patterns of moving objects. It's main use is reducing noise in still images. Merely point a video camera at a stationary subject for 30 frames, capture the frames, and average them using TIME AVERAGE and you'll have a super high quality print. In floating point colormodels, time average can increase the dynamic range of lousy cameras.

Inside the time average effect is an accumulation buffer and a divisor. A number of frames are accumulated in the accumulation buffer and divided by the divisor to get the average.

Because the time average can consume enourmous amounts of memory, it is best applied by first disabling playback for the track, dropping the time average in it, configuring time average for the desired number of frames, and re-enabling playback for the track.

Frames count: This determines the number of frames to be accumulated in the accumulation buffer. For extremely large integrations it's easier to edit the EDL in a text editor and put in the number of frames.

Accumulate sequence again: If an effect before the time average is adjusted the time average normally doesn't reread the accumulation buffer to get the change. This forces it to reread the accumulation buffer when any other effects change.

Average: This causes the accumulation buffer to be divided before being output. The result is the average of all the frames.

Accumulate: This outputs the accumulation buffer without dividing it. The result is the sum of all the frames.

Accumulate only:

In order to accumulate only the specified number of frames, the time average retains all the previous frames in memory and subtracts them out as it plays forward. **Accumulate only:** causes the history buffer to not be used in **averaging** and **accumulating**. Without the history buffer, frames are added endlessly without ever being subtracted. It's the same as an infinitely long accumulation buffer. The only difference is for **Average** mode, the output is still divided by the **Frame count**. **Accumulate only** is used where the number of frames in the accumulation would be too big to fit in memory.

Replace: This causes the accumulation buffer to be replaced by only pixels which aren't transparent. This allows black borders from motion tracking to be filled in.

Threshold: The value a pixel must be before it replaces the previous pixel. If alpha channels are enabled, the alpha is the value compared. If there is no alpha channel, the brightness is the value compared.

Border: The number of pixels on the border of the image to never replace. This hides errors in the replacement operation from the output, since errors occur at the transition between the replaced area and the ignored area.

Greater: Pixels are replaced if their value is greater than the previous pixel. Use this to create star trails in stacks of many night sky photos or paint many copies of an object from its motion if it is lighter than the background.

Less: Pixels are replaced if their value is less than the previous pixel. Use this to paint copies of an object from its motion if it is darker than the background.

Next: VIDEO SCOPE, Previous: TIME AVERAGE, Up: SECRETS OF CINELERRA EFFECTS

18.26 TITLER

While it is possible to add text to movies by importing still images from The Gimp and compositing them, the Titler allows you to add text from within Cinelerra.

The titler has standard options for **font, size, and style**. The best font is a generic, normal font like Arial in a large size.

The titler also has options you'll only find in moving pictures. The **Justify** operation justifies the text relative to the entire frame. Once justified, the **X and Y** offset is applied. This allows text to be justified while at the same time letting you push it within the title safe region.

The **motion type** scrolls the text in any of the four directions. When using this, the text may dissappear. Move the insertion point along the timeline until the text is far enough along the animation to reappear. The text scrolls on and scrolls off.

Setting **loop** causes the text to scroll completely off and repeat. Without **loop** the text scrolls off and never reappears.

The speed of the animation is determined by **speed** Set it higher to speed up the animation.

Drop shadow draws a black copy of the text to the bottom right of the original text. Useful when drawing text over changing video to keep the border always visible.

In addition to the scrolling, **Fade in/Fade out** are a second type of animation. If the fade seconds are 0, no fading is done.

Outline draws an outline on the characters if it's greater than 0. Set the outline size by changing the number. Set the outline color with the **OUTLINE COLOR** button. If no outline is visible, make sure the alpha in **OUTLINE COLOR** is nonzero. To get pure outline characters, set **COLOR** alpha to 0.

COLOR picks the color to draw the text in. Usually white is the only practical color.

OUTLINE COLOR picks the color to draw the text outline in.

Stamp timecode replaces the text with the current position on the timeline in seconds and frames.

SECRETS OF THE TITLER

- ADDING FONTS TO THE TITLER: How to add fonts to the titler
- THE TITLE-SAFE REGION: How to keep text visible on output

- MAKING TITLES LOOK GOOD: How to make your titles look good.

Next: THE TITLE-SAFE REGION, Up: TITLER

18.26.1 ADDING FONTS TO THE TITLER

The X Window system originally didn't have a suitable font renderer for video. It also is restricted to the current bit depth. It doesn't have a convenient way to know which fonts work with the suitable font renderer in the desired bit depth. The easiest way we've found to support fonts in the titler is to have a directory for them at **/usr/lib/cinelerra/fonts**.

The titler supports mainly **TTF**, true type fonts. It supports others but TTF are the most reliable. To add true type fonts, copy the **.TTF** files to the **/usr/lib/cinelerra/fonts** directory. In that directory run **ttmkfdir && mv fonts.scale fonts.dir** and restart Cinelerra. The new fonts should appear. The usage of ttmkfdir changes frequently so this technique might not work.

Next: MAKING TITLES LOOK GOOD, Previous: ADDING FONTS TO THE TITLER, Up: TITLER

18.26.2 THE TITLE-SAFE REGION

If the video is displayed on a consumer TV, the outer border is going to be cropped by 5% on each side. Moreover, text which is too close to the edge looks sloppy. Make sure when adding titles to have the **title-safe** ▣ tool active in the **compositor** window. The text shouldn't cross the inner rectangle.

Previous: THE TITLE-SAFE REGION, Up: TITLER

18.26.3 MAKING TITLES LOOK GOOD

No-one else is going to tell you this, but to make good looking titles, ignore most of the features of the titler. The best settings are:

- Font: **Arial**
- Italic: **off**
- Motion: **No motion**
- Bold: **on or off**
- Fade in: **0**
- Fade out: **0**
- Color: **white**
- Outline color: **black**
- Drop Shadow or outline: **use either to improve contrast but not both**

Don't waste the audience's time with fading & crawls. Use crawls only if there's too much text to fit on the screen. The title should be legible enough to take the least amount of time to read. You're supposed to show the story, not write it. If they wanted to read a story, they would be reading a book instead of watching video.

Previous: TITLER, Up: SECRETS OF CINELERRA EFFECTS

18.27 VIDEO SCOPE

The video scope plots two views of the image. One view plots the intensity of each pixel against horizontal position. They call this the WAVEFORM. Another view translates hue to angle and saturation to radius for each pixel. They call this the VECTORSCOPE.

The vectorscope is actually very useful for determining if an image is saturated. When adjusting saturation, it's important to watch the vectorscope to make sure pixels don't extend past the 100 radius.

The waveform allows you to make sure image data extends from complete black to complete white while adjusting the brightness/contrast.

Some thought is being given to having a video scope for recording. Unfortunately, this would require a lot of variations of the video scope for all the different video drivers.

Next: KEYBOARD SHORTCUTS, Previous: SECRETS OF CINELERRA EFFECTS, Up: Top

19 PLUGIN AUTHORING

The plugin API in Cinelerra dates back to 1997, before the LADSPA and before VST became popular. It's fundamentally the same as it was in 1997, with minor modifications to handle keyframes and GUI feedback. The GUI is not abstracted from the programmer. This allows the programmer to use whatever toolkit they want and allows more flexibility in appearance but it costs more.

There are several types of plugins, each with a common method of implementation and specific changes for that particular type. The easiest way to implement a plugin is to take the simplest existing one out of the group and rename the symbols.

- INTRODUCING THE PULL METHOD: The current paradigm for plugin writing
- COMMON PLUGIN FUNCTIONS: What all effects have to do.
- REALTIME PLUGINS: What realtime effects have to do.
- NONREALTIME PLUGINS: What rendered effects have to do.
- AUDIO PLUGINS: What audio effects have to do.
- VIDEO PLUGINS: What video effects have to do.
- TRANSITION PLUGINS: What transitions have to do.
- PLUGIN GUI'S WHICH UPDATE DURING PLAYBACK: How to use currently playing data to draw the GUI.

- USING OPENGL: How to use hardware to speed up operations.
- PLUGIN QUERIES: How plugins get information about the data to be processed.

Next: COMMON PLUGIN FUNCTIONS, Up: PLUGIN AUTHORING

19.1 INTRODUCING THE PULL METHOD

Originally plugins were designed with the push method. The push method is intuitive and simple. A source pushes data to a plugin, the plugin does math operations on it, and the plugin pushes it to a destination. For 6 years this was the way all realtime plugins were driven internally but it didn't allow you to reduce the rate of playback in realtime. While plugins can still be designed as if they're pushing data, this is not the way they're processed internally anymore.

The latest evolution in Cinelerra's plugin design is the pull method. The rendering pipeline starts at the final output and the final steps in the rendering pipeline are reading the data from disk. Every step in the rendering chain involves requesting data from the previous step. When the rendering pipleline eventually requests data from a plugin chain, each plugin requests data from the plugin before it.

This is less intuitive than the push method but is much more powerful. Realtime plugins written using the pull method can change the rate data is presented to the viewer and the direction of playback. The pull method allows plugins to take in data at a higher rate than they send it out.

To get the power of rate independance, the pull method requires plugins to know more about the data than they needed to under the push method. Plugins need to know what rate the project is at, what rate their output is supposed to be at and what rate their input is supposed to be at. These different data rates have to be correlated for a plugin to configure itself properly.

Keyframes for a plugin are stored relative to the project frame rate. Queries from a plugin for for the current playback position are given relative to the project frame rate. If the plugin's output was requested to be at twice the project frame rate, the positions need to be converted to the project rate for keyframes to match up. Two classes of data rates were created to handle this problem.

Rate conversions are done in terms of the **project rate** and the **requested rate**. The project rate is identical for all plugins. It is determined by the **settings->format** window. The requested rate is determined by the downstream plugin requesting data from the current plugin. The requested rate is arbitrary. Exactly how to use these rates is described below.

Next: REALTIME PLUGINS, Previous: INTRODUCING THE PULL METHOD, Up: PLUGIN AUTHORING

19.2 COMMON PLUGIN FUNCTIONS

All plugins inherit from a derivative of PluginClient. This PluginClient derivative implements most of the required methods in PluginClient, but users must still define methods for PluginClient. The most commonly used methods are predefined in macros to reduce the typing yet still allow flexibility.

The files they include depend on the plugin type. Audio plugins include **pluginaclient.h** and video plugins include **pluginvclient.h**. They inherit

PluginAClient and **PluginVClient** respectively.

Cinelerra instantiates all plugins at least twice when they are used in a movie. Once instance is the GUI. The other instance is the signal processor. User input, through a complicated sequence, is propogated from the GUI instance to the signal processor instance. If the signal processor wants to alter the GUI, it propogates data back to the GUI instance. There are utility functions for doing all this.

All plugins define at least three objects:

- **Processing object** - Contains pointers to all the other objects and performs the signal processing. This object contains a number of queries to identify itself and is the object you register to register the plugin.
- **User interface object** - This is a subclass of **PluginClientWindow**. It shows data on the screen and collects parameters from the user.

  The window has pointers to a number of widgets, a few initialization methods, and a back pointer to the plugin's processing object. The GUI uses Cinelerra's toolkit. The plugin abstraction layer handles creating a thread for the GUI.

- **Configuration object** - This stores the user parameters and always needs interpolation, copying, and comparison functions. Macros for the plugin client automatically call configuration methods to interpolate keyframes.

Next: THE CONFIGURATION OBJECT, Up: COMMON PLUGIN FUNCTIONS

19.2.1 THE PROCESSING OBJECT

Load up a simple plugin like gain to see what this object looks like. The processing object should inherit from the intended PluginClient derivative. Its constructor should take a PluginServer argument.

```
MyPlugin(PluginServer *server);
```

In the implementation, the plugin must contain a registration line with the name of the processing object like

```
REGISTER_PLUGIN(MyPlugin)
```

Another function which is useful but not mandatory is

```
int is_multichannel();
```

It should return 1 if one instance of the plugin handles multiple tracks simultaneously or 0 if one instance of the plugin only handles one track. The default is 0 if it is omitted.

Multichannel plugins in their processing function should refer to a function called **PluginClient::get_total_buffers()** to determine the number of channels.

To simplify the implementation of realtime plugins, a macro for commonly used members has been created for the class header, taking the configuration object and user interface thread object as arguments. The macro definitions apply mainly to realtime plugins and are not useful in nonrealtime plugins. Fortunately, nonrealtime plugins are simpler.

```
PLUGIN_CLASS_MEMBERS(config_name, thread_name)
```

The commonly used members in PLUGIN_CLASS_MEMBERS are described below.

- int load_configuration();

  Loads the configuration based on surrounding keyframes and current position. The class definition for load_configuration should contain

  ```
  LOAD_CONFIGURATION_MACRO(plugin_class, config_class)
  ```

  to implement the default behavior for load_configuration. This stores whatever the current configuration is inside the plugin's configuration object and returns 1 if the new configuration differs from the previous configuration. The return value of load_configuration is used by another commonly used function, update_gui to determine if the GUI really needs to be updated.

  The plugin's configuration object is always called **config** inside PLUGIN_CLASS_MEMBERS.

- VFrame* new_picon();

  Creates a picon for display in the resource window. Use

  ```
  #include "picon_png.h"
  NEW_PICON_MACRO(plugin_class)
  ```

  to implement new_picon. In addition, the user should create a **picon_png.h** header file from a PNG image using **pngtoh**. **pngtoh** is compiled in the **guicast/ARCH** directory.

  The source PNG image should be called picon.png and can be any format supported by PNG.

- char* plugin_title();

  Returns a text string identifying the plugin in the resource window. The string has to be unique.

- void update_gui();

Should first load the configuration, test for a return of 1, and then redraw the GUI with the new parameters. All the plugins using GuiCast have a format like

```
void MyPlugin::update_gui()
{
      if(thread)
      {
              if(load_configuration())
              {
                      thread->window->lock_window();
// update widgets here
                      thread->window->unlock_window();
              }
      }
}
```

to handle concurrency and conditions of no GUI.

Important functions the processing object must define are the functions which load and save configuration data from keyframes. These functions are called by the macros so all you need to worry about is accessing the keyframe data.

```
void save_data(KeyFrame *keyframe);
void read_data(KeyFrame *keyframe);
```

The read data functions are only used in realtime plugins. The read data functions translate the plugin configuration between the KeyFrame argument and the configuration object for the plugin. The keyframes are stored on the timeline and can change for every project.

Use an object called **FileXML** to do the translation and some specific commands to get the data out of the KeyFrame argument. See any existing plugin to see the usage of KeyFrame and FileXML.

```
int load_defaults();
int save_defaults();
```

The load defaults functions are used in realtime and non-realtime plugins. The load defaults functions translate the plugin configuration between a BC_Hash object and the plugin's configuration. The BC_Hash object stores configurations in a discrete file on disk for each plugin but doesn't isolate different configurations for different projects.

The function overriding **load_defaults** also needs to call **defaults = new BC_Hash(path);** with the configuration path. See any existing plugin to see the usage of BC_Hash. The function overriding **save_defaults** does not create **defaults**.

Other standard members may be defined in the processing object, depending on the plugin type.

Next: THE USER INTERFACE OBJECT, Previous: THE PROCESSING OBJECT, Up: COMMON PLUGIN FUNCTIONS

19.2.2 THE CONFIGURATION OBJECT

The configuration object is critical for GUI updates, signal processing, and default settings in realtime plugins. Be aware it is not used in nonrealtime plugins. The configuration object inherits from nothing and has no dependancies. It's merely a class containing three functions and variables specific to the plugin's parameters.

Usually the configuration object starts with the name of the plugin followed by Config.

```
class MyPluginConfig
{
public:
   MyPluginConfig();
```

Following the name of the configuration class, we put in three required functions and the configuration variables.

```
   int equivalent(MyPluginConfig &that);
   void copy_from(MyPluginConfig &that);
   void interpolate(MyPluginConfig &prev,
           MyPluginConfig &next,
           int64_t prev_position,
           int64_t next_position,
           int64_t current_position);



   float parameter1;
   float parameter2;
   int parameter3;
};
```

Now you must define the three functions. **Equivalent** is called by LOAD_CONFIGURATION_MACRO to determine if the local configuration parameters are identical to the configuration parameters in the arguement. If equivalent returns 0, the LOAD_CONFIGURATION_MACRO causes the GUI to redraw. If equivalent returns 1, the LOAD_CONFIGURATION_MACRO doesn't redraw the GUI.

Then there's **copy_from** which transfers the configuration values from the argument to the local variables. This is once again used in LOAD_CONFIGURATION_MACRO to store configurations in temporaries. Once LOAD_CONFIGURATION_MACRO has replicated the configuration, it loads a second configuration. Then it interpolates the two configurations to get the current configuration. The interpolation function performs the interpolation and stores the result in the local variables.

Normally the interpolate function calculates a previous and next fraction, using the arguments.

```
void MyPluginConfig::interpolate(MyPluginConfig &prev,
                MyPluginConfig &next,
                int64_t prev_position,
                int64_t next_position,
                int64_t current_position)
     {
        double next_scale = (double)(current_position - prev_position) / (next_position - prev_position);
        double prev_scale = (double)(next_position - current_position) / (next_position - prev_position);
```

Then the fractions are applied to the previous and next configuration variables to yield the current values.

```
        this->parameter1 = (float)(prev.parameter1 * prev_scale + next.parameter1 * next_scale);
        this->parameter2 = (float)(prev.parameter2 * prev_scale + next.parameter2 * next_scale);
        this->parameter3 = (int)(prev.parameter3 * prev_scale + next.parameter3 * next_scale);
     }
```

Alternatively you can copy the values from the previous configuration argument if no interpolation is desired.

This usage of the configuration object is the same in audio and video plugins. In video playback, the interpolation function is called for every frame, yielding smooth interpolation. In audio playback, the interpolation function is called only once for every console fragment and once every time the insertion point moves. This is good enough for updating the GUI while selecting regions on the timeline but it may not be accurate enough for really smooth rendering of the effect.

For really smooth rendering of audio, you can still use load_configuration when updating the GUI. For process_buffer; however, ignore load_configuration and write your own interpolation routine which loads all the keyframes in a console fragment and interpolates every sample. This would be really slow and hard to debug, yielding improvement which may not be audible. Then of course, every country has its own wierdos.

An easier way to get smoother interpolation is to reduce the console fragment to 1 sample. This would have to be rendered and played back with the console fragment back over 2048 of course. The Linux sound drivers can't play fragments of 1 sample.

Previous: THE CONFIGURATION OBJECT, Up: COMMON PLUGIN FUNCTIONS

19.2.3 THE USER INTERFACE OBJECT

The user interface object is derived from **PluginClientWindow**. The user must call **NEW_WINDOW_MACRO** in the processing object to create the **PluginClientWindow**. This system is used in realtime plugins but not in nonrealtime plugins.

Nonrealtime plugins create and destroy their own GUI in their **get_parameters** function and there's no need for a **PluginClientWindow** subclass.

Now the window class must be declared in the plugin header. It's easiest to implement the window by copying an existing plugin and renaming the symbols. The following is an outline of what happens. The plugin header must declare the window's constructor using the appropriate arguments.

```
#include "guicast.h"

MyWindow::MyWindow(MyPlugin *plugin)
 : PluginClientWindow(plugin,
   440,
   500,
   440,
   500,
   0)
{
```

This becomes a window on the screen with the size given by the arguments to **PluginClientWindow**.

It needs two methods

```
      void create_objects();
```

and a back pointer to the plugin

```
      MyPlugin *plugin;
```

The create_objects member puts widgets in the window according to GuiCast's syntax. A pointer to each widget which you want to synchronize to a configuration parameter is stored in the window class. These are updated in the **update_gui** function you earlier defined for the plugin. The widgets are usually derivatives of a GuiCast widget and they override functions in GuiCast to handle events. Finally create_objects calls

```
      show_window();
```

to make the window appear all at once.

Every widget in the GUI needs to detect when its value changes. In GuiCast the **handle_event** method is called whenever the value changes. In **handle_event**, the widget then needs to call **plugin->send_configure_change()** to propogate the change to any copies of the plugin which are processing data.

Next: NONREALTIME PLUGINS, Previous: COMMON PLUGIN FUNCTIONS, Up: PLUGIN AUTHORING

19.3 REALTIME PLUGINS

Realtime plugins should use PLUGIN_CLASS_MEMBERS to define the basic set of members in their headers. All realtime plugins must define an

```
int is_realtime()
```

member returning 1. This causes a number of methods to be called during live playback and the plugin to be usable on the timeline.

Realtime plugins must override a member called

```
process_buffer
```

This function takes different arguments depending on if the plugin handles video or audio. See an existing plugin to find out which usage applies.

The main features of the process_buffer function are a buffer to store the output, the starting position of the output, and the requested output rate. For audio, there's also a size argument for the number of samples.

The starting position of the output buffer is the lowest numbered sample on the timeline if playback is forward and the highest numbered sample on the timeline if playback is reverse. The direction of playback is determined by one of the plugin queries described below.

The position and size arguments are all relative to the frame rate and sample rate passed to process_buffer. This is the requested data rate and may not be the same as the project data rate.

The process_realtime function should start by calling **load_configuration**. The LOAD_CONFIGURATION_MACRO returns 1 if the configuration changed.

After determining the plugin's configuration, input media has to be loaded for processing. Call

```
read_frame(VFrame *buffer,
           int channel,
           int64_t start_position,
           double frame_rate)
```

or

```
read_samples(double *buffer,
           int channel,
           int sample_rate,
           int64_t start_position,
           int64_t len)
```

to request input data from the object which comes before this plugin. The read function needs a buffer to store the input data in. This can either be a temporary you create in the plugin or the output buffer supplied to process_buffer if you don't need a temporary.

It also needs a set of position arguments to determine when you want to read the data from. The start position, rate, and len passed to a read function need not be the same as the values recieved by the process_buffer function. This way plugins can read data at a different rate than they output data.

The channel argument is only meaningful if this is a multichannel plugin. They need to read data for each track in the get_total_buffers() value and process all the tracks. Single channel plugins should pass 0 for channel.

Additional members are implemented to maintain configuration in realtime plugins. Some of these are also needed in nonrealtime plugins.

- void read_data(KeyFrame *keyframe);

  Loads data from a keyframe into the plugin's configuration. Inside the keyframe is an XML string. It's most easily parsed by creating a **FileXML** object. See an existing plugin to see how the read_data function is implemented.

  Read data loads data out of the XML object and stores values in the plugin's configuration object. Since configuration objects vary from plugin to plugin, these functions can't be automated.

- void save_data(KeyFrame *keyframe);

  Saves data from the plugin's configuration to a keyframe. Inside the keyframe you'll put an XML string which is normally created by a FileXML object. See an existing plugin to see how the save_data function is implemented.

  Save data saves data from the plugin's configuration object into the XML object.

- int load_defaults();

  Another way the plugin gets parameters is from a defaults file. The load and save defaults routines use a BC_Hash object to parse the defaults file. The defaults object is created in **load_defaults** and destroyed in the plugin's destructor. See an existing plugin to see how the BC_Hash object is used.

- int save_defaults();

  Saves the configuration in the defaults object.

Next: AUDIO PLUGINS, Previous: REALTIME PLUGINS, Up: PLUGIN AUTHORING

19.4 NONREALTIME PLUGINS

Some references for non-realtime plugins are **Normalize** for audio and **Reframe** for video.

Like realtime plugins, **load_defaults** and **save_defaults** must be implemented. In nonrealtime plugins, these are not just used for default parameters but to transfer values from the user interface to the signal processor. There doesn't need to be a configuration class in nonrealtime plugins.

Unlike realtime plugins, the LOAD_CONFIGURATION_MACRO can't be used in the plugin header. Instead, the following methods must be defined.

The nonrealtime plugin should contain a pointer to a defaults object.

```
    BC_Hash *defaults;
```

It should also have a pointer to a MainProgressBar.

```
    MainProgressBar *progress;
```

The progress pointer allows nonrealtime plugins to display their progress in Cinelerra's main window.

The constructor for a nonrealtime plugin can't use PLUGIN_CONSTRUCTOR_MACRO but must call **load_defaults** directly.

The destructor, likewise, must call **save_defaults** and **delete defaults** directly instead of PLUGIN_DESTRUCTOR_MACRO.

- VFrame* new_picon();

  char* plugin_title();

  The usage of these is the same as realtime plugins.

- int is_realtime();

  This function must return 0 to indicate a nonrealtime plugin.

- int get_parameters();

  Here, the user should create a GUI, wait for the user to hit an OK button or a cancel button, and store the parameters in plugin variables. This routine must return 0 for success and 1 for failure. This way the user can cancel the effect from the GUI.

  Unlike the realtime plugin, this GUI need not run asynchronously of the plugin. It should block the get_parameters function until the user selects OK or Cancel.

- int load_defaults();

  This should set the **defaults** variable to a new **Defaults** object and load parameters from the defaults object into plugin variables.

- int save_defaults();

  This should save plugin variables to the defaults object. It should not create the defaults object.

- int start_loop();

If **get_parameters** returned 0 for success, this is called once to give the plugin a chance to initialize processing. The plugin should instantiate the progress object with a line like

```
progress = start_progress("MyPlugin progress...",
      PluginClient::get_total_len());
```

The usage of **start_progress** depends on whether the plugin is multichannel or single channel. If it's multichannel you always call start_progress. If it's single channel, you first need to know whether the progress bar has already started in another instance of the plugin.

If **PluginClient::interactive** is 1, you need to start the progress bar. If it's 0, the progress bar has already been started.

The PluginClient defines **get_total_len()** and **get_source_start()** to describe the timeline range to be processed. The units are either samples or frames and in the project rate.

- int process_loop

This is called repeatedly until the timeline range is processed. It has either a samples or frames buffer for output and a reference to write_length to store the number of samples processed. If this is an audio plugin, the user needs to call **get_buffer_size()** to know how many samples the output buffer can hold.

The plugin must use **read_samples** or **read_frame** to read the input. These functions are a bit different for a non realtime plugin than they are for a realtime plugin.

They take a buffer and a position relative to the start of the timeline, in the timeline's rate. Then you must process it and put the output in the buffer argument to process_loop. write_length should contain the number of samples generated if it's audio.

Finally, process_loop must test **PluginClient::interactive** and update the progress bar if it's 1.

```
progress->update(total_written);
```

returns 1 or 0 if the progress bar was cancelled. If it's 1, process_loop should return 1 to indicate a cancellation. In addition to progress bar cancellation, **process_loop** should return 1 when the entire timeline range is processed.

- int stop_loop();

This is called after process_loop processes its last buffer.

If PluginClient::is_interactive is 1, this should call **stop_progress** in the progress bar pointer and delete the pointer. Then it should delete any objects it created for processing in **start_loop**.

Next: VIDEO PLUGINS, Previous: NONREALTIME PLUGINS, Up: PLUGIN AUTHORING

19.5 AUDIO PLUGINS

The simplest audio plugin is Gain. The processing object should include **pluginaclient.h** and inherit from **PluginAClient**. Realtime audio plugins need to define

```
int process_buffer(int64_t size,
           double **buffer,
           int64_t start_position,
           int sample_rate);
```

if it's multichannel or

```
int process_buffer(int64_t size,
           double *buffer,
           int64_t start_position,
           int sample_rate);
```

if it's single channel. These should return 0 on success and 1 on failure. In the future, the return value may abort failed rendering.

The processing function needs to request input samples with

```
int read_samples(double *buffer,
           int channel,
           int sample_rate,
           int64_t start_position,
           int64_t len);
```

It always returns 0. The user may specify any desired sample rate and start position.

Nonrealtime audio plugins need to define

```
int process_loop(double *buffer, int64_t &write_length);
```

for single channel or

```
int process_loop(double **buffers, int64_t &write_length);
```

for multi channel. Non realtime plugins use a different set of read_samples functions to request input data. These are fixed to the project sample rate.

Next: TRANSITION PLUGINS, Previous: AUDIO PLUGINS, Up: PLUGIN AUTHORING

19.6 VIDEO PLUGINS

The simplest video plugin is Flip. The processing object should include **pluginvclient.h** and inherit from **PluginVClient**. Realtime video plugins need to define

```
int process_buffer(VFrame **frame,
   int64_t start_position,
   double frame_rate);
```

if it's multichannel or

```
int process_buffer(VFrame *frame,
   int64_t start_position,
   double frame_rate);
```

if it's single channel.

The nonrealtime video plugins need to define

```
int process_loop(VFrame *buffer);
```

for single channel or

```
int process_loop(VFrame **buffers);
```

for multi channel. The amount of frames generated in a single process_loop is always assumed to be 1, hence the lack of a write_length argument. Returning 0 causes the rendering to continue. Returning 1 causes the rendering to abort.

A set of read_frame functions exist for requesting input frames in non-realtime video plugins. These are fixed to the project frame rate.

Next: PLUGIN GUI'S WHICH UPDATE DURING PLAYBACK, Previous: VIDEO PLUGINS, Up: PLUGIN AUTHORING

19.7 TRANSITION PLUGINS

The simplest video transition is **wipe** and the simplest audio transition is **crossfade**. These use a subset of the default class members of realtime plugins, but so far no analogue to PLUGIN_CLASS_MEMBERS has been done for transitions.

The processing object for audio transitions still inherits from PluginAClient and for video transitions it still inherits from PluginVClient.

Transitions may or may not have a GUI. If they have a GUI, they must also manage a thread like realtime plugins. Do this with the same

PLUGIN_THREAD_OBJECT and PLUGIN_THREAD_HEADER macros as realtime plugins. Since there is only one keyframe in a transition, you don't need to worry about updating the GUI from the processing object like you do in a realtime plugin.

If the transition has a GUI, you can use PLUGIN_CONSTRUCTOR_MACRO and PLUGIN_DESTRUCTOR_MACRO to initialize the processing object. You'll also need a BC_Hash object and a Thread object for these macros.

Since the GUI is optional, overwrite a function called **uses_gui()** to signifiy whether or not the transition has a GUI. Return 1 if it does and 0 if it doesn't.

Transitions need a **load_defaults** and **save_defaults** function so the first time they're dropped on the timeline they'll have useful settings.

A **read_data** and **save_data** function takes over after insertion to access data specific to each instance of the transition.

The most important difference between transitions and realtime plugins is the addition of an **is_transition** method to the processing object. **is_transition** should return 1 to signify the plugin is a transition.

Transitions process data in a **process_realtime** function.

```
int process_realtime(VFrame *input,
           VFrame *output);

int process_realtime(int64_t size,
           double *input_ptr,
           double *output_ptr);
```

The input argument to process_realtime is the data for the next edit. The output argument to process_realtime is the data for the previous edit.

Routines exist for determining where you are relative to the transition's start and end.

- **PluginClient::get_source_position()** - returns the current position since the start of the transition of the lowest sample in the buffers.
- **PluginClient::get_total_len()** - returns the integer length of the transition. The units are either samples or frames, in the data rate requested by the first plugin.

Users should divide the source position by total length to get the fraction of the transition the current **process_realtime** function is at.

Transitions run in the data rate requested by the first plugin in the track. This may be different than the project data rate. Since process_realtime lacks a rate argument, use **get_framerate()** or **get_samplerate** to get the requested rate.

Next: USING OPENGL, Previous: TRANSITION PLUGINS, Up: PLUGIN AUTHORING

19.8 PLUGIN GUI'S WHICH UPDATE DURING PLAYBACK

Effects like **Histogram** and **VideoScope** need to update the GUI during playback to display information about the signal. This is achieved with the

send_render_gui and **render_gui** methods. Normally in process_buffer, when the processing object wants to update the GUI it should call **send_render_gui**. This should only be called in process_buffer. Send_render_gui goes through a search and eventually calls **render_gui** in the GUI instance of the plugin.

Render_gui should have a sequence like

```
void MyPlugin::render_gui(void *data)
{
   if(thread)
   {
           thread->window->lock_window();

// update GUI here

           thread->window->unlock_window();
   }
}
```

Send_render_gui and render_gui use one argument, a void pointer to transfer information from the processing object to the GUI. The user should typecast this pointer into something useful.

Previous: USING OPENGL, Up: PLUGIN AUTHORING

19.9 PLUGIN QUERIES

There are several useful queries in PluginClient which can be accessed from the processing object. Some of them have different meaning in realtime and non-realtime mode. They all give information about the operating system or the project which can be used to improve the quality of the processing.

- SYSTEM QUERIES: Utilities for determining the system resources.
- TIMING QUERIES: Utilities for performing time-dependant processing.

Next: TIMING QUERIES, Up: PLUGIN QUERIES

19.9.1 SYSTEM QUERIES

- **get_interpolation_type()** returns the type of interpolation the user wants for all scaling operations. This is a macro from overlayframe.inc. It can be applied to any call to the **OverlayFrame** object.
- **get_project_smp()** Gives the number of CPU's on the system minus 1. If it's a uniprocessor it's 0. If it's a dual processor, it's 1. This number should be used to gain parallelism.
- **get_total_buffers()** Gives the number of tracks a multichannel plugin needs to process.

19.9.2 TIMING QUERIES

There are two rates for media a realtime plugin has to be aware of: the project rate and the requested rate. Functions are provided for getting the project and requested rate. In addition, doing time dependant effects requires using several functions which tell where you are in the effect.

- **get_project_framerate()** Gives the frames per second of the video as defined by the project settings.
- **get_project_samplerate()** Gives the samples per second of the audio as defined by the project settings.
- **get_framerate()** Gives the frames per second requested by the plugin after this one. This is the requested frame rate and is the same as the frame_rate argument to process_buffer.
- **get_samplerate()** Gives the samples per second requested by the plugin after this one. This is the requested sample rate and is the same as the sample_rate argument to process_buffer.
- **get_total_len()** Gives the number of samples or frames in the range covered by the effect, relative to the requested data rate.
- **get_source_start()** For realtime plugins it gives the lowest sample or frame in the effect range in the requested data rate. For nonrealtime plugins it's the start of the range of the timeline to process.
- **get_source_position()** For realtime plugins it's the lowest numbered sample in the requested region to process if playing forward and the highest numbered sample in the region if playing backward. For video it's the start of the frame if playing forward and the end of the frame if playing in reverse. The position is relative to the start of the EDL and in the requested data rate.

  For transitions this is always the lowest numbered sample of the region to process relative to the start of the transition.

- **get_direction()** Gives the direction of the current playback operation. This is a macro defined in transportque.inc. This is useful for calling read functions since the read functions position themselves at the start or end of the region to read, depending on the playback operation.
- **local_to_edl()**
- **edl_to_local()**

  These convert between the requested data rate and the project data rate. They are used to convert keyframe positions into numbers which can be interpolated at the requested data rate. The conversion is automatically based on frame rate or sample rate depending on the type of plugin.

- **get_prev_keyframe(int64_t position, int is_local)**
- **get_next_keyframe(int64_t position, int is_local)**

  These give the nearest keyframe before or after the position given. The macro defined version of load_configuration automatically retrieves the right keyframes but you may want to do this on your own.

  The position argument can be either in the project rate or the requested rate. Set is_local to 1 if it's in the requested rate and 0 if it's in the project rate.

In each keyframe, another position value tells the keyframe's position relative to the start of the timeline and in the project rate.

The only way to get smooth interpolation between keyframes is to convert the positions in the keyframe objects to the requested rate. Do this by using edl_to_local on the keyframe positions.

Next: PLUGIN QUERIES, Previous: PLUGIN GUI'S WHICH UPDATE DURING PLAYBACK, Up: PLUGIN AUTHORING

19.10 USING OPENGL

Realtime video plugins support OpenGL. Using OpenGL to do plugin routines can speed up playback greatly since it does most of the work in hardware. Unfortunately, every OpenGL routine needs a software counterpart for rendering, doubling the amount of software to maintain. Fortunately, having an OpenGL routine means the software version doesn't need to be as optimized as it did when software was the only way.

As always, the best way to design a first OpenGL plugin is to copy an existing one and alter it. The **Brightness** plugin is a simple OpenGL plugin to copy. There are 3 main points in OpenGL rendering and 1 point for optimizing OpenGL rendering.

- GETTING OPENGL DATA: Getting video data in a form usable by OpenGL
- DRAWING USING OPENGL: The method of drawing video in OpenGL
- USING SHADERS: Routines to simplify shader usage
- AGGREGATING PLUGINS: Combining OpenGL routines from different plugins into one.

Next: DRAWING USING OPENGL, Up: USING OPENGL

19.10.1 GETTING OPENGL DATA

The first problem is getting OpenGL-enabled plugins to interact with software-only plugins. To solve this, all the information required to do OpenGL playback is stored in the VFrame object which is passed to **process_buffer**. To support 3D, the VFrame contains a PBuffer and a texture, in addition to VFrame's original rows.

In OpenGL mode, VFrame has 3 states corresponding to the location of its video data. The opengl state is recovered by calling **get_opengl_state** and is set by calling **set_opengl_state**. The states are:

- **VFrame::RAM** - This means the video data is stored in the traditional row pointers. It must be loaded into a texture before being drawn using OpenGL routines.
- **VFrame::TEXTURE** - The video data is stored in texture memory. It's ready to be drawn using OpenGL routines.
- **VFrame::SCREEN** - The video data is stored in a frame buffer in the graphics card. For plugins, the frame buffer is always a PBuffer. The image on the frame buffer can't be replicated again unless it is read back into the texture and the opengl state is reset to TEXTURE. The frame buffer is limited to 8 bits per channel. If an OpenGL effect is used in a floating point project, it only retains 8 bits.

In the plugin's **process_buffer** routine, there is normally a call to **read_frame** to get data from the previous plugin in the chain. **read_frame** takes a new parameter called **use_opengl**.

The plugin passes 1 to **use_opengl** if it intends to handle the data using OpenGL. It passes 0 to **use_opengl** if it can only handle the data using software. The value of **use_opengl** is passed up the chain to ensure a plugin which only does software only gets the data in the row pointers. If **use_opengl** is 0, the opengl state in VFrame is RAM.

The plugin must not only know if it is software-only but if its output must be software only. Call **get_use_opengl** to determine if the output can be handled by OpenGL. If **get_use_opengl** returns 0, the plugin must pass 0 for **use_opengl** in **read_frame** and do its processing in software. If **get_use_opengl** is 1, the plugin can decide based on its implementation whether to use OpenGL.

The main problem with OpenGL is that all the gl... calls need to be run from the same thread. To work around this, the plugin interface has routines for running OpenGL in a common thread.

run_opengl transfers control to the common OpenGL thread. This is normally called by the plugin in **process_buffer** after it calls **read_frame** and only if **get_use_opengl** is 1.

Through a series of indirections, **run_opengl** eventually transfers control to a virtual function called **handle_opengl**. **handle_opengl** must be overridden with a function to perform all the OpenGL routines. The contents of **handle_opengl** must be enclosed in **#ifdef HAVE_GL** ... **#endif** to allow it to be compiled on systems with no graphics support, like render nodes. The return value of **handle_opengl** is passed back from **run_opengl**.

read_frame can't be called from inside **handle_opengl**. This would create a recursive lockup because it would cause other objects to call **run_opengl**.

Once inside **handle_opengl**, the plugin has full usage of all the OpenGL features. VFrame provides some functions to automate common OpenGL sequences.

The VFrame argument to **process_buffer** is always available through the **get_output(int layer)** function. If the plugin is multichannel, the layer argument retrieves a specific layer of the output buffers. The PBuffer of the output buffer is where the OpenGL output must go if any processing is done.

Next: USING SHADERS, Previous: GETTING OPENGL DATA, Up: USING OPENGL

19.10.2 DRAWING USING OPENGL

The sequence of commands to draw on the output PBuffer stars with getting the video in a memory area where it can be recalled for drawing:

```
get_output()->to_texture();
get_output()->enable_opengl();
```

to_texture transfers the OpenGL data from wherever it is to the output's texture memory and sets the output state to TEXTURE.

enable_opengl makes the OpenGL context relative to the output's PBuffer.

The next step is to draw the texture with some processing on the PBuffer. The normal sequence of commands to draw a texture is:

```
get_output()->init_screen();
get_output()->bind_texture(0);
get_output()->draw_texture();
```

VFrame::init_screen sets the OpenGL frustum and parameters to known values.

VFrame::bind_texture(int texture_unit) binds the texture to the given texture unit and enables it.

VFrame::draw_texture() calls the vertex functions to draw the texture normalized to the size of the PBuffer. Copy this if you want custom vertices.

The last step in the handle_opengl routine, after the texture has been drawn on the PBuffer, is to set the output's opengl state to SCREEN with a call to **VFrame::set_opengl_state**. The plugin should not read back the frame buffer into a texture or row pointers if it has no further processing. Plugins should only leave the output in the texture or RAM if its location results from normal processing. They should set the opengl state to RAM or TEXTURE if they do.

Colormodels in OpenGL

The colormodel exposed to OpenGL routines is always floating point since that is what OpenGL uses, but it may be YUV or RGB depending on the project settings. If it's YUV, the U & V are offset by 0.5 just like in software. Passing YUV colormodels to plugins was necessary for speed. The other option was to convert YUV to RGB in the first step that needed OpenGL. Every effect and rendering step would have needed a YUV to RGB routine. With the YUV retained, only the final compositing step needs a YUV to RGB routine.

The OpenGL mode differentiates between alpha & flat colormodels even though OpenGL always has an alpha channel. For RGB colormodels, you must multiply the alpha component by the RGB & set the alpha component to 1 whenever the colormodel has no alpha to ensure consistency with the software mode.

```
Rout = Rin * Ain
Gout = Gin * Ain
Bout = Bin * Ain
Aout = 1
```

For YUV colormodels, you must multiply the alpha using the following formula.

```
Yout = Yin * Ain
Uout = Uin * Ain + 0.5 * (1 - Ain)
Vout = Vin * Ain + 0.5 * (1 - Ain)
Aout = 1
```

Next: AGGREGATING PLUGINS, Previous: DRAWING USING OPENGL, Up: USING OPENGL

19.10.3 USING SHADERS

Very few effects can do anything useful with just a straight drawing of the texture on the PBuffer. It's also not easy to figure out exactly what math is being used by the different OpenGL blending macros. Normally you'll use shaders. The shader is a C program which runs on the graphics card. Since the graphics card is optimized for graphics, it can be much faster than running it on the CPU.

Shaders are written in OpenGL Shading Language. The shader source code is contained in a string. The normal sequence for using a shader comes after a call to **enable_opengl**.

```
char *shader_source = "...";
unsigned char shader_id = VFrame::make_shader(0, shader_source, 0);
glUseProgram(shader_id);
// Set uniform variables using glUniform commands
```

The compilation and linking step for shaders is encapsulated by the VFrame::make_shader command. It returns a shader_id which can be passed to OpenGL functions. The first and last arguments must always by 0. And arbitrary number of source strings may be put between the 0's. The source strings are concatenated by make_shader into one huge shader source. If multiple main functions are in the sources, the main functions are renamed and run in order.

There are a number of useful macros for shaders in playback3d.h. All the shaders so far have been fragment shaders. After the shader is initialized, draw the texture starting from **init_screen**. The shader program must be disabled with another call to **glUseProgram(0)** and 0 as the argument.

The shader_id and source code is stored in memory as long as Cinelerra runs. Future calls to make_shader with the same source code run much faster.

Previous: USING SHADERS, Up: USING OPENGL

19.10.4 AGGREGATING PLUGINS

Further speed improvements may be obtained by combining OpenGL routines from two plugins into a single handle_opengl function. This is done when **Frame to Fields** and **RGB to 601** are attached in order. Aggregations of more than two plugins are possible but very hard to get working. Aggregation is useful for OpenGL because each plugin must copy the video from a texture to a PBuffer. In software there was no copy operation.

In aggregation, one plugin processes everything from the other plugins and the other plugins fall through. The fall through plugins must copy their parameters to the output buffer so they can be detected by the processing plugin.

The VFrame used as the output buffer contains a parameter table for parameter passing between plugins and it's accessed with **get_output()->get_params()**. Parameters are set and retrieved in the table with calls to **update** and **get** just like with defaults.

The fall through plugins must determine if the processor plugin is attached with calls to **next_effect_is** and **prev_effect_is**. These take the name of the processor plugin as a string argument and return 1 if the next or previous plugin is the processor plugin. If either returns 1, the fall through plugin must still call **read_frame** to propogate the data but return after that.

The processor plugin must call **next_effect_is** and **prev_effect_is** to determine if it's aggregated with a fall through plugin. If it is, it must perform the operations of the fall through plugin in its OpenGL routine. The parameters for the the fall through plugin should be available by **get_output()->get_params()** if the fall through plugin set them.

Previous: PLUGIN AUTHORING, Up: Top

20 KEYBOARD SHORTCUTS

Alex Ferrer started summarizing most of the keyboard shortcuts. Most of the keys work without any modifier like shift or ctrl. Most windows can be closed with a **Ctrl-w**. Most operations can be cancelled with **ESC** and accepted with **Enter**.

20.1 PROGRAM WINDOW

20.1.1 Editing Media

z	Undo
Shift Z	Re-Do
x	Cut
c	Copy
v	Paste
Del	Clear
Shift Spc	Paste Silence
m	Mute region
a	Select all
shift + click	When done over an edit causes the highlighted selection to extend to the cursor position. When done over the boundary of an effect causes the trim operation to apply to one effect.

20.1.2 Editing Labels & In/Out Points

[	Toggle In point
]	Toggle Out point
l	Toggle label at current position
Ctrl <-	Go to Previous Label
Ctrl ->	Go to Next Label

20.1.3 Navigation

Right arrow	Move right*
Left arrow	Move left*

Up arrow	Zoom out*
Down arrow	Zoom in*
Ctrl Up	Expand waveform amplitude
Ctrl Dn	Shrink waveform amplitude
Alt Up	Expand curve amplitude
Alt Dn	Shrink curve amplitude
f	Fit time displayed to selection
Alt f	Fit curve amplitude to highlighted section of curves
Alt Left	Move left one edit
Alt Right	Move right one edit
Page Up	Move up*
Page Dn	Move down*
Ctrl Page Up	Expand track height
Ctrl Page Dn	Shrink track height
Home	Go to beginning of timeline*
End	Go to end of timeline*

* You may have to click on the timeline to deactivate any text boxes or tumblers before these work.

20.1.4 File operations

n	New project
o	Load Files
s	Save Project
r	Record
Shift R	Render
q	Quit
Shift P	Preferences
Shift B	Batch Render
Shift F	Set Format

20.1.5 Key Frame Editing

Shift X	Cut keyframes
Shift C	Copy keyframes
Shift V	Paste keyframes
Shift Del	Clear keyframes
Alt c	Copy default keyframe
Alt v	Paste default keyframe

20.1.6 Track Manipulation

t	Add Audio Track
u	Insert default Audio Transition
Shift T	Add Video Track
Shift U	Insert Default Video Transition
d	Delete last Track
Shift L	Loop playback
Tab	Toggle single track arming status
Shift-Tab	Toggle every other track's arming status

20.1.7 What's drawn on the timeline

1	Show titles
2	Show transitions
3	Fade keyframes
4	Mute keyframes
5	Mode keyframes
6	Pan keyframes
7	Camera keyframes
8	Projector keyframes
9	Plugin keyframes
0	Mask keyframes
-	Camera Zoom
=	Projector Zoom

20.2 VIEWER & COMPOSITOR WINDOWS

x	Cut
c	Copy
v	Paste
v	Splice
b	Overwrite
[	Toggle In point
]	Toggle Out point
l	Toggle label at current position
Ctrl <-	Go to Previous Label
Ctrl ->	Go to Next Label
Home	Go to beginning
End	Go to end
z	Undo
Shift Z	Re-Do
+	Zoom in
-	Zoom out

20.3 PLAYBACK TRANSPORT

Transport controls work in any window which has a playback transport. They are accessed through the number pad with num lock disabled.

```
4 Frame back         5 Reverse Slow     6 Reverse      + Reverse Fast
1 Frame Forward      2 Forward Slow     3 Play     Enter Fast Forward
0 Stop
```

[Space bar] is normal Play, Hitting any key twice is Pause.

Hitting any transport control with CTRL down causes only the region between the in/out points to be played, if in/out points are defined.

20.4 RECORD WINDOW

```
Space              Start and pause recording of the current batch
l                  Toggle label at current position.
```

Cinelerra CV Manual

Non-linear video editor for GNU/Linux
Community Version 2.1
Edition 1.55.EN

Heroine Virtual Ltd
Cinelerra CV Team

Table of Contents

1 Introduction

1.1 About Cinelerra

For years, some people have wanted a way to edit their audio and video in one place as fluidly as writing text. Cinelerra tries to be a single location for all your audio and video editing needs. All the recording, editing, and playback are handled here. It can be used as an audio player. It can be used to record audio or video. It can even be used as a photo retoucher.

There are two types of moviegoers: producers who create new content and revisit it for further refinement, and consumers who want to acquire the content and watch it. Cinelerra is not intended for consumers. Cinelerra has many features for uncompressed content, high resolution processing, and compositing. Producers need these features in order to retouch many generations of footage, which makes Cinelerra very complex. Consumers should consider other tools such as Avidemux (`http://www.avidemux.org/`), Kino (`http://kinodv.org/`) or Kdenlive (`http://kdenlive.org/`).

Quote from Miro's Wiki (`http://www.mitvwiki.org/Cinelerra`):
"The key difference between Cinelerra and many of the commercial editors is that Cinelerra hides much less from the user, exposing much of the inner workings to direct interaction. This can be harder to use, but does make it tremendously powerful, and for some operations blistering fast."

1.2 The two versions of Cinelerra

There are two branches of Cinelerra. One can be found at `http://www.heroinewarrior.com` and the other at `http://cvs.cinelerra.org`. This documentation is focused on **Cinelerra-CV (Community Version)**.

The official Cinelerra source code is developed "upstream" by Heroine Virtual, Ltd (HV). HV shares its code base with a community version of Cinelerra (Cinelerra-CV), but does not actively participate with the community of developers responsible for Cinelerra-CV. HV likes to work on its own copy of Cinelerra, releasing code on a periodic basis every 6 months or so.

Cinelerra-CV was founded by developers who wanted to extend the functionality and fix bugs inherent in the HV code base. They decided to develop Cinelerra in a community fashion and not create a separate fork of the original HV code. So, the Cinelerra CV code is very similar to the official release. CV coders apply bug fixes (`http://bugs.cinelerra.org`), enhancements to the SVN and compliance fixes. Programmers occasionally send patches upstream. In this way, Cinelerra CV has a number of features that the official version does not.

Unlike other programs, the HV release can not be described as "stable". After HV's Cinelerra is released, there are often bugs or unusable new features. When there is a new release, a CV member (j6t) merges HV's code with Cinelerra CV code, taking the enhancements from HV and reformatting the CV code (white spaces, function naming, directory naming) to be more similar to HV's with slight changes to implementations. After the merge, the latest Cinelerra CV release is a little unstable as users find bugs. Time permitting, the CV programmers will address as many of these bugs as possible. In this way, Cinelerra CV can be seen as the community's attempt to stabilize HV's release.

As mentioned, the community adds new enhancements to the HV source. Members will comment on each other's implementations in order to create a more fully functional and stable product. Occasionally, HV will give feedback on implementations that the members of the CV submit to it. However, not all of the enhancements that the community create make it upstream; for example, YUV pipe rendering.

Given the above discussion, obtaining the SVN just before a merge will generally be more stable than a post-merge CV version. Be aware that existing project description files, or Edit

Decision Lists (discussed below), may not be compatible with the newly merged CV version. With any version of Cinelerra, the task of finding bugs is relatively easy. However, clearly and concisely documenting these bugs for the community that fixes them is a task that we ask of all users of the software. The community is very responsive. Please help them by creating well-formed bug reports. You may join our mailing list at http://cvs.cinelerra.org.

1.3 About this manual

This manual edition is 1.55.EN, for Cinelerra CV version 2.1. You may redistribute it and/or modify it under the terms of the GNU General Public License, as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

This manual originates from "Secrets of Cinelerra", an excellent primer written by Adam Williams from Heroine Virtual Ltd. In 2003 Alex Ferrer created a Wiki based on that manual and added many screenshots and topic descriptions. At that time, Cinelerra CV still did not have its own manual and information regarding the Community Version of Cinelerra was scattered across the Internet (mailing-list, IRC, websites, wiki, etc). In 2006, Nicolas Maufrais combined the original "Secrets of Cinelerra" with the contents from Alex Ferrer's Wiki into a unified document.

Cinelerra-CV documentation maintainers:
English: Nicolas Maufrais (coordinator), Raffaella Traniello (apprentice sorcerer)

Manual translators: French: Jean-Luc Coulon
Brazilian Portuguese: Flavio Soares (maintainer), Willie Marcel
Spanish: Alberto Ramallo, Gustavo Iñiguez Goya (chapter 17 - Keyframes)
Basque: Iñaki Larrañaga Murgoitio "Dooteo".

Other contributors: Alexandre Bourget, Kevin Brosius, Carlos Davila, Cillian de Roiste, Rafael Diniz, Pierre Dumuid, Mike Edwards, Martin Ellison, Graham Evans, Alex Ferrer, Scott Frase, Joe Friedrichsen, gour, Gus Gus, Terje Hanssen, Mikko Huhtala, Ben Jorden, Nathan Kidd, Marcin Kostur, Joseph L., David McNab, Valentina Messeri, Sean Pappalardo, Paolo Rampino, Herman Robak, Dana Rogers, Jim Scott, Andraz Tori, Raffaella Traniello, Hermann Vosseler, Norval Watson.

Thanks to the GNU project team, and particularly to Karl Berry, maintainer of GNU Texinfo, for the precious help he gave us during the elaboration of this manual.

The sources of the manuals are Texinfo files. They are in the same SVN repository as Cinelerra's source code (hvirtual/doc folder). They can be converted in many formats. The doc/README_en file contains instructions for building the manual in PDF, HTML (single page) HTML (one page per chapter, in a folder), plain TXT, TXT in DokuWiki sintax (one file per chapter, in a folder), Docbook.

You can participate on editing this manual by making changes in the Cinelerra-CV wiki:
http://cvs.cinelerra.org/docs/wiki/doku.php

If you would like to translate this manual in your language, see the doc/TRANSLATIONS file and contact the Cinelerra CV Community.

Note: This manual is intended to be duplex-printed. Therefore, it is normal in the PDF manual for some even pages to be left blank.

1.4 Getting help

Help can be found at:

- **IRC channel:** #cinelerra on Freenode
- **Mailing list:** https://init.linpro.no/mailman/skolelinux.no/listinfo/cinelerra
- **Cinelerra CV website:** http://cvs.cinelerra.org

1.5 Tutorials

Some Cinelerra tutorials are available on the internet:

- **Cinelerra Tutorial - Getting Started**, by Rob Fisher
  http://www.robfisher.net/video/cinelerra1.html
- **Cinelerra video tutorials**, by The Source - tutorials (talk and screencast) inside The Source Show
  http://www.thesourceshow.org/node/11
  #1 is in Episode 6 "The Return Of The Pixel" from min 45 to min 60 (Introduction to Cinelerra and non linear editing, the 4 windows interface, project attributes, loading files).
  #2 is in Episode 1 "The Filesystem Menace" from min 32 to min 54 (Arming tracks, sample zoom, selection boxes, two screen editing, cut and paste editing, adding and moving tracks, drag and drop editing, trimming, transitions).
  #3 is in Episode 2 "Attack Of The Elephants (Dream)" from min 45 to 1:12 (Keyframes, camera and projector, masks, titles, effects).
- **Edicion de video bajo GNU/Linux (Cinelerra)**, in Spanish, by Gustavo Iñiguez Goya
  http://kutxa.homeunix.org/cinelerra
- **Guide d'utilisation de Cinelerra**, in French
  http://www.funix.org/fr/linux/cinelerra.htm
- **Faire un montage video** French tutorial for beginners on Cinelerra HV, by Laurent Bellegarde
  http://laurent.bellegarde.free.fr/lprod/tutoriels/tutoriel_cinelerra_niv1_debutant.pdf
- **Capturando e editando video usando Software Livre**, in Portuguese, by Rafael Diniz
  https://docs.indymedia.org/view/Sysadmin/Cinelerra
- **Tutorial Cinelerra**, in Portuguese, by Leo Germani
  http://www.estudiolivre.org/tiki-index.php?page=Cinelerra
- **Cinelerra is very easy**, Introduction to Cinelerra, for beginners, by Paolo Rampino
  http://project.akirad.net/node/12

1.6 HOWTOs

Some HOWTOs for specific needs are available on the internet:

- **Beginner's Guide to Exporting Video from Cinelerra**, by Scott Frase
  http://content.serveftp.net/video/renderTest/guideToCinExport.html
- **Capturing desktop screens in Cinelerra**, screencast by Scott Frase
  http://www.youtube.com/watch?v=MhaOgNQOBbc
- **HOWTO use the Chromakey (HSV) plugin**, by Jerome Cornet
  http://jcornet.free.fr/linux/chromakey.html
- **HOWTO make professional looking Scrolled Credits in Cinelerra**, by David McNab
  http://www.freenet.org.nz/misc/cintitles/
- **Crear tÃtulos diferentes con Cinelerra** in Spanish, by Gustavo Iñiguez Goya - how to add effects to titles. With downloadable sample projects.
  http://kutxa.homeunix.org/bloga/2007/08/13/crear-titulos-diferentes-con-cinelerra/#more-
- **SimAV's HOWTOs**, by Simeon Volkel - How to create a picture in picture effect, How to create overlays, How to change theme.
  http://g-raffa.eu/SimAV/
- **Tips for Transcoding Cinelerra Compatible Video with FFmpeg, MEncoder**, by Alexander Grundner
  http://www.alexandergrundner.com/2007/07/19/tips-for-transcoding-cinelerra-compatible-vi

- **FFMPEG compatibility** - HOWTO produce videos that can be played in common proprietary multimedia players
  http://ffmpeg.mplayerhq.hu/compat.html

1.7 Miscellaneous links

Miscellaneous links:

- **Interlacing**
  http://neuron2.net/LVG/interlacing.html
- **What is Deinterlacing? Facts, solutions, examples**
  http://www.100fps.com
- **MPEG-2 FAQ**
  http://bmrc.berkeley.edu/frame/research/mpeg/mpeg2faq.html
- **"Exporting edited HD content back to the camcorder" (HDV related)**
  http://dvinfo.net/conf/showthread.php?t=76674
- **A Quick Guide to Digital Video Resolution and Aspect Ratio Conversions**
  http://lipas.uwasa.fi/~f76998/video/conversion
- **Colour specification and image coding**
  http://www.poynton.com/notes/colour_and_gamma/ColorFAQ.html
- **DVD Video** - about DVD structure
  http://wlug.org.nz/DVDVideo
- **Creating DVD videos on Linux and Unix** - an excellent high level overview of DVD authoring in general on Linux
  http://womble.decadent.org.uk/talks/dvd-ukuug06/dvd-talk-ukuug06-paper.html
- **lprod - Libre Production** a French Wiki full of resources for Open Source video editing, especially for Cinelerra HV (among them an Ubuntu package)
  http://fr.lprod.org/wiki/doku.php
- **Cinelerra CV Glossary** for newbies
  http://g-raffa.eu/Cinelerra/cin_glossary.html

2 Installation

This is the general contents of all Cinelerra packages.

- **Foreign language translations** - These go into '`/usr/share/locale`'
- **Cinelerra executable** - This goes into '`/usr/bin`'
- **Cinelerra plugins** - These go into '`/usr/lib/cinelerra`' in 32 bit systems and '`/usr/lib64/cinelerra`' in 64 bit systems.
- **soundtest** - Utility for determining sound card buffer size.
- **mplexlo** - Multiplexing of MPEG elementary streams without standards conformance but more efficiently.
- **mpeg3cat** - Utility for reading an MPEG file from a certain standard and outputting it to stdout.
- **mpeg3toc, mpeg3cat, mpeg3dump** - Utilities for indexing and reading MPEG files.
- **mpeg3peek** - Utility for displaying the byte offset of a frame in an MPEG file.

2.1 Hardware requirements

Cinelerra is demanding on all PC subsystems, as reading, decoding and playing video can be quite taxing. Thus, performance and usability of Cinelerra are directly proportional to the video format (SVCD/DV/HDV/HD/etc) used and the CPU and I/O bus speeds and video and memory bus architecture of your hardware. Therefore, it stands to reason that a less powerful system will be sufficient for users working with audio only or lower resolution video formats. However, that same system may slow down considerably when playing back a higher resolution format, such as DV video. Effects and several tracks of audio will compound these problems. Given these constraints, here are some suggestions for running Cinelerra:

- **CPU speed**
  At least 500 MHz CPU speed, anything less would be useless. Dual-core and SMP processors greatly improve Cinelerra speed.
- **Memory**
  When working with video, a large amount of free memory available can help speed up operations by avoiding unnecessary disk swaps and keeping material ready accessible. Have at least 256 Megabytes of memory. To really use Cinelerra for higher resolution video formats and larger projects, greater than 1 Gb memory space is suggested.
- **Storage**
  Video editing can be quite I/O intensive. Storage requirements are based on your particular video editing needs. If you expect to produce long pieces in uncompressed or larger resolution formats, you should have large (>200 Gb) and fast (<10ms) disk drives. For example, DV uses about 3.5 Megs per second, or 12 Gigs per hour. For smaller projects you might get away with 1 Gb. RAID0 (stripe set), RAID1+0 (striped/mirrored) or RAID5 (stripe set with parity) will also speed playback
- **Video adapters**
  Since version 2.1, Cinelerra benefits from OpenGL hardware acceleration. Make sure the video card you use supports OpenGL 2.0 in order to benefit from that acceleration. Nvidia series 7 (ie. 7600GS) are known to work well. Unfortunately, ATI's Linux drivers do not support a complete implementation of OpenGL 2.0. If you are going to send a composite signal directly to a TV or video recorder, make sure your video card supports it.
- **Multiple monitors**
  You can use XFree86's Xinerama features to work on multiple monitor heads. This feature can be a very effective way of increasing productivity.

- **TV-Out**
  If your Adapter supports a TV-Out option, connecting a TV or S-Video monitor to it is a great way to view your material as it will be seen on TV screen.
- **Video grabbers**
  If you have an analog video camera, or want to grab video from a trusty old VCR, you need some sort of video grabber. Video grabbers are supported through Video4Linux in Cinelerra.
- **Firewire**
  Firewire is the fastest way to download material into your system. Unless you will be importing your media from a CD, any other pre-captured format or use an analog video grabber, you will need firewire on your system.
- **DV cameras**
  There is an large variety of DV cameras that can be used with Cinelerra. Almost any camera that can connect using firewire will work. Be sure to set the appropriate parameters on the video grabbing system to match your particular camera. `http://www.linux1394.org` has a complete listing of supported cameras.

2.2 Software requirements

To install Cinelerra you should have a current version of GNU/Linux with the X Window System (e.g., X.org) and some audio management software properly running. You should also have the following libraries installed (partial list):

- a52dec
- dv
- faac
- ffmpeg
- fftw
- lame
- libavc1394
- libfaad2
- libraw1394
- mjpegtools
- OpenEXR
- theora
- x264

You will also need the headers for all required libraries. For many distributions, this means that you will need to install the "-dev" or "devel" packages that correspond to your installed library packages. In addition to the libraries listed here, be sure you have the X library headers. Missing headers will usually result in compilation failing with cryptic error messages.

2.3 Compiling Cinelerra CV

2.3.1 Usual compilation process

You can install Cinelerra CV by fetching the source code and compiling it. That is the method to use if you want to compile the most up-to-date version of Cinelerra CV.

The source code of Cinelerra-CV is available from a Subversion (SVN) repository. Subversion is available for download at `http://subversion.tigris.org/`, but most likely your distribution has prebuilt packages. Complete documentation of subversion is available at `http://svnbook.red-bean.com/nightly/en/index.html`.

1. First you have to fetch Cinelerra CV’s sources from the SVN repository (approximately 170Mb or 60Mb for a read-only checkout). Run the following command:
   ```
   svn checkout svn://svn.skolelinux.org/cinelerra/trunk/hvirtual
   ```
   The svn command above will create in your current working directory a directory hvirtual that contains the sources.
2. Go to the hvirtual directory:
   ```
   cd hvirtual
   ```
3. Create the ‘./configure’ file by running:
   ```
   autoreconf -i --force
   ```
4. Then run the ‘.configure’ file:
   ```
   ./configure --with-buildinfo=svn/recompile
   ```
   This option makes the revision number to be shown in the **About** tab of the **Preferences** window. You can have a look at all the other options available by running:
   ```
   ./configure --help
   ```
   Most of the missing dependencies should be listed after running.
5. And run make:
   ```
   make
   ```
   If you wish to log the make output in order to search for errors, this command can be used:
   ```
   make 2>&1 | tee logfile
   ```
6. Install Cinelerra CV:
   ```
   sudo make install
   ```
7. Finally run as root (for first time compilation only):
   ```
   ldconfig
   ```

Notes:

- **SMP machine:**
  If you compile Cinelerra CV on a multiprocessor machine (SMP), we recommend you to add the ‘-j 3’ option to make in order to benefit from the available CPUs.
- **For x86 CPUs only**:
  You probably want to enable MMX support. To do that, run ./configure with the ‘--enable-mmx32’ option. If you do that, you may have to use the ‘--without-pic’ option too, otherwise, compilation may fail.
- **For Pentium-M:**
  Here are some useful compiler flags:
  ```
  ./configure --prefix=/usr --enable-x86 --enable-mmx32 --enable-freetype2
  --with-buildinfo=svn/recompile CFLAGS='-O3 -pipe -fomit-frame-pointer
  -funroll-all-loops -falign-loops=2 -falign-jumps=2 -falign-functions=2
  -ffast-math -march=pentium-m -mfpmath=sse,387 -mmmx -msse'
  ```
- **For 64bits:**
  As root, run:
  ```
  ./autogen.sh
  ./configure
  ```
  Replace ‘-prefer-non-pic’ with ‘-fPIC \’ in your ‘quicktime/ffmpeg/libavcodec/i386/Makefile.am’ file.
  ```
  make
  make install
  ```
- **Updating the source code:**
  If you already fetched the sources of an out of date revision, you can update to the latest revision by running:

```
svn update
```

- **Installing old revisions:**
  If you wish to fetch an old revision, run:
  `svn checkout -r <revision> svn://svn.skolelinux.org/cinelerra/trunk/hvirtual`
- **Installing several revisions:**
  If you wish to install several revisions of Cinelerra CV on your computer, create a '`/usr/local_cinelerra`' folder, and use the following options with `./configure` (replace '`xxx`' by the number of the revision you are compiling):
  '`--prefix=/usr/local_cinelerra/rxxx --exec-prefix=/usr/local_cinelerra/rxxx --program-suffix=_rxxx`'
  You will have to run Cinelerra CV from the directory in which it is installed:
  ```
  cd /usr/local_cinelerra/rxxx
  ./cinelerra_rxxx
  ```
  If you install Cinelerra using this method, the translated '`.po`' files do not get installed correctly. If you want to run Cinelerra in another language, See Section 3.1 [Environment variables], page 19, for specific instructions.
- **Automake version:**
  You need automake version 1.7 to build. 1.4 will not work. Autoconf 2.57 is also required to build.

2.3.2 Compiling with debugging symbols

When Cinelerra CV crashes, one can compile it with debugging symbols and run it inside gdb. The information displayed by gdb is far more detailed and will help CV developers find bugs faster.

First, fetch the SVN sources as usual. Then, run the following commands:

```
cd hvirtual
nice -19 autoreconf -i --force
mkdir ../hvdbg
cd ../hvdbg
nice -19 ../hvirtual/configure CXXFLAGS='-O0 -g' CFLAGS='-O0 -g' --with-buildinfo=svn/recompile
cd quicktime/ffmpeg
nice -19 make CFLAGS='-O3'
cd ../..
nice -19 make
nice -19 make install
```

See Section 22.1 [Reporting bugs], page 171, for information about running Cinelerra inside gdb.

2.4 Running Cinelerra

The simplest way to run Cinelerra is by running `/usr/bin/cinelerra`
Command line options are also available by typing `cinelerra -h` These options are described in several sections below. For rendering from the command line See Chapter 20 [Rendering files], page 141.

If you get this error message when running Cinelerra for the first time:

```
WARNING:/proc/sys/kernel/shmmax is 0x2000000, which is too low
```

See Section 21.9.3 [Freeing more shared memory], page 161, for details.

2.5 Live CDs

You can try and use Cinelerra on a computer without having to install it on your system. This is possible by using Live CDs, that are GNU/Linux distributions which boot from a CD, without installation on a hard drive. Here are some of the Live CD's known to contain Cinelerra:

- **Knoppix** - the "original" Debian-based LiveDistro - `http://www.knoppix.org`
- **dyne:bolic** - for multimedia production - uses Window Maker window manager - `http://www.dynebolic.org`
- **Elive** - Debian based live CD using Enlightenment window manager - `http://www.elivecd.org`
- **x-evian** - Debian based live CD for multimedia creations - `http://x-evian.org`
- **Mediainlinux** - Knoppix based - `http://www.mediainlinux.org/`
- **Musix** - Knoppix based live CD for audio production, graphic design and video editing - `http://musix.org.ar`
- **pho** (garbure) - dedicated to video editing - `http://garbure.org/pho/`
- **Slo-Tech** - based on Debian and Morphix - `http://linux.slo-tech.com`
- **ArtistX** - Debian based live CD, Gnome or KDE. For multimedia productions - `http://artistx.org`

2.6 Arch Linux

Cinelerra CV is included in the Arch Linux community repository.
To install the **cinelerra** package enable the **community** repository first (See `http://wiki.archlinux.org/index.php/AUR_User_Guidelines` for more info).
Then run the following command from the command line:
`pacman -Sy cinelerra-cv`

2.7 Ark Linux

Cinelerra CV is included in the Ark Linux package repository.
To install the **cinelerra** package use the **Install Software** tool in Mission Control or run the following commands from a command line:
`apt-get update`
`apt-get install cinelerra`.

2.8 Debian

2.8.1 Debian binaries

Andraz Tori maintains build rules for Debian Sid. He also makes binary .deb packages for Sid. They are built from the unofficial SVN releases. Debian Sid packages can be found here:

- **Apt source for i386:**
  `deb http://www.kiberpipa.org/~minmax/cinelerra/builds/sid/ ./`
- **Apt source for Pentium4 (optimized):**
  `deb http://www.kiberpipa.org/~minmax/cinelerra/builds/pentium4/ ./`
- **Apt source for Pentium-M (optimized):**
  `deb http://www.kiberpipa.org/~minmax/cinelerra/builds/pentiumm/ ./`
- **Apt source for AthlonXP (optimized):**
  `deb http://www.kiberpipa.org/~minmax/cinelerra/builds/athlonxp/ ./`

Valentina Messeri built also

- **Apt source for Opteron (AMD64) (optimized):**
  `deb http://giss.tv/~vale/debian64/ ./`

Christian Marillat makes binary Debian packages, built from the unofficial SVN releases, for stable, testing and unstable.

- **Apt source for amd64, hppa, i386, ia64, powerpc (not optimized):**
  `deb http://www.debian-multimedia.org BRANCH main`

Note: BRANCH = stable, testing or unstable
Note: Install **debian-multimedia-keyring** to add in your keyring Marillat's gpg-key.

Note: If Cinelerra produces the following error:

```
cinelerra: relocation error: /usr/lib/libavcodec.so.0.4.8: undefined symbol:
faacDecOpen
```

You can solve the problem by entering the following command as root:

```
apt-get install --reinstall libfaad2-0=2.0.0-0.5
```

2.8.2 Debian prerequisites

Standard development packages

These are packages which might be considered "standard" development pacakges. The chances are, though, that you wouldn't have them installed by default, so you will probably need them:

- libtool
- nasm
- x11proto-xf86vidmode-dev - needed if you get `error: X11/extensions/xf86vmode.h: No such file or directory`
- libxv-dev - needed if you get `error: X11/extensions/Xvlib.h: No such file or directory`
- libxxf86vm-dev - needed if you get `/usr/bin/ld: cannot find -lXxf86vm`

Extra Debian packages

These are development packages which are "non-standard", and you'll almost certainly have to install them if you want to compile Cinelerra:

- libogg-dev
- libvorbis-dev
- libtheora-dev
- libopenexr-dev
- libdv-dev
- libpng-dev
- libjpeg62-dev
- libtiff4-dev
- libfreetype6-dev
- libfaad-dev
- libsndfile1-dev
- uuid-dev

Some packages which may or may not be required:

- libavutil-dev
- libmpeg3-dev
- libavcodec-dev

External packages

You need some prerequisites which are not found in Debian's official repositories. You should add in your '`/etc/apt/sources.list`' the following line, which is Christian Marillat's repository:

```
deb http://www.debian-multimedia.org/ sid main
```

You will need to apt-get install the following packages:

- libx264-dev
- libfaac-dev

2.9 Ubuntu

2.9.1 Ubuntu packages repositories

For Ubuntu 8.04 Hardy Heron:

- for all x86 (full working on 32 and 64 bits), by Paolo Rampino:

  ```
  deb http://repository.akirad.net akirad-hardy main
  ```

  Installation notes:
  - To add this repository in your sources list use the following terminal command:
  ```
  sudo wget http://repository.akirad.net/dists/hardy.list -O
  /etc/apt/sources.list.d/akirad.list
  ```
  -Installations from this repository need an authentication key. Add it by typing the following command in your terminal:
  ```
  wget -q http://repository.akirad.net/dists/akirad.key -O- | sudo apt-key add -
  ```
  - Cinelerra package is available in 5 variants:
  cinelerra (x86 and x86_64 without opengl 2.0 video card)
  cinelerra-generic (all x86 and x86_64 with opengl 2.0 video card)
  cinelerra-k7 (amd32 without opengl 2.0 video card)
  cinelerra-k7gl (amd32 with opengl 2.0 video card)
  cinelerra-k8 (amd k8 optimized with opengl 2.0 video card)
  - Cinelerra must be set to work with PulseAudio. Open Cinelerra and go to Settings->Preferences->Playback->Audio Driver. Select ESound and set the following parameters:
  Server:
  Port: 7007
  - These packages set shmmax to 0x7fffffff and add non-English language support for Cinelerra.
  - Please, report any package bug to akir4d at gmail dot com

For Ubuntu 7.10 Gutsy Gibbon:

- for all x86 (full working on 32 and 64 bits), by Paolo Rampino:

  ```
  deb http://repository.akirad.net akirad-gutsy main
  ```

  Installation notes:
  - To add this repository in your sources list use the following terminal command:
  ```
  sudo wget http://repository.akirad.net/dists/gutsy.list -O
  /etc/apt/sources.list.d/akirad.list
  ```
  -Installations from this repository need an authentication key. Add it by typing the following command in your terminal:
  ```
  wget -q http://repository.akirad.net/dists/akirad.key -O- | sudo apt-key add -
  ```
  - Cinelerra package is available in 5 variants:
  cinelerra (all x86 and x86_64 without opengl 2.0 video card)
  cinelerra-generic (all x86 and x86_64 with opengl 2.0 video card)

cinelerra-k7 (all amd32 without opengl 2.0 video card)
cinelerra-k7gl (all amd32 with opengl 2.0 video card)
cinelerra-k8 (all amd64 with opengl 2.0 video card)
- These packages set shmmax to 0x7fffffff and add Cinelerra non-English language support on Ubuntu.
- Please, report any package bug to akir4d at gmail dot com

- for i386 (not working on amd 32 bits), by Valentina Messeri:

  `deb http://giss.tv/~vale/ubuntu32 ./`

- for AMD64 (and also Core Duo Intel64), by Valentina Messeri:

  `deb http://giss.tv/~vale/ubuntu64 ./`

  Note:
  - If your package manager complains that it does not have the right version of libfaac (1.25) you can install:
  http://www.debian-multimedia.org/dists/stable/main/binary-amd64/package/libfaac0.php

For Ubuntu 7.04 Feisty Fawn:

- for i386, optimised for UbuntuStudio, with OpenGL, by Valentina Messeri:

  `deb http://giss.tv/~vale/ubuntuopengl/ ./`

- for AMD64 (and also Core Duo Intel64), by Valentina Messeri:

  `deb http://giss.tv/~vale/ubuntu64 ./`

- for AMD64, with OpenGL disabled, by Valentina Messeri:

  `deb http://giss.tv/~vale/ubuntu64NOopengl/ ./`

- for i386, by muzzol:

  `deb http://www.kiberpipa.org/~muzzol/cinelerra/feisty-i386/ ./`

- for i686, by Jure Cuhalev:

  `deb http://www.kiberpipa.org/~gandalf/ubuntu/feisty/cinelerra/i686/ ./`

- for athlonxp, by Jure Cuhalev:

  `deb http://www.kiberpipa.org/~gandalf/ubuntu/feisty/cinelerra/athlonxp/ ./`

- for pentium4, by Jure Cuhalev:

  `deb http://www.kiberpipa.org/~gandalf/ubuntu/feisty/cinelerra/pentium4/ ./`

For Ubuntu 6.10 Edgy Eft:

- by muzzol

  `deb http://www.kiberpipa.org/~muzzol/cinelerra/edgy-i386/ ./`

- by Valentina Messeri:

  `deb http://giss.tv/~vale/ubuntu32 ./`

For Ubuntu 6.06 Dapper Drake

- necessary mjpegtools ubuntu backport, by Jure Cuhalev:

  `deb http://www.kiberpipa.org/~gandalf/ubuntu/dapper/mjpegtools ./`

- for pentium4, by Jure Cuhalev:

  `deb http://www.kiberpipa.org/~gandalf/ubuntu/dapper/cinelerra/pentium4/ ./`

- for i686, by Jure Cuhalev:

  `deb http://www.kiberpipa.org/~gandalf/ubuntu/dapper/cinelerra/i686/ ./`

- for athlonxp, by Jure Cuhalev:

  `deb http://www.kiberpipa.org/~gandalf/ubuntu/dapper/cinelerra/athlonxp/ ./`

2.9.2 Instructions for Ubuntu packages installation

Chose a repository from the ones above according to your release and CPU type and install the package.
Here are 3 ways of doing that:

With Synaptic Package Manager:

Open the Software Sources Window.
You can do it in two ways:
- Go to System -> Administraton -> Software Sources
- Inside Synaptic Package Manager: Go to Settings -> Repositories.
Make sure you have universe, multiverse and restricted sources checked in the first tab.
Click on tab Third Party. Click on the Add button and enter your chosen repository.
Clicking Add Source will display the new repository enabled in the Software Sources window.
You should now see Cinelerra in the list of packages available in Synaptic.
Follow Synaptic instructions for installation.

With the command line:

Edit directly your '`/etc/apt/sources.list`' file.
Make sure you have universe, multiverse and restricted sources enabled by checking you have the following line uncommented:

```
deb http://archive.ubuntu.com/ubuntu dapper universe multiverse restricted
```

Add the complete APT line of your chosen repository.
Install Cinelerra by typing in your terminal:

```
apt-get update
```

and then

```
apt-get install cinelerra
```

With GDebi Package Installer:

Send Firefox to the web address of the repository
(e.g. http://www.kiberpipa.org/~muzzol/cinelerra/edgy-i386/.)
Click on the .deb link for your chosen Cinelerra package
(e.g. cinelerra_2.1.0+svn20070109-0ubuntu1_i386.deb)
A dialog window will ask you to confirm your intention to open this file with GDebi Package installer.
Clicking OK will start the download.
If during the process you get errors about not satisfiable dependencies, try installing the problematic library with the same method from the same webpage.

HOWTOs for package installation or compilation from source code

- Installation of Ubunty Feisty AMD64 Cinelerra package:
  `https://help.ubuntu.com/community/CinelerraOnFeistyAMD64`
- Compilation from source code on Ubuntu 7.10 Gutsy Gibbon (for beginners):
  `http://www.g-raffa.eu/Cinelerra/cin_compilation.html`
- Compilation from source code on Ubuntu 7.10 Gutsy Gibbon:
  `http://lab.dyne.org/cinelerra/Gutsy`
- Compilation from source code on Ubuntu 6.10 Edgy Eft:
  `http://www.ubuntuforums.org/showthread.php?t=320701&highlight=cinelerra`

- Compilation from source code on Ubuntu Breezy:
  http://placide.home.sapo.pt/cinelerra02.html
- Compilation from source code on Ubuntu (for beginners, in Italian):
  https://faberlibertatis.org/wiki/Cinelerra_CV_su_Ubuntu

2.10 Gentoo

Installation for Gentoo GNU/Linux is very straight forward. Simply type:

```
emerge cinelerra-cvs
```

as root and it should install and run without any problems. Note that you may need to put cinelerra-cvs in your '/etc/portage/package.keywords' file in order to unmask it:

```
echo "=media-video/cinelerra-cvs ~x86" >> /etc/portage/package.keywords
```

See http://www.gentoo.org/doc/en/handbook/handbook-x86.xml?part=3&chap=3 for details. If you are running on an architecture other than x86 e.g. amd64, you will need to replace ~x86 with the relevant architecture e.g. ~amd64.

You may also want to adjust the USE flags. First run

```
emerge -av cinelerra-cvs
```

to see what flags are available and then add the relevant ones to '/etc/portage/package.use':

```
echo "media-video/cinelerra-cvs ieee1394" >> /etc/portage/package.use
```

This would enable support for firewire devices.

2.11 Fedora

Cinelerra is included in the Freshrpms repository at http://freshrpms.net. The easiest way to install packages from Freshrpms is to include the repository in the **yum** configuration. Also make sure that the Fedora Extras repository is enabled. This is the case by default on Fedora 5 and 6, and Core and Extras are merged into one on Fedora 7.

For Fedora 8 see http://kernelreloaded.blog385.com/index.php/archives/install-cinelerra-on-fe

On Fedora 6, as the user root do:

```
rpm -ivh http://ftp.freshrpms.net/pub/freshrpms/fedora/linux/6/\
freshrpms-release/freshrpms-release-1.1-1.fc.noarch.rpm
```

On Fedora 5, do:

```
rpm -ivh http://ftp.freshrpms.net/pub/freshrpms/fedora/linux/5/\
freshrpms-release/freshrpms-release-1.1-1.fc.noarch.rpm
```

Then type:

```
yum -y install cinelerra
```

to get and install Cinelerra and all the dependencies, including ffmpeg and mjpegtools. If it does not work, check the '/etc/yum.conf' file and make sure that the Freshrpms config gets included from the '/etc/yum.repos.d'.

Notes:

- The package collection of Freshrpms may overlap and/or conflict with other third-party repositories such as Livna, which may also carry audio and video libraries and Cinelerra. It may be a good idea to stick with one repository and not mix packages from several different third-party repositories.

- The header files of the various libraries are needed for compiling Cinelerra from source. The header files are included in separate devel packages that are included in the Fedora and Freshrpms repositories and can be installed with yum. At least the following are required:
  OpenEXR-devel SDL-devel a52dec-devel alsa-lib-devel e2fsprogs-devel faac-devel faad2-devel ffmpeg-devel fftw-devel imlib2-devel lame-devel libXv-devel libXxf86vm-devel libavc1394-devel libdv-devel libiec61883-devel libogg-devel libraw1394-devel libsndfile-devel libtheora-devel libvorbis-devel mjpegtools-devel x264-devel xvidcore-devel
- If you want to compile Cinelerra from source on Fedora Core 6, detailed instructions on how to install the necessary dependent files can be found at: `http://crazedmuleproductions.blogspot.com /2007/03/fedora-core-6-cinelerra-dependencies.html`

2.12 Mandriva

Cinelerra packages for Mandriva are made by PLF are ready to install. Read `http://plf.zarb.org/packages.php` for more information.

2.13 Slackware

Rafael Diniz build Slackware packages for Cinelerra.

- **For x86:**
  `http://slack.sarava.org/packages/slackware/slackware-11.0/multimedia/`
- **For slackintosh:**
  `http://slack.sarava.org/packages/slackintosh/slackintosh-11.0/multimedia/`

2.14 Suse

RPMs for SuSE 9 are built from SVN sources by Kevin Brosius, and available at `http://cin.kevb.net/files/RPM/`

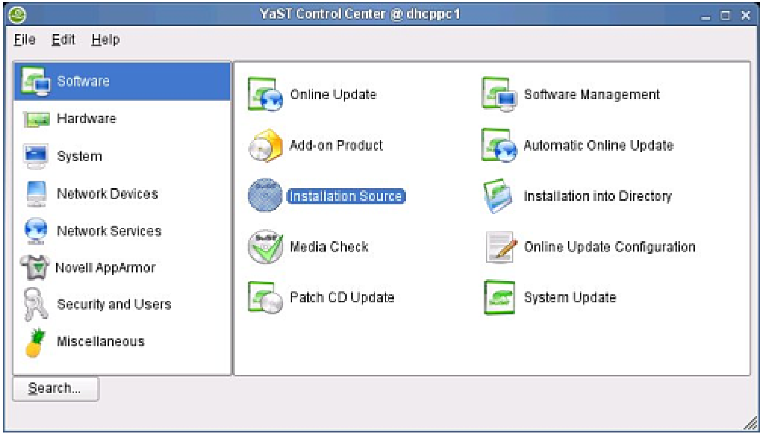
RPMs for OpenSUSE 10.1 and 10.2, architecture i586 and x86_64, are built from SVN by Leon Freitag at Packman. They are available at `http://packman.links2linux.org/package/cinelerra/16413`.

The RPM package(s) can be installed as root in a terminal using this command:

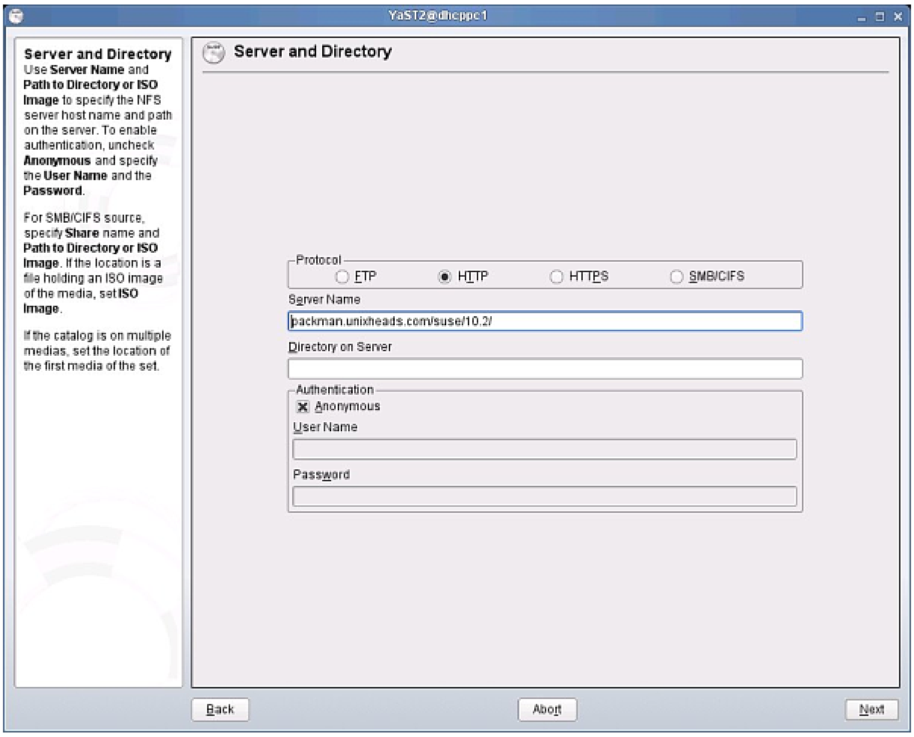
```
rpm -Uvh package_name.rpm
```

The following installation case shows four screenshots for a GUI based Cinelerra SVN installation on OpenSUSE 10.2 i586 using YaST2. First by adding packman's YaST2 repository as a YaST2 Installation source, and next the package installation with the YaST2 Software Manager.

Start the YaST Control center on OpenSUSE 10.2 and add the root password when requested:



Start the YaST2 installation source tool, select the HTTP protocol and add the servername for packman as shown. Synchronization with Zenworks may take some time, wait until it is finished.



Server and Directory
Use **Server Name** and **Path to Directory or ISO Image** to specify the NFS server host name and path on the server. To enable authentication, uncheck **Anonymous** and specify the **User Name** and the **Password**.

For SMB/CIFS source, specify **Share** name and **Path to Directory or ISO Image**. If the location is a file holding an ISO image of the media, set **ISO Image**.

If the catalog is on multiple medias, set the location of the first media of the set.

Server and Directory

Protocol: ○ FTP ● HTTP ○ HTTPS ○ SMB/CIFS

Server Name: packman.unixheads.com/suse/10.2/

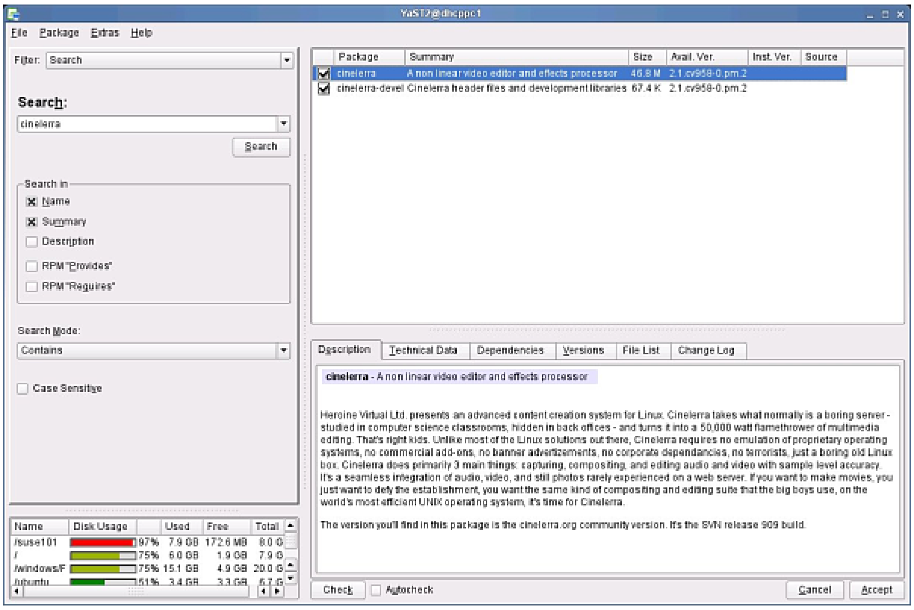
Directory on Server:

Authentication: ☒ Anonymous

User Name:

Password:

Start the YaST2 Software Management. Enter "Cinelerra" in the left search field and next check the checkboxes for the Cinelerra packages in the right window. If an older version of Cinelerra is installed on beforehand visible with a lock symbol, delete it, possibly try an update first.



Filter: Search

Search: cinelerra

Search in: ☒ Name ☒ Summary □ Description □ RPM "Provides" □ RPM "Requires"

Search Mode: Contains

□ Case Sensitive

Name	Disk Usage		Used	Free	Total
/suse101	🟥	97%	7.9 GB	172.6 MB	8.0 G
/	🟩	75%	6.0 GB	1.9 GB	7.9 G
/windows/F	🟩	75%	15.1 GB	4.9 GB	20.0 G
/ubuntu	🟩	51%	3.4 GB	3.3 GB	6.7 G

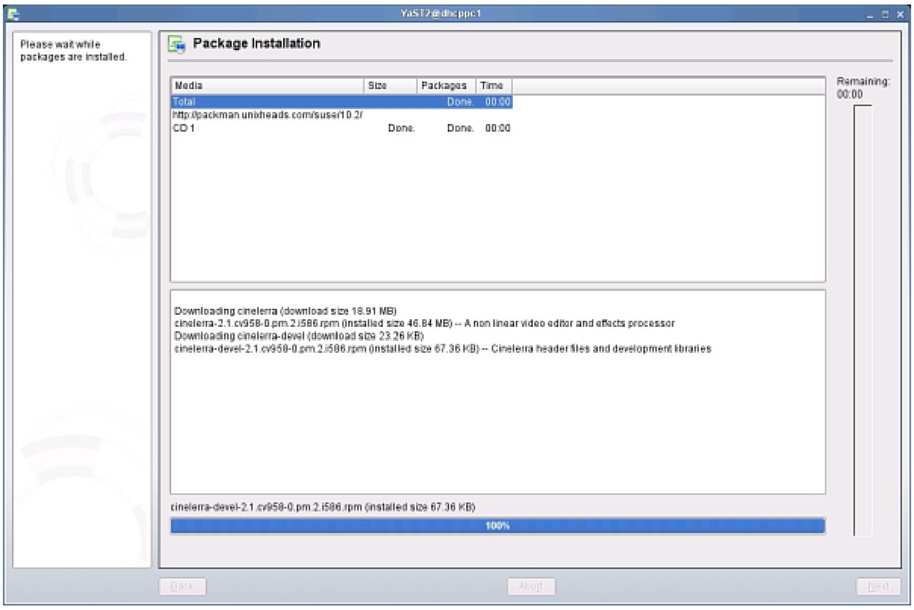
	Package	Summary	Size	Avail. Ver.	Inst. Ver.	Source
☑	cinelerra	A non linear video editor and effects processor	46.8 M	2.1.cv958-0.pm.2		
☑	cinelerra-devel	Cinelerra header files and development libraries	67.4 K	2.1.cv958-0.pm.2		

cinelerra - A non linear video editor and effects processor

Heroine Virtual Ltd. presents an advanced content creation system for Linux. Cinelerra takes what normally is a boring server - studied in computer science classrooms, hidden in back offices - and turns it into a 50,000 watt flamethrower of multimedia editing. That's right kids. Unlike most of the Linux solutions out there, Cinelerra requires no emulation of proprietary operating systems, no commercial add-ons, no banner advertizements, no corporate dependancies, no terrorists, just a boring old Linux box. Cinelerra does primarily 3 main things: capturing, compositing, and editing audio and video with sample level accuracy. It's a seamless integration of audio, video, and still photos rarely experienced on a web server. If you want to make movies, you just want to defy the establishment, you want the same kind of compositing and editing suite that the big boys use, on the world's most efficient UNIX operating system, it's time for Cinelerra.

The version you'll find in this package is the cinelerra.org community version. It's the SVN release 909 build.

Click Accept to start the package installation and afterwards Next to finish.



Please wait while packages are installed.

Media	Size	Packages	Time
Total		Done.	00:00
http://packman.unixheads.com/suse/10.2/			
CD 1	Done.	Done.	00:00

Remaining:
00:00

```
Downloading cinelerra (download size 18.91 MB)
cinelerra-2.1.cv958-0.pm.2.i586.rpm (installed size 46.84 MB) -- A non linear video editor and effects processor
Downloading cinelerra-devel (download size 23.26 KB)
cinelerra-devel-2.1.cv958-0.pm.2.i586.rpm (installed size 67.36 KB) -- Cinelerra header files and development libraries
```

cinelerra-devel-2.1.cv958-0.pm.2.i586.rpm (installed size 67.36 KB)

100%

2.15 MacOSX

FIXME

3 Configuration

Because of its flexibility, Cinelerra cannot be optimized without special configuration for your specific needs. Unfortunately, very few parameters are adjustable at compile time. Therefore, runtime configuration is the only option for most users because of the multitude of parameters available.
Below are configuration options as well as the supported API's in GNU/Linux.
In Cinelerra, go to **settings->preferences** to see the options.

3.1 Environment variables

In UNIX derivatives, environment variables are global variables in the shell which all applications can read. They are set with a command like `set VARIABLE=value`. All the environment variables can be viewed with a command like `env`. Cinelerra recognizes the following environment variables:

- **LADSPA_PATH**
  If you want to use LADSPA plugins, this must be defined: a colon separated list of directories to search for LADSPA plugins. These are not native Cinelerra plugins. See Chapter 16 [Ladspa effects], page 127.
- **GLOBAL_PLUGIN_DIR**
  The directory in which Cinelerra should look for native plugins. The default is '`/usr/lib/cinelerra`' but you may need an alternate directory if you share the same executable directory among many machines via NFS. Plugins of different binary formats need to be in different directories.
- **LANG and LANGUAGE**
  Cinelerra can be localized to display menus and messages in many languages. Cinelerra language settings are normally read from your GNU/Linux language settings. To run Cinelerra on a language different than the one selected on your system just change the LANG and LANGUAGE environment variables.
  For example, open a shell and type: `export LANG=es_ES LANGUAGE=es_ES`, then run `cinelerra` from the same shell. It will open set on the Spanish language.
  Available languages are:
  - en_EN - English
  - es_ES - Espanol
  - sl_SI - Slovenian
  - fr_FR - Francais
  - eu_ES - Euskera
  - de_DE - German
  - pt_BR - Brazilian Portuguese
  - it_IT - Italian

  If your distribution has only UTF-8 support (like Ubuntu), first you must create the language charset with this command:
  ```
  localedef -c -i (language_prefix) -f (your ISO-8859 variant) (language_prefix).(your ISO-8859 variant)
  ```
  This is an example for Italian language:
  ```
  localedef -c -i it_IT -f ISO-8859-15 it_IT.ISO-8859-15
  ```
  Then you can run cinelerra with this command:
  ```
  env LANG=$(echo $LANG | sed -e s/UTF-8/(your ISO-8859 variant)/g) cinelerra
  ```
  This is an example for Italian language:
  ```
  env LANG=$(echo $LANG | sed -e s/UTF-8/ISO-8859-15/g) cinelerra
  ```

In some cases (e.g. if you compiled Cinelerra specifying a '--prefix=' option different from '/usr/local') the translated .po files are not installed. If you can't run Cinelerra in your chosen language, try running the following commands before changing the LANG and LANGUAGE environment variables:

```
cd hvirtual
./configure prefix=/usr
cd po
sudo make install
```

3.2 Audio drivers

The audio drivers are used for both recording and playback. Their functionality is described below:

3.2.1 Sound driver attributes

- **Device path**
  Usually a file in the '/dev/' directory which controls the device.
- **Bits**
  The number of bits of precision Cinelerra should set the device for. This sometimes has a figurative meaning. Some sound drivers need to be set to 32 bits to perform 24 bit playback and will not play anything when set to 24 bits. Some sound drivers need to be set to 24 bits for 24 bit playback.
- **Port**
  The IEEE1394 standard specifies something known as the **port**. This is probably the firewire card number.
- **Channel**
  The IEEE1394 standard specifies something known as the channel. For DV cameras it is always 63.
- **Device**
  The chosen device.
- **Stop playback locks up**
  This ALSA only checkbox is needed if stopping playback causes the software to lock up.

3.2.2 OSS

This was the first GNU/Linux sound driver. It had an open source implementation and a commercial implementation with more sound cards supported. It was the standard sound driver up to GNU/Linux 2.4. It still is the only sound driver which an i386 binary can use when running on an x86_64 system.

3.2.3 OSS Envy24

The commercial version of OSS had a variant for 24 bit 96 KHz soundcards. This variant required significant changes to the way the sound drivers were used, hence the need for the new driver.

3.2.4 Alsa

ALSA is the most common sound driver in GNU/Linux 2.6. It supports most of soundcards now. It takes advantage of low latency features in GNU/Linux 2.6 to get better performance than OSS had in 2.4, but roughly the same performance that OSS had in 2.0. Unfortunately ALSA is constantly changing. A program which works with it one day may not the next day. New wrappers are being developed on top of ALSA. We plan to support them at regular intervals,

though not at every new release of a new wrapper.
ALSA is no longer portable between i386 and x86_64. If an i386 binary tries to play back on an x86_64 kernel, it will crash. For this scenario, use OSS.

3.2.5 Esound

ESOUND was a sound server that sat on top of OSS. It was written for a window manager called Enlightenment. It supports a limited number of bits and has high latency compared to more modern drivers, but it does have the ability to multiplex multiple audio sources. It is unknown whether it still works.

3.2.6 Raw 1394

The was the first interface between GNU/Linux software and firewire camcorders. It is the least reliable way to play audio to a camcorder and consists of a library on top of the kernel commands.

3.2.7 DV 1394

This is the second rewrite of DV camcorder support in GNU/Linux. This is the most reliable way to play audio to a camcorder and consists of direct kernel commands.

3.2.8 IEC 61883

The third rewrite of DV camcorder support in GNU/Linux. This is a library on top of RAW 1394 which is a library on top of the kernel commands. It is less reliable than DV 1394 but more reliable than RAW 1394. The next rewrite ought to fix that. Visit `http://www.linux1394.org` for more information and the latest drivers.

3.3 Video drivers

The video drivers are used for video playback in the compositor and the viewer.

3.3.1 Video driver attributes

- **Display**
  The interface is intended for dual monitor displays. Depending on the value of Display, the Compositor window will appear on a different monitor from the rest of the windows.
- **Device path**
  Usually a file in the '`/dev/`' directory which controls the device.
- **Swap fields**
  Make the even lines odd and the odd lines even when sending to the device. On an NTSC or 1080i monitor the fields may need to be swapped to prevent jittery motion.
- **Output channel**
  You may need a specific connector to send video out to devices with multiple outputs.
- **Port**
  The IEEE1394 standard specifies something known as the **port**. This is probably the firewire card number.
- **Channel**
  The IEEE1394 standard specifies something known as the **channel**. For DV cameras it is always **63**.

3.3.2 X11

This was the first method of graphical display on any UNIX system. It just writes the RGB triplet for each pixel directly to the window. It is the slowest playback method. It is still useful as a fallback when graphics hardware can not handle very large frames.

3.3.3 X11-XV

This was an enhancement to X11 in 1999. It converts YUV to RGB in hardware with scaling. It is the preferred playback method but can not handle large frame sizes. The maximum video size for XV is usually 1920x1080.

3.3.4 X11-OpenGL

The most powerful video playback method is OpenGL. With this driver, most effects are done in hardware. OpenGL allows video sizes up to the maximum texture size, which is usually larger than what XV supports, depending on the graphics driver. To enable it you will need a binary built with OpenGL support. The `configure` option to enable OpenGL is '`--enable-opengl`'. You need a video card which supports OpenGL 2.0. Recent Nvidia video cards should work. You also need to use a video driver supporting OpenGL 2.0, such as Nvidia's binary driver. To know if your video driver supports OpenGL 2.0, type the following command: `glxinfo | grep "OpenGL version"`

- Video driver supporting hardware OpenGL 2.0 rendering:
  `OpenGL version string: 2.0.2 NVIDIA 87.74`
- Video driver not supporting hardware OpenGL 2.0 rendering:
  `OpenGL version string: `**`1.4`**` (2.0.2 NVIDIA 87.74)`

OpenGL relies on PBuffers and shaders to do video rendering. The graphics driver must support OpenGL 2.0 and Cinelerra needs to be explicitly compiled with OpenGL 2.0 support. This requires compiling it on a system with the OpenGL 2.0 headers. PBuffers are known to be fickle. If the graphics card does not have enough memory or does not have the right visuals, PBuffers will not work. If OpenGL does not work, try seeking several frames or restarting Cinelerra.

Limitations:

- OpenGL does not affect rendering. It just accelerates playback.
- X11-OpenGL processes everything in 8 bit color models, although the difference between YUV and RGB is retained.
- OpenGL does not work with frames whose size is larger than 4096x4096.
  Here is what is written in the console when working with large frames:
  `BC_Texture::create_texture frame size <frame_width>x<frame_height> bigger than maximum texture 4096x4096.`
- The scaling equation set in the preferences window is ignored by OpenGL. OpenGL always uses linear scaling.
- Project and track sizes need to be multiples of four for OpenGL to work.
- To get the most acceleration, OpenGL-enabled effects must be placed after software-only effects. All rendering before the last software-only effect is done in software. The core Cinelerra operations like camera and projector are OpenGL.
- Not all of the effects support OpenGL acceleration. The following effects support OpenGL: Brightness, Chromakey, Chromakeyhsv, Color balance, Deinterlace, Diffkey, Dissolve, Flip, Frames to fields, Freeze frame, Gamma, Gradient, Histogram, Hue saturation, Interpolate Pixels, Invert video, Linear blur, Overlay, Perspective, Radial blur, RGB601, Rotate, Scale, Threshold, Zoomblur.

3.3.5 Buz

This is a method for playing motion JPEG-A files directly to a composite analog signal. It uses a popular hack of the Video4Linux 1 driver from 2000 to decompress JPEG in hardware. Even though analog output is largely obsolete, newer drivers have replaced BUZ.

3.3.6 Raw 1394 video playback

This was the first interface between GNU/Linux software and firewire camcorders. It is the least reliable way to play video to a camcorder and it consists of a library on top of the kernel commands.

3.3.7 DV 1394 video playback

The second rewrite of DV camcorder support in GNU/Linux. This was the most reliable way to play video to a camcorder and consists of direct kernel commands.

3.3.8 IEC 61883 video playback

The third rewrite of DV camcorder support in GNU/Linux. This is a library on top of RAW 1394 and is less reliable than DV 1394 but more reliable than RAW 1394. The next rewrite ought to fix that. Visit `http://www.linux1394.org` for more information and the latest drivers.

3.4 Playback

3.4.1 Audio out

These determine what happens when you play sound from the timeline.

- **Playback buffer size**
  For playing audio, small fragments of sound are read from disk and processed sequentially in a virtual console. A larger value here causes more latency when you change mixing parameters but yields more reliable playback.
  Some sound drivers do not allow changing of the console fragment, so latency is unchanged no matter what the value.
  Previously, a good way of ensuring high quality playback was to read bigger fragments from the disk and break them into smaller fragments for the soundcard. That changed when the virtual console moved from the push model to the pull model. Since different stages of the rendering pipeline can change the rate of the incoming data, it would be difficult to disconnect the size of the console fragments from the size of the fragments read from disk.
- **Audio offset**
  The ability to tell the exact playback position on GNU/Linux sound drivers is poor, if it is provided at all. Since this information is required for proper video synchronization, it has to be accurate. The **audio offset** allows users to adjust the position returned by the sound driver in order to reflect reality. The audio offset does not affect the audio playback or rendering at all. It merely changes the synchronization of video playback.
  The easiest way to set the audio offset is to create a timeline with one video track and one audio track. Expand the audio track and center the audio pan. The frame rate should be larger than 24 fps and the sampling rate should be greater than 32000. The frame size should be small enough for your computer to render it at the full framerate. Highlight a region of the timeline starting at 10 seconds and ending at 20 seconds. Drop a **gradient** effect on the video track and configure it to be clearly visible. Drop a **synthesizer** effect on the audio and configure it to be clearly audible.
  Play the timeline from 0 and watch to see if the gradient effect starts exactly when the audio starts. If it does not, expand the audio track and adjust the nudge. If the audio starts ahead of the video, decrease the nudge value. If the audio starts after the video, increase the nudge value. Once the tracks play back synchronized, copy the nudge value to the **audio offset** value in preferences.
  Note: if you change sound drivers or you change the value of **Use software for positioning information**, you will need to change the audio offset because different sound drivers are unequally inaccurate.

- **View follows playback**
  This causes the timeline window to scroll when the playback cursor moves. This can bog down the X Server or cause the timeline window to lock up for long periods of time while drawing the assets.
- **Use software for positioning information**
  Most soundcards and sound drivers do not give reliable information on the number of samples the card has played. You need this information for synchronization when playing back video. This option causes the sound driver to be ignored and a software timer to be used for synchronization.
- **Audio playback in realtime**
  Back in the days when 150 MHz was the maximum speed for a personal computer, this setting allowed uninterrupted playback during periods of heavy load. It forces the audio playback to the highest priority in the kernel. Today, it is most useful for achieving very low latency between console tweeks and soundcard output. You must be root to get real-time priority.
- **Audio driver**
  There are many sound drivers for GNU/Linux. This allows selecting one sound driver and setting parameters specific to it. The sound drivers and their parameters are described in the sound driver section. See Section 3.2 [Audio drivers], page 20.

3.4.2 Video out

These determine how video gets from the timeline to your eyes.

- **Play every frame**
  This causes every frame of video to be displayed even if it means that the playback of the video track(s) will fall behind. This option should always be enabled unless you use uncompressed codecs. As of 1/2007, most compressed codecs do not support frame dropping anymore.
- **Framerate achieved**
  The number of frames per second being displayed during playback. This is updated during playback only.
- **Decode frames asynchronously**
  If you have lots of memory and more than one CPU, this option can improve playback performance by decoding video on one CPU as fast as possible while dedicating the other CPU to playing back video. It assumes all playback operations are forward and no frames are dropped. Operations involving reverse playback or frame dropping are negatively impacted. Since this option requires enormous amounts of memory, Cinelerra may crash if the input frames are very large.
- **Scaling equation**
  This algorithm is used when video playback involves any kind of scaling or translation in the virtual console. This does not affect 1:1 playback.
  - **Nearest neighbor enlarge and reduce**
    Low quality output with fast playback. Produces jagged edges and uneven motion.
  - **Bicubic enlarge and bilinear reduce**
    High quality output with slow playback. Bicubic interpolation is used for enlarging, which blurs slightly but does not show stair step artifacts. A bilinear interpolation is used for reduction, which produces very sharp images and reduces noise. Bilinearly reduced images can be sharpened with a sharpen effect with less noise side effects than a normal sized image.

  - **Bilinear enlarge and bilinear reduce**
    When slight enlargement is needed, a bilinear enlargement looks better than a bicubic enlargement.

- **Preload buffer for Quicktime**
  The Quicktime/AVI decoder can handle DVD sources better when this is set to around 10000000. This reduces the amount of seeking required. When reading high bitrate sources from a hard drive, this tends to impair performance by slowing down decoding. For normal use this should be 0.
- **DVD subtitle to display**
  DVD IFO files usually contain subtitle tracks. These must be decoded with the MPEG decoder. Select **Enable subtitles** to enable subtitle decoding. There are usually multiple subtitle tracks indexed by number and starting from 0. Enter the index number of the subtitle track to be decoded in the "DVD Subtitle to display" text box or use the tumbler to increase the index value. Go to the asset corresponding to the MPEG file in the Resources window and right click. Click on Info. The number of subtitle tracks is shown at the bottom.
- **Interpolate CR2 images**
  Enables interpolation of CR2 images. Interpolation is required since the raw image in a CR2 file is a Bayer pattern. The interpolation uses dcraw's built-in interpolation and is very slow. This operation can be disabled and the **Interpolate Pixels** effect used instead for faster previewing.
- **White balance CR2 images**
  This enables white balancing for CR2 images if interpolation is also enabled. This is because proper white balancing needs a blending of all 3 primary colors. White balance uses the camera's matrix which is contained in the CR2 file.
  Disabling white balancing is useful for operations involving dark frame subtraction. The dark frame and the long exposure need to have the same color matrix.
  If you disable **Interpolate CR2 Images** and use the **Interpolate Pixels** effect, be aware the **Interpolate Pixels** effect always does both interpolation and white balancing using the camera's matrix, regardless of the settings in Preferences. Dark frame subtraction needs to be performed before **Interpolate Pixels**.
- **Video driver**
  Normally video on the timeline goes to the compositor window during both continuous playback and when the insertion point is repositioned. Instead of sending video to the Compositor window, the video driver can be set to send video to another output device during continuous playback. However, this does not affect where video is routed when the insertion point is repositioned.
  The video drivers and their parameters are described in the video drivers section. See Section 3.3 [Video drivers], page 21.

3.5 Recording

The parameters here expedite the **File->Record...** function by allowing the user to pre-configure the file format. The file format is applied to all recordings. Also set here is the hardware for recording, since the hardware determines the supported file format (in most cases).

3.5.1 File format

This determines the output file format for recordings. It depends heavily on the type of driver used. The menu selections are the same as the rendering interface. See See Chapter 20 [Rendering files], page 141. The **Record audio tracks** toggle must be enabled to record audio. The **Record video tracks** toggle must be enabled to record video. The wrench button left of each toggle opens a configuration dialog in order to set the compression scheme (codec) for each audio and video output stream. The audio and video is wrapped in a container format defined by the **File Format** menu. Different wrappers may record audio only, video only, or both.

Some video drivers can only record to a certain container. DV, for example, can only record to Quicktime with DV as the video compression scheme. If the video driver is changed, the file format may be updated to give the supported output. If you change the file format to an unsupported format, it may not work with the video driver.

3.5.2 Audio in

These determine what happens when you record audio.

- **Record driver**
  This is used for recording audio in the Record window. It may be configured the same as the Record Driver for video if the audio and video are wrapped in the same stream. Available parameters vary depending on the driver. Note that the drivers are the same as those available in Preferences->Playback. See Section 3.2 [Audio drivers], page 20.
- **Samples to write to disk at a time**
  First, audio is read in small fragments from the device. Then, many small fragments are combined into a large fragment before writing to disk. The disk writing process is done in a different thread. The value here determines how large the combination of fragments is for each disk write.
- **Sample rate for recording**
  Regardless of what the project settings are, the value set here will be the sample rate used for recording. The sample rate should be set to the highest value the audio device supports.

3.5.3 Video in

These determine what happens when you record video.

- **Record driver**
  This is used for recording video in the Record window. It may be configured the same as the Record Driver for video if the audio and video are wrapped in the same container. Available parameters vary depending on the driver. Note that the drivers available are the as those available in Preferences->Playback. See Section 3.3 [Video drivers], page 21.
- **Frames to record to disk at a time**
  Frames are recorded in a pipeline. First, frames are buffered in the device. Then, they are read into a larger buffer for writing to disk. The disk writing is done in a separate thread from the device reading. For certain codecs the disk writing uses multiple processors. The value set here determines how many frames are written to disk at a time.
- **Frames to buffer in device**
  This is the number of frames to store in the device before reading and determines how much latency there can be in the system before frames are dropped.
- **Use software for positioning information**
  Video uses audio for synchronization, but most soundcards do not give accurate position information. Selecting this options makes Cinelerra calculate an estimation of audio position in software instead of hardware for synchronization.
- **Sync drives automatically**
  For high bitrate recording, the disk drives you use may be fast enough to store the data but your operating system may wait several minutes and stall as it writes several minutes of data at a time. This forces the operating system to flush its buffers every second instead of every few minutes to produce slightly better real-time behavior.
- **Size of captured frame**
  This is the size of the recorded frames in pixels. It is independent of the project frame size

because most video devices only record a fixed frame size. If the frame size given here is not supported by the device, Cinelerra may crash.

- **Frame rate for recording**
  The frame rate recorded is different from the project settings. This sets the recorded frame rate.

3.6 Performance

You will spend most of your time configuring this section. The main focus of the performance section is rendering parameters not available in the rendering dialog.

- **Cache items**
  To speed up rendering, several assets are kept open simultaneously. This determines how many are kept open. A number too large may exhaust your memory pretty fast and result in a crash. A number too small may result in slow playback as assets need to be reopened more frequently.
- **Seconds to preroll renders**
  Some effects need a certain amount of time to settle in. Checking this option sets a number of seconds to render without writing to disk before the selected region is rendered. When using the renderfarm, you will sometimes need to preroll to get seemless transitions between the jobs. Every job in a renderfarm is prerolled by this value. This does not affect background rendering, however. Background rendering uses a different preroll value.
- **Force single processor use**
  Cinelerra tries to use all processors on the system by default, but sometimes you will only want to use one processor, like in a renderfarm client. This forces only one processor to be used. In addition, the operating system usually uses the second processor for disk access. So this option is really a 1.25 processor mode. The value of this parameter is used in renderfarm clients.

3.6.1 Background rendering

Background rendering was originally conceived to allow HDTV effects to be displayed in real-time. Background rendering causes temporary output to be rendered constantly while the timeline is being modified. The temporary output is displayed during playback whenever possible. This is useful for transitions and previewing effects that are too slow to display in real time. If a renderfarm is enabled, the renderfarm is used for background rendering. This gives you the potential for real-time effects if enough network bandwidth and CPU nodes exist.

Background rendering is enabled in the **Performance** tab of the **Preferences** window. It has one interactive function **Settings menu -> Set background render**. This sets the point where background rendering starts up to the position of the insertion point. If any video exists, a red bar appears in the time ruler showing what has been background rendered.

It is often useful to insert an effect or a transition and then select **Settings menu -> Set background render** right before the effect to preview it in real time and full framerates.

- **Frames per background rendering job**
  This only works if a renderfarm is being used; otherwise, background rendering creates a single job for the entire timeline. The number of frames specified here is scaled to the relative CPU speed of rendering nodes and used in a single renderfarm job. The optimum number is 10 - 30 since network bandwidth is used to initialize each job.
- **Frames to preroll background**
  This is the number of frames to render ahead of each background rendering job. Background rendering is degraded when preroll is used since the jobs are small. When using background rendering, this number is ideally 0. Some effects may require 3 frames of preroll.

- **Output for background rendering**
  Background rendering generates a sequence of image files in a certain directory. This parameter determines the filename prefix of the image files. It should be on a fast disk, accessible to every node in the renderfarm by the same path. Since hundreds of thousands of image files are usually created, `ls` commands will not work in the background rendering directory. The 🔍 browse button for this option normally will not work either, but the 🔧 configuration button for this option works.
- **File format**
  The file format for background rendering has to be a sequence of images. The format of the image sequences determines the quality and speed of playback. JPEG is good most of the time.

3.6.2 Renderfarm

To use the renderfarm, set these options. Ignore them for a standalone system

- **Use render farm for rendering**
  When selected, all the **file->render** operations use the renderfarm.
- **Nodes**
  Displays all the nodes on the renderfarm and shows which ones are active. Nodes are added by entering the host name of the node, verifying the value of **port** and selecting **add node**. If you have hundreds of nodes, experienced users may be better off editing the '`~/.bcast/.Cinelerra_rc`' file rather than using configuration dialog. Remember that '`.Cinelerra_rc`' is overwritten whenever a copy of Cinelerra exits.
  Once nodes are created, select the **ON** column to activate and deactivate nodes. Nodes may be edited by highlighting a row and hitting **apply changes**.
- **Hostname**
  Edit the hostname of an existing node or enter the hostname of a new node here.
- **Port**
  Edit the port number of an existing node or enter the port number of a new node here.
- **Apply changes**
  When editing an existing node, select this to commit the changes to **hostname** and **port**. The changes will not be committed if you do not click this button.
- **Add node**
  Create a new node with the **hostname** and **port** settings.
- **Delete node**
  Deletes whatever node is highlighted in the **nodes** list.
- **Sort nodes**
  Sorts the **nodes** list based on the hostname.
- **Reset rates**
  This sets the framerate for all the nodes to 0. Frame rates are used to scale job sizes based on CPU speed of the node. Frame rates are calculated only when renderfarm is enabled.
- **Total jobs to create**
  Determines the number of jobs to dispatch to the renderfarm. The more jobs you create, the more finely balanced the renderfarm becomes.
  You can determine the total jobs to create by multiplying the number of nodes including the master node by some number. Multiply them by 1 to have one job dispatched for every node. Multiply them by 3 to have 3 jobs dispatched for every node. If you have 10 slave nodes and one master node, specify 33 to have a well balanced renderfarm.

3.7 Interface

These parameters affect purely how the user interface works.

- **Time format**
  Various representations of time are given. Select the most convenient one. The time representation can also be changed by CTRL clicking on the timebar.
- **Index files go here**
  Back in the days when 4 MB/sec was extremely fast for a hard drive, index files were introduced to speed up drawing the audio tracks. This option determines where index files are placed on the hard drive.
- **Size of index file**
  This determines the size of an index file. Larger index sizes allow smaller files to be drawn faster, while slowing down the drawing of large files. Smaller index sizes allow large files to be drawn faster, while slowing down small files.
- **Number of index files to keep**
  To keep the index directory from becoming unruly, old index files are deleted. This determines the maximum number of index files to keep in the directory.
- **Delete existing indexes**
  When you change the index size or you want to clean out excess index files, this deletes all the index files.
- **Use thumbnails**
  The Resource Window displays thumbnails of assets by default. Drawing asset thumbnails can take a while. This option disables thumbnail drawing.
- **Dragging edit boundaries does what**
  Cinelerra not only allows you to perform editing by dragging edit boundaries, but also defines three separate operations that occur when you drag an edit boundary. Here you can select the behavior of each mouse button. The usage of each editing mode is described in the editing chapter. See Section 7.10 [Trimming], page 58.
- **Min dB for meter**
  Some sound sources have a lower noise threshold than others. Everything below the noise threshold is meaningless. This option sets the meters to clip below a certain level. Consumer soundcards usually bottom out at -65. Professional soundcards bottom out at -90. See Chapter 11 [Sound level meters window], page 81.
- **Max dB for meter**
  This sets the maximum sound level represented by the sound meters. No matter what this value is, no soundcard can play sound over 0 dB. This value is presented merely to show how far over the limit a sound wave is. See Chapter 11 [Sound level meters window], page 81.
- **Theme**
  Cinelerra supports variable themes. Select one here and restart Cinelerra to see it.

3.8 About window

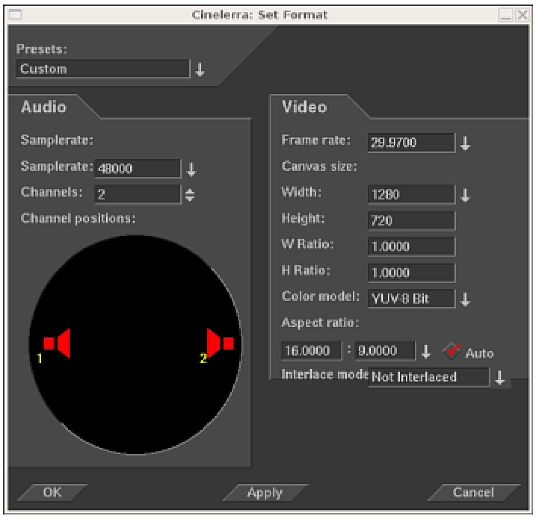
This section gives you information about the copyright, the time of the current build, the lack of a warranty, and the versions of some of the libraries. Be sure to agree to the terms of the lack of the warranty.

4 Project attributes

4.1 Set format window

When you play media files in Cinelerra, the media files have a certain number of tracks, a certain frame size, a certain sample size, and so on and so forth. No matter what attributes the media file has, it is played back according to the project attributes. So, if an audio file's sample rate is different than the project attributes, it is resampled. In like fashion, if a video file's frame size is different than the project attributes, the video is composited on a black frame, either cropped or bordered with black.

The project attributes are adjusted in **Settings->Set Format** and to a lesser extent in **File->New**. When you adjust project settings in **File->New**, a new, empty timeline is created. Every timeline created from this point on uses the same settings. When you adjust settings in **Settings->Format**, media on the timeline is left unchanged. Also, every timeline created from this point uses the same settings.


Cinelerra: Set Format

Presets: Custom

Audio

Samplerate:

Samplerate: 48000

Channels: 2

Channel positions:

Video

Frame rate: 29.9700

Canvas size:

Width: 1280

Height: 720

W Ratio: 1.0000

H Ratio: 1.0000

Color model: YUV-8 Bit

Aspect ratio:

16.0000 : 9.0000 Auto

Interlace mode Not Interlaced

Set Format window

In addition to the traditional settings for sample rate, frame rate, frame size, Cinelerra uses some unusual settings like **channel positions, color model, and aspect ratio.**

4.2 Presets

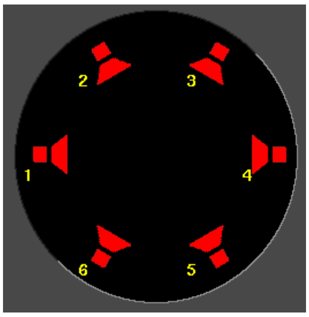
Select an option from this menu to have all the project settings set to one of the known standards.

4.3 Audio attributes

- **Tracks**

  Sets the number of audio tracks for the new project. Tracks can be added or deleted later, but options are provided here for convenience.
- **Samplerate**
  Sets the samplerate of the audio. The project samplerate does not have to be the same as the media sample rate that you load. Media is resampled to match the project sample rate.
- **Channels**
  Sets the number of audio channels for the new project. The number of audio channels does not have to be the same as the number of tracks.

- **Channels positions**
  The currently enabled audio channels and their positions in the audio panning boxes in the track patchbay are displayed in the channel position widget.



The channel position widget

The channels are numbered. When rendered, the output from channel 1 is rendered to the first output track in the file or the first soundcard channel of the soundcard. Later channels are rendered to output tracks numbered consecutively.

The audio channel positions correspond to where in the panning widgets each of the audio outputs is located. The closer the panning position is to one of the audio outputs, the more signal that speaker gets. Click on a speaker icon and drag to change the audio channel location.

The speakers can be in any orientation. A different speaker arrangement is stored for every number of audio channels since normally you do not want the same speaker arrangement for different numbers of channels.

Channel positions is the only setting that does not affect the output necessarily. It is merely a convenience, so that when more than two channels are used, the pan controls on the timeline can distinguish between them. It has nothing to do with the actual arrangement of speakers.

Different channels can be positioned very close together to make them have the same output.

See Section 7.3 [Panning audio tracks], page 52.

4.4 Video attributes

- **Tracks**
  Sets the number of video tracks the new project is assigned. Tracks can be added or deleted later, but options are provided here for convenience.
- **Framerate**
  Sets the framerate of the video. The project framerate does not have to be the same as an individual media file frame rate that you load. Media is reframed to match the project framerate.
- **Canvas size**
  Sets the size of the video output. In addition, each track also has its own frame size. Initially, the **New Project** dialog creates video tracks whose size match the video output. The video track sizes can be changed later without changing the video output. See Section 6.1.4 [The track popup menu], page 45.
- **Aspect ratio**
  Sets the aspect ratio. The aspect ratio is applied to the video output. The aspect ratio can be different than the ratio that results from the formula: h / v (the number of horizontal pixels divided into the number of vertical pixels). If the aspect ratio differs from the results of the formula above, your output will be in non-square pixels.
- **Auto aspect ratio**
  If this option is checked, the **New Project** dialog always recalculates the **Aspect ratio** setting based upon the given **Canvas size**. This ensures pixels are always square.

- **Color model**
  The project will be stored in the color model video intermediates selected in the dropdown. Color model is very important for video playback because video has the disadvantage of being very slow. Although it is not noticeable, audio intermediates contain much more information than the audio on disk and the audio which is played. Audio always uses the highest bandwidth intermediate because it is fast.
  Video intermediates must use the least amount of data for the required quality because it is slow, but video intermediates still use a higher bandwidth color model than video which is stored and video which is played. This allows more processing to be done with less destruction of the original data.
  The video is stored on disk in one colormodel, usually a YUV derivative. When played back, Cinelerra decompresses it from the file format directly into the format of the output device. If effects are processed, Cinelerra decompresses the video into an intermediate colormodel first and then converts it to the format of the output device. The selection of an intermediate colormodel determines how fast and accurate the effects are.
  Cinelerra colormodels are described using a certain packing order of components and a certain number of bits for each component. The packing order is printed on the left and the bit allocation is printed on the right.

  - **RGB-888**
    This allocates 8 bits for the R, G, and B channels and no alpha. This is normally used for uncompressed media with low dynamic range.
  - **RGBA-8888**
    This allocates an alpha channel to the 8 bit RGB colormodel. It is used for overlaying multiple tracks.
  - **YUV-888**
    This allocates 8 bits for Y, U, and V. This is used for low dynamic range operations in which the media is compressed in the YUV color space. Most compressed media is in YUV and this derivate allows video to be processed fast with the least color degradation.
  - **YUVA-8888**
    This allocates an alpha channel to the 8 bit YUV colormodel for transparency.
  - **RGB-Float**
    This allocates a 32 bit float for the R, G, and B channels and no alpha. This is used for high dynamic range processing with no transparency.
  - **RGBA-Float**
    This adds a 32 bit float for alpha to RGB-Float. This is used for high dynamic range processing with transparency.

  In order to do effects which involve alpha channels, a colormodel with an alpha channel must be selected. These are RGBA8888, YUVA8888, and RGBA Float. The 4 channel colormodels are slower than 3 channel colormodels, with the slowest being RGBA Float. Some effects, like fade, work around the need for alpha channels while other effects, like chromakey, require an alpha channel to do anything, so it is a good idea to try the effect without alpha channels to see if it works before settling on an alpha channel and slowing it down.
  When using compressed footage, YUV colormodels are usually faster than RGB colormodels. They also destroy fewer colors than RGB colormodels. If footage stored as JPEG or MPEG is processed many times in RGB, the colors will fade whereas they will not fade if processed in YUV.
  Years of working with high dynamic range footage have shown floating point RGB to be the best format for high dynamic range. 16 bit integers were used in the past and were too

lossy and slow for the amount of improvement.
RGB float does not destroy information when used with YUV source footage and also supports brightness above 100%. Be aware that some effects, like Histogram, still clip above 100% when in floating point.

5 Loading and saving files

5.1 Supported file formats

Here are most of the supported file formats that can be loaded and redered to, with notes regarding their compression. You may be able to load other formats not described here.
The format of the file affects what Cinelerra does with it. Edit decision lists stored in XML save the project settings. Formats which contain media but no edit decisions just add data to the tracks. If your project sample rate is 48 kHz and you load a sound file with 96khz, you will still be playing it at 48 kHz. If you load an EDL file at 96khz and the current project sample rate is 48 kHz, you will change it to 96 kHz.
Some file formats are very slow to display on the timeline. These usually have video which is highly compressed. Drawing highly compressed video thumbnails on the timeline (picons) can be very slow. Disable picon drawing for these files with the **draw media** toggle in the patchbay to speed up operations.

Supported file formats that Cinelerra can import and export are currently:

5.1.1 Quicktime

Quicktime is not the standard for UNIX but we use it because it is well documented. All of the Quicktime movies on the internet are compressed. Cinelerra supports some compressed Quicktime movies. If Cinelerra crashes when loading a Quicktime movie, it is most likely because the format was not supported.
Quicktime is a container for two streams, a video stream and an audio stream. These streams are compressed using separate encoding schemes. The preferred encoding for Quicktime output is MPEG-4 Video and MPEG-4 Audio. This format is compatible in the commercial players for Windows, has good compression quality and good output quality. For better compression, use H-264 video. Unfortunately H-264 decoding is so slow it can not play very large frame sizes.
Cinelerra supports two non-standard codecs: Dual MPEG-4 video and Dual H.264 video. These will not play in anything but Cinelerra and XMovie. They are designed for movies where the frames have been divided into two fields, each field displayed sequentially. The dual codecs interleave two video streams to improve efficiency without requiring major changes to the player.

5.1.2 MPEG-4 audio

This is the same as Quicktime with MPEG-4 Audio as the audio codec.

5.1.3 Still images

5.1.3.1 Loading still images

You can load still images on video tracks just like you do for any video file.
Supported file formats are mainly: PNG, TIF, TGA or JPG, EXR, raw digital camera images.

When loaded on the timeline, by default the image takes up one frame in length. To view the image, zoom in time (DOWN ARROW) on the timeline so you can see the single frame.
To extend the length of the image, drag its boundaries just as you would do with regular video media.
You can drag the boundaries of a still image as much as you want. Images in Cinelerra have the ability to be dragged to an infinite length.
Cinelerra lets you define the initial duration of the loaded images. The parameter is set in the **Images** section of the **Settings->Preferences->Recording window**.

Unless your original material comes from a digital source (like a digital photo camera), the first thing you have to do before you can use it is to somehow capture the assets into a usable

digital medium.
For old photos, paper maps, drawings or diagrams, you might have to scan them into a file format like PNG, TIF, TGA or JPG files by using a digital scanner. You might want to use Gimp to post-process the images, clean damaged areas or color correct the assets.
If your assets come from a digital source like a digital camera or a screen capture, be sure to capture the material using the best resolution possible. This will allow you to get the best quality output from your Cinelerra project.

Rendering a video to a single image causes the final image file to be overwritten for every timeline position. The rendered file is a single still image of the last frame of the video. No table of contents is created. See Section 5.1.4 [Images sequence], page 37.

5.1.3.2 Still images size

Imported images always stay at their original size. Therefore, you may need to scale your pictures before importing them in Cinelerra.
For resizing your picture to fit the project size you can use Imagemagick (http://www.imagemagick.org/script/index.php)
Example:

```
convert inputfile.jpg -resize 720x576 outputfile.jpg
```

You have to take into account the aspect ratio of your video. For example, PAL images aspect ratio is 4/3, but 720x576 is 5/4. For your imported images to be displayed correctly, you have to rescale their horizontal size:
new horizontal size=(5/4)/(4/3) x original horizontal size
For PAL videos, you have to multiply the horizontal size of the pictures you want to import by a factor of 0.9375.
Here is a small shell script which, when ran from a folder containing jpg images, resize those images and put the new images in a ‘resized’ folder:
Note: Make sure you have installed Imagemagick which provides the functions ’identify’ and ’convert’ used in the script.

```
#/bin/sh
mkdir resized
for element in ‘ls . | grep -i ’\.jpe*g$\’‘;
do
    size=‘identify ${element}‘
    width=‘echo ${size} | sed ’+s+.*JPEG ++’ | sed ’+s+x.*++’‘
    height=‘echo ${size} | sed ’+s+.*JPEG [0-9]*x++’ | sed ’+s+DirectClass.*++’‘
    let new_width=${width}*9375/10000
    convert -resize "${new_width}x${height}!" -quality 100 ${element} resized/${element}
done
```

When the size of your image is different from the size of your project, but the ratio is the same, you might want to keep the image at its original size, to load it on a dedicated track and adjust the display of it with the camera zoom. See Section 8.2.1 [The camera and projector], page 62.

5.1.3.3 Open EXR images

You may not know about Open EXR. This format stores floating point RGB images. It also supports a small amount of compression.

Projects which render to EXR should be in a floating point color model to take advantage of the benefits of EXR. See Chapter 4 [Project attributes], page 31.

Several compression options are available for EXR.

- **PIZ:** Lossless wavelet compression. This is the best compression.
- **ZIP:** Lossless gzip algorithm.
- **RLE:** Lossless run length encoding. This is the fastest, but worst compression.
- **PXR24:** Lossy compression where the floating point numbers are converted to 24 bits and compressed with gzip.

Select **Use Alpha** if the project colormodel has an alpha channel and you want to retain it in the file. Otherwise the primary colors are multiplied by the alpha channel.

5.1.3.4 Raw digital camera images

RAW digital camera images are a special kind of image file that Cinelerra only imports.
Once they are on the timeline, these must be processed in a floating point color space. Raw images from Canon cameras are the only ones tested. They need to have the **Gamma** effect applied to correct gamma. Because raw images take a long time to interpolate, they are usually viewed first in a proxy file and then touched up.

First apply the Gamma effect to a track of raw images and set it to **automatic** with **0.6** gamma. Then render the timeline to a Quicktime JPEG file. Append the Quicktime JPEG file in a new track and disable playback of the old track. Now the gamma corrected copy of each raw image can be previewed relatively fast in the same timeline position as the original image.

5.1.4 Images sequence

An images sequence is a series of ordered still pictures (e.g. the frames of an animated scene). They can be loaded as multiple files.

An image sequence can be represented in Cinelerra also by an image list file, called also Table Of Contents file (TOC). A TOC is a text file with a specific format containing absolute paths to every frame in the sequence plus additional information like image resolution, fileformat and sequence framerate. To get better performance, the table of contents can be loaded as a single asset instead of the individual images. A TOC is not a media file but it behaves like a video clip.

Cinelerra creates TOC files by rendering to "Images sequence".
When rendering a video to an images sequence Cinelerra creates a different image file for every timeline position and generates a TOC for this images sequence. This is useful to split video into frames as single stills.
When rendering a series of stills to an images sequence Cinelerra generates a TOC for the images sequence but also creates a different image file for every still. The source files are copied and renamed. The TOC file contains the paths to the new files. This is useful only when you want to create a list and change the format of your source files.
For creating a TOC file without creating new image files you can use external list generators like IMG2LIST 0.1.5. (by Claudio "malefico" Andaur) or Seven Gnomes (by Peter Semiletov). See `http://cvs.cinelerra.org/user-tips.php`.

Cinelerra can create TOCs with the following formats: JPEG, PNG, EXR, TIFF, TGA.
Images lists can be edited manually.

5.1.5 AVI

Because AVI (Audio-Video Interleave) is so fragmented with varied audio and video codecs, you may not be able to play all AVI formatted files.

5.1.6 MPEG files containing video

MPEG files containing video can be loaded directly into Cinelerra. If the file is supported, a table of contents is built. If the file is unsupported, it usually crashes or shows very short tracks. Unfortunately, this method of loading MPEG files is not good enough if you intend to use the files in a renderfarm.

To use MPEG files in a renderfarm, you need to run mpeg3toc in order to generate a table of contents for the file and then load the table of contents. mpeg3toc needs the absolute path of the MPEG file. If you do not use an absolute path, it assumes that the MPEG file is in the same directory that Cinelerra is run from.

MPEG streams are structured into multiple tracks. Each track can be video or audio. Each audio track can have 1-6 channels. Cinelerra converts each channel of audio into a track.

Notes on mpeg video encoding:

MPEG video encoding is done separately from MPEG audio encoding. In MPEG video there are two colormodels. The YUV 4:2:0 colormodel is encoded by a highly optimized version of mpeg2enc with presets for standard consumer electronics. In the process of optimizing mpeg2enc, they got rid of YUV 4:2:2 encoding. The YUV 4:2:2 colormodel is encoded by a less optimized version of mpeg2enc.

YUV 4:2:2 encoding was kept around because the NTSC version of DV video loses too much quality when transferred to YUV 4:2:0. This DV video must be transferred to YUV 4:2:2.

When encoding YUV 4:2:0, the bitrate parameter changes meaning depending on whether the bitrate or quantization is fixed. If the bitrate is fixed, it is the target bitrate. If the quantization is fixed, it is the maximum bitrate allowed. This is a quirk of the mpeg2enc version.

5.1.7 DVD movies

DVD are split into a number of programs, each identified by a unique 'IFO' file. If you want to load a DVD, find the corresponding 'IFO' file for the program of interest. Load the IFO file directly and a table of contents will be built. Alternatively for renderfarm usage, a table of contents can be created separately.

Run: `mpeg3toc -v /cdrom/video_ts/vts_01_0.ifo dvd.toc`
or something similar. Then load 'dvd.toc'.

5.1.8 MPEG 1 audio

MPEG 1 audio files have .mp2 and .mp3 extension. If the files are encoded using a fixed bitrate, they can be loaded directly on Cinelerra. Otherwise a table of contents (TOC) needs to be created and loaded as resources in place of the audio file. If you know your audio stream has variable bitrate or if you see Cinelerra can't seek and playback your file properly, you must create the TOC using mpeg3toc.

Here is an example of command:

```
mpeg3toc -v /path/to/myfile.mp3 myfile.toc
```

'myfile.toc' is the Table of Contents that can be loaded as resource.

The path should be absolute unless you plan to always keep your .xml in the same directory as the filename. For renderfarms the filesystem prefix should be / and the movie directory mounted under the same directory on each node.

5.1.9 Ogg Theora/Vorbis

The OGG format is an antiquated but supposedly unpatented way of compressing audio and video. The quality is not as good as H.264 or MPEG-4 Audio. In reality, anyone with enough money and desire can find a patent violation so the justification for OGG is questionable.

5.1.10 Edit decision list

Edit decision lists are generated by Cinelerra for storing projects. EDL files end in .xml. When loaded, they change the attributes of the current project. Because edit decision lists consist of text, they can be edited in a text editor.

5.1.11 WAV

FIXME

5.1.12 PCM

FIXME

5.1.13 AIFF

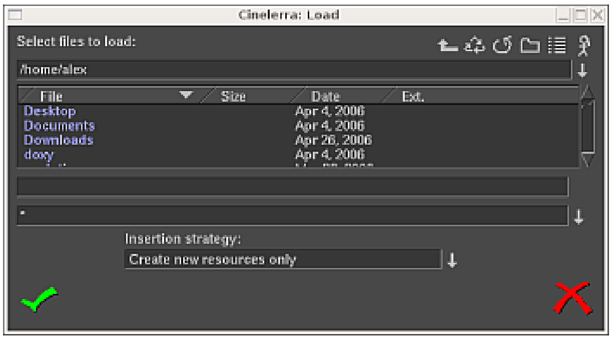
FIXME

5.1.14 AC3 audio

FIXME

5.2 Loading files

All data that you work with in Cinelerra is acquired either by **recording from a device** or by **loading from disk**. This section describes loading.
The loading and playing of files is just as you would expect. Just go to **file->Load Files**, select a file for loading, and click **ok**. Depending on the setting of the Insertion Strategy list box, your file will be either loaded on the Resources Media window or directly on the Program window. In this last case, click the forward play button and it should start playing, regardless of whether a progress bar has appeared.



Select files to load:

/home/alex

File	Size	Date	Ext.
Desktop		Apr 4, 2006	
Documents		Apr 4, 2006	
Downloads		Apr 26, 2006	
doxy		Apr 4, 2006	

*

Insertion strategy:
Create new resources only

The Load window

If the file is a still image, the project's attributes are not changed and the first frame of the track becomes the image. If the file has audio, Cinelerra may build an index file in order to speed up drawing. You can edit and play the file while the index file is being built.

5.2.1 Insertion strategy

Usually, three things happen when you load a file:

1. the existing project is cleared from the screen
2. the project's attributes are changed to match the file's attributes
3. the new file's tracks are created in the timeline

However, Cinelerra lets you change what happens when you load a file.
In the **Load** dialog window go to the **Insertion strategy** box and select one of the options of the drop down menu. Each of these options loads the file a different way.

- **Replace current project**
  All tracks in the current project are deleted and a set of new tracks are created to match the source file. Project attributes are only changed when loading XML. If multiple files are selected for loading, Cinelerra adds a set of new tracks for each file. New resources are created in the Resources Window, replacing the current ones.
- **Replace current project and concatenate tracks**
  Same as replace current project, except that if multiple files are selected, Cinelerra will concatenate the tracks of each file, inserting different source files in the same set of tracks, one after another, in alphanumeric order, starting at 0. New resources are created in the Resources Window, replacing the current ones.
- **Append in new tracks**
  The current project is not deleted and new tracks are created for the source, one set of tracks for each file. New resources are created in the Resources Window
- **Concatenate to existing tracks**
  The current project is not deleted and new files are concatenated to the existing armed tracks, inserted in the same set of tracks of the current project, one after another, in alphanumeric order, starting at the end of the tracks. If the current project has more tracks than the source, the source file will be inserted in the first set of armed tracks. If no tracks are armed, no files will be inserted. New resources are created in the Resources Window
- **Paste at insertion point**
  The file is pasted into the timeline at the insertion point, on the first set of armed tracks. If multiple files are selected for loading, they will be inserted on the same set of tracks, one after the other. New resources are created in the Resources Window
- **Create new resources only**
  The timeline is unchanged and new resources are created in the Resources Window only.

Using these options, you can almost do all your editing by loading files.
The insertion strategy is a recurring option in many of Cinelerra's functions. In each place the options do the same thing.
If you load files by passing command line arguments to Cinelerra, the files are loaded with **Replace current project** rules.

5.2.2 Loading multiple files

In the **Load** dialog go to the list of files. Select a file. Go to another file and select it while holding down CTRL. This selects one additional file. Go to another file and select it while holding down SHIFT. This selects every intervening file. This behavior is available in most list box.
Use this method and the **Concatenate to existing tracks** insertion strategy to create an images slideshow or a song playlist.

5.2.3 Loading files from the command prompt

Another way to load files is to pass the filenames as arguments on the command line.

```
cinelerra myvideo.mov myothervideo.mov
```

This starts the program with all the arguments loaded and creates new tracks for every file.

5.2.4 Filtering files by extension

If there are too many files in your media directory, it can be difficult to find the file you want. For this purpose, the **Load** window allows you to filter which files are displayed in the list box by extension name.
Click the dropdown box (right below the file name text box) and select the file extension of

your media (i.e. mpg, mov, mp3, avi, etc). The file list now shows only files with the selected extension.

5.2.5 Loading other formats

If you can not load a particular kind of video clip and do not have the original source file, you will have to convert it to a format supported by Cinelerra. To convert your file to mpeg2 is a good solution, since Cinelerra load that format without any problem. In that case, you should use ffmpeg to do the convertion. However, the mpeg2 formats requires the video to have specific image size and framerates:

- **PAL** is 720x576 at 25 fps
- **NTSC** is 720x480 at 29.97 (=30000/1001) fps

For input files which do not have those properties, you should use mencoder to convert to MPEG4. You can identify the codecs and container of any video by running the following command:

```
mplayer -identify <your_video_file.xyz>
```

- **Converting with ffmpeg:**
  ```
  ffmpeg -sameq -i original_video.xyz converted_video.mpeg
  ```
  The '`-sameq`' option maintains the original quality.
- **Converting with mencoder:**
  ```
  mencoder original_video.xyz -ovc lavc -lavcopts vcodec=mpeg4:\
  vhq:vbitrate=6000 -oac mp3lame -lameopts br=256:vol=1 \
  -ffourcc DIVX -o converted_video.avi
  ```

5.3 Loading the backup

There is one special XML file on disk at all times. After every editing operation, Cinelerra saves the current project to a backup in '`$HOME/.bcast/backup.xml`'. In the event of a crash, the first thing you should do after restarting Cinelerra is select **File->Load backup** in order to load the backup. This will start Cinelerra at the point in your editing operations directly before the program crashed.

It is important after a crash to restart Cinelerra without performing any editing operations as you will overwrite the backup.

Note that the backup.xml file is always an only file, also when you are working with two instances of Cinelerra open at the same time. In this case, the last operation made in whatever instance will overwrite the backup.

5.4 Saving project files

Cinelerra saves projects as XML files. Go to **File->Save**. Select a file to overwrite or enter a new file. Cinelerra automatically concatenates '`.xml`' to the filename if no '`.xml`' extension is given.

When Cinelerra saves a file, it saves an edit decision list (EDL) of the current project but does not save any media. The saved file consists of text. It contains all the project settings and locations of every edit. Instead of media, the file contains pointers to the original media files on disk. For each media file, the XML file stores either an absolute path or just the relative path. If the media is in the same directory as the XML file, a relative path is saved. If it is in a different directory, an absolute path is saved.

You have to be careful when moving files around: you risk to break the media linkages.

You can keep the media and the XML file in the same directory forever and freely move the whole directory, since relative paths are saved. Alternatively you can save the XML file in a different directory than the media but you can't move the media ever again. In this case you can freely move your XML file around, since absolute paths are saved.

If you saved your XML file in the same directory of your media but you would like to move your project to another location, you can change the paths from relative to absolute by going to **File->Save as...** and entering the new location.
Similarly if you saved your project outside your media directory but you would like to move your media to another location, you can change the paths from absolute to relative by going to **File->Save as...** and saving your XML file in the same directory of the media.
If you want to create an audio playlist and burn it on a CD-ROM, save the XML file in the same directory as the audio files and burn the entire directory. This keeps the media paths relative.

It must be said that since an XML file is a text file, you can always repair broken media linkage by editing the XML file in a text editor. For every media you moved, search for the old path and replace it with the new one. Don't forget to make a backup copy of your XML file before doing any editing!
You can replace the path of every asset whose source file you moved also within the program, by entering the new location in the **Asset info** window. To open this window, right click on the asset in the Resources window and choose **Info...** in the popup menu. Directly type the path in the first field of the dialog or click on the magnifier on the right to browse your files. Operating from the GUI is convenient only when a very small number of changes is needed.

XML files are useful in saving the current state of Cinelerra before retiring from an editing session.
XML files are specific to Cinelerra only. You can not play XML files in a dedicated movie player.
Real-time effects in an XML file have to be re-synthesized every time you play it back.
The XML file also requires you to maintain copies of all the source assets on hard disk, which can take up space and cost a lot of electricity to spin. Render your projects to a final format for more persistent storage of the output.

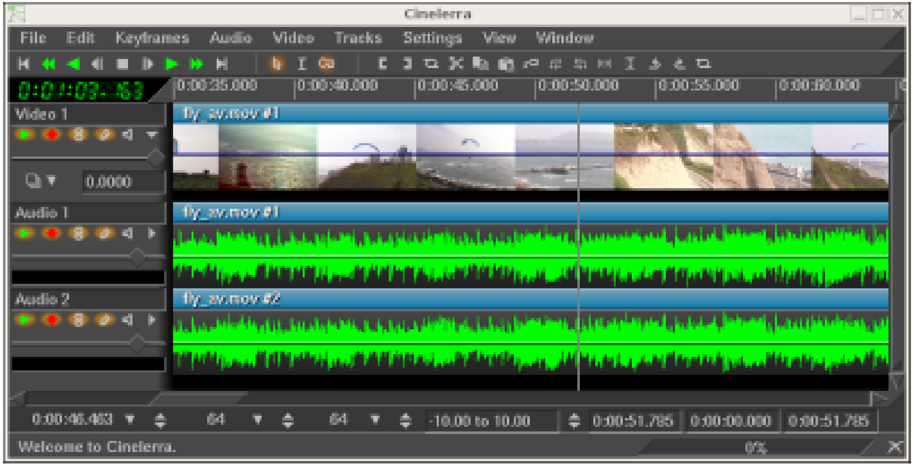
5.5 Merging projects

To merge several separate projects into one big one :

1. Open Cinelerra
2. Load project A
3. Open a second copy of Cinelerra
4. Load project B
5. Cut and paste from A to B

6 Program window

This window contains the timeline and the entry point for all menu driven operations. The timeline consists of a vertical stack of tracks with a horizontal representation of time. This defines the output of rendering operations and what is saved when you save files. To the left of the timeline is the patchbay which contains options affecting each track.



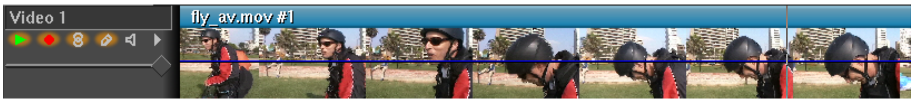
The timeline

Under the **Window** menu, you will find options that affect the main windows. **Default positions** repositions all the windows to a 4 screen editing configuration. On dual headed displays, the **Default positions** operation fills only one monitor with windows.

6.1 Navigating the program window

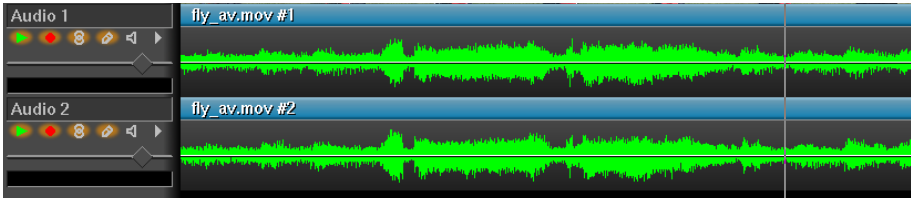
The program window contains many features for navigation and displays the timeline as it is structured in memory: tracks stacked vertically and extending across time horizontally. The horizontal scroll bar allows you to scan across time. The vertical scroll bar allows you to scan across tracks.

6.1.1 Video and audio tracks



A video track

Video tracks represent the duration of your videos and clips, just as if you placed real photographic film stock end-to-end on a table. The individual images you see on the track are samples of what is located at that particular instant on the timeline.



An audio track

Audio tracks represent your sound media as an audio waveform. Following the film analogy, it would be as if you "viewed" magnetic tape horizontally on your table.

You can adjust the horizontal and vertical magnification of the tracks and the magnification of the audio "waveform" display using the **zoom panel bar** controls.
Every track on the timeline has a set of attributes on the left, called the **patch bay**. It is used to control the behavior of the tracks. The most important attribute is **arm track**.

6.1.2 Track navigation

Track Navigation involves both selecting a specific audio or video track and moving to a certain time in the track. The program window contains many features for navigation and displays the timeline as it is structured in memory.

The vertical scroll bar allows you to scan across tracks. For vertical scrolling you can use also the mouse wheel.

The horizontal scroll bar allows you to scan across time. For horizontal scrolling you can use also the mouse wheel with the CTRL key.

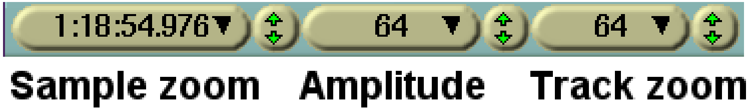
In addition to the graphical tools, you may also use the keyboard to navigate. As a general rule, keyboard navigation is faster than navigation with a mouse. Use PAGE UP and PAGE DOWN to scroll up and down the tracks.

You will often need to scroll beyond the end of the timeline, but the scrollbars will not let you do it. Instead, use the RIGHT arrow to scroll past the end of timeline.

Use the HOME and END keys to instantly go to the beginning or end of the timeline. In **I-beam** mode, hold down SHIFT while pressing HOME or END in order to select the region of the timeline between the insertion point and the key pressed.

6.1.3 The zoom panel

Below the timeline, you will find the zoom panel. The zoom panel contains values for **sample zoom** (duration visible on the timeline), **amplitude** (audio waveform scale), **track zoom** (height of tracks in the timeline), and **curve zoom**(automation range). In addition to the scrollbars, these zooms are the main tools for positioning the timeline.



Changing the **sample zoom** causes the unit of time displayed in the timeline to change size. It allows you to view your media all the way from individual frames to the entire length of your project. The higher the setting, the more frames you can see per screen. The sample zoom value is not an absolute reference for the unit of time since it refers to the duration visible on the timeline and thus changes also as you modify the length of the program window horizontally.
Use the *UP* and *DOWN* arrows to change the sample zoom by a power of two.
If your mouse has a wheel and it works in X11, mouse over the tumblers and use the wheel to zoom in and out.

The **amplitude** only affects audio. It determines how large the waveform appears.
CTRL-UP and *CTRL-DOWN* cause the amplitude zoom to change.

The **track zoom** affects all tracks. It determines the height of each track. If you change the track zoom, the amplitude zoom compensates so that the audio waveforms look proportional.
CTRL-PGUP and *CTRL-PGDOWN* cause the track zoom to change.

The **curve zoom** affects the curves in all the tracks of the same type. It determines the value range for curves. First select the automation type (audio fade, video fade, zoom, X,Y) then use the left tumblers for the minimum value and the right tumblers for the maximum value or manually enter the values in the text box. Normally you will use -40.0 to 6.0 for audio fade and 0.0 to 100.0 for video fade. See Section 7.1 [The patchbay], page 49.
The tumblers changes curve amplitude, but the only way to curve offset is to use the **fit curves** button I.
ALT-UP and *ALT-DOWN* cause the curve amplitude to change.

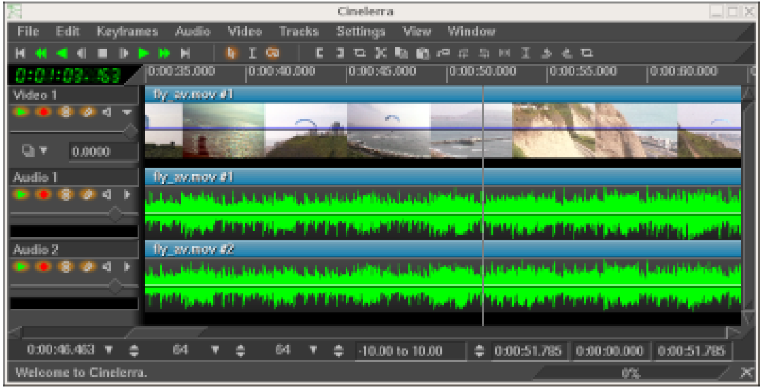
6.1.4 The track popup menu

Each Track has a popup menu. To activate the **track popup menu**, RIGHT-click on the track. The popup menu affects the track whether the track is armed on the **patch bay** or not. The Track Menu contains a number of options:

- Attach Effect - opens a dialog box of effects applicable to the type of track (audio/video)
- Move up - moves the selected track one step up in the stack.
- Move down - moves the selected track one step down in the stack.
- Delete track - removes the track from the timeline
- Add Track - adds a track of the same media type (audio/video) as the one selected.
- Resize Track - resizes the track
- Match Output Size - resizes the track to match the current output size

6.1.5 The insertion point

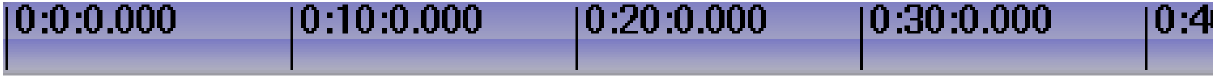
The insertion point is the flashing hairline mark that vertically spans the timeline in the program window. Analogous to the cursor on your word processor, the insertion point marks the place on the timeline where the next activity will begin. It's the point where a paste operation takes place. When rendering, it defines the beginning of the region of the timeline to be rendered. It is also the starting point of all playback operations.



Welcome to Cinelerra.

The insertion point on the main window,
represented as a vertical hair-line at the 00:00.500 point

Normally, the insertion point is moved by clicking inside the main timebar. Any region of the timebar not obscured by labels and in or out points is a hotspot for repositioning the insertion point. In cut and paste editing mode only, the insertion point can be moved also by clicking in the timeline itself.



The main timebar

When moving the insertion point the position is either aligned to frames or aligned to samples. When editing video, you will want to align to frames. When editing audio you will want to align to samples. Select your preference by using **Settings->Align cursor on frames**.

6.1.6 Editing modes

Editing modes are two different methods of operation that affect the insertion point and the editing on the timeline.
They are:

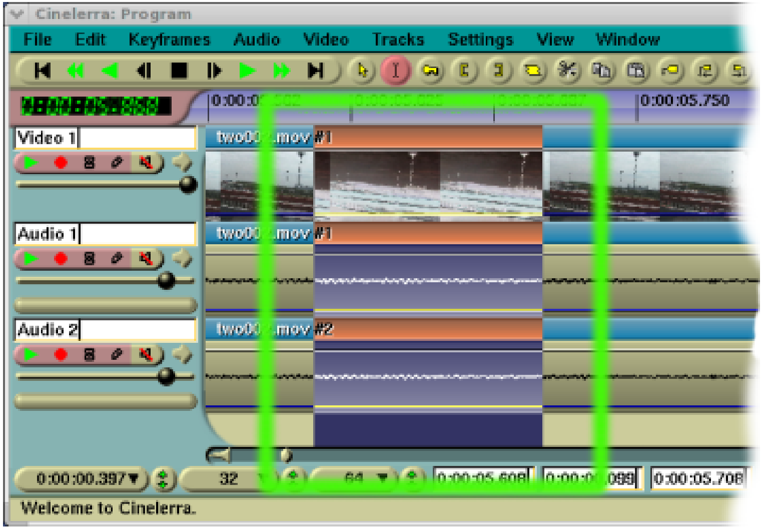
- drag and drop mode
- cut and paste mode

The editing mode is determined by selecting the arrow or the i-beam in the buttonbar. Alternatively you can use E as a keyboard shortcut to toggle between modes.

The editing mode buttons

If the arrow is highlighted, it enables **drag and drop mode**.
In drag and drop mode, clicking in the timeline does not reposition the insertion point.
Double-clicking in the timeline selects the entire edit the mouse pointer is over.
Dragging in the timeline repositions the edit the mouse pointer is over. This is useful for reordering audio playlists, sorting movie scenes, moving effects around.
To cut and paste in drag and drop mode you need to set **in/out points** to define an affected region. See Section 6.1.7 [The in/out points], page 46.
See Section 7.8 [Drag and drop editing], page 54.

If the i-beam is highlighted it enables **cut and paste mode**.
In cut and paste mode, clicking in the timeline repositions the insertion point.
Double-clicking in the timeline selects the entire edit the cursor is over.
Dragging in the timeline highlights a region. The highlighted region becomes the region affected by cut and paste operations and the playback range during the next playback operation. SHIFT-clicking in the timeline extends the highlighted region.



Welcome to Cinelerra.

Tracks with highlighted area, shown inside the green outline

When highlighting a region, the start and end points are either aligned to frames or aligned to samples. When editing video, you will want to align to frames. When editing audio you will want to align to samples. Select your preference by using **settings->align cursor on frames**.
See Section 7.9 [Cut and paste editing], page 57.

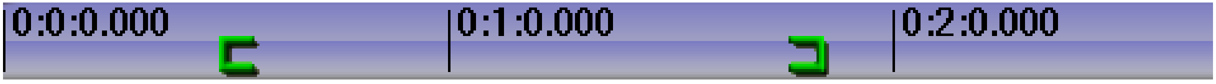
Note: Cinelerra CV revisions 943 and 944 (SVN checkouts from 19 to 21 October 2006) had no editing modes buttons. "Copy and paste" and "Drag and drop" editing modes were merged into one, shift key being differentiation between them. This is the case of the Gentoo ebuild media-video/cinelerra-cvs-20061020.

6.1.7 The in/out points

In both editing modes, you can set one in point and one out point. The in/out points define the affected region. In drag and drop mode, they are the only way to define an affected region. In both cut and paste mode and drag and drop mode, the highlighted area overrides the in/out points. If a highlighted area and in/out points are set, the highlighted area is affected by editing operations and the in/out points are ignored. If no region is highlighted, the in/out points are used. To avoid confusion, it is better to use either highlighting or in/out points but not both simultaneously.

Normally, in/out points do not affect the playback region. The in/out points determine the playback region only if you hold down CTRL while issuing a playback command.

To set in/out points, go to the timebar and position the insertion point somewhere. Select the **in point button**. Move the insertion point to a position after the in point and click the **out point button**. Instead of using the button bar, you can use the [and] keys to toggle in/out points.



Timebar with in/out points set.

If you set the insertion point somewhere else while in/out points already exist, when you click the in/out buttons the existing points will be repositioned.

If you click on in/out points while a region is highlighted, the insertion point will be ignored and in/out points will be set at the beginning and at the end of the highlighted area.

If you select either the in point or the out point, the insertion point will jump to that location. After selecting an in point, if you click the **in point button** the in point will be deleted. After selecting an out point, if you click the **out point button** the out point will be deleted.

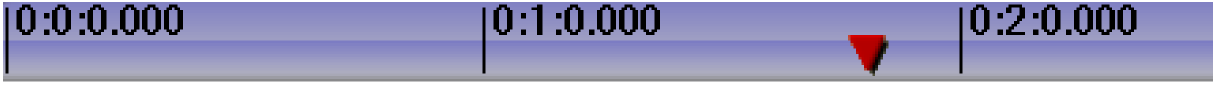
Tip: To quickly get rid of in/out points, without caring about where they are or if they are set or not, just double click on [and] buttons. The first click will set a new point or reposition an old one at the insertion point; the second click will delete it. Obviously this trick does not work if the in point or the out point is already set at insertion point.

SHIFT-clicking on an in/out point highlights the region between the insertion point and that in/out point. If a region is already highlighted, it extends the highlighted region up to that in/out point.

The insertion point and the in/out points allow you to define an affected region, but they do not let you jump to exact points on the timeline very easily. For this purpose there are labels.

6.1.8 Using labels in the program window

Labels are an easy way to set exact locations on the timeline that you want to jump to. When you position the insertion point somewhere and click the **label button**, a new label appears on the timeline.



Timebar with a label on it

No matter what the zoom settings are, clicking on the label highlights it and positions the insertion point exactly where you set the label. Hitting the L key has the same effect as the label button.

Labels can reposition the insertion point when they are selected but they can also be traversed with the **label traversal** buttons. When a label is out of view, the label traversal buttons reposition the timeline so the label is visible. There are keyboard shortcuts for label traversal, too.

CTRL-LEFT repositions the insertion point on the previous label.

CTRL-RIGHT repositions the insertion point on the next label.

With label traversal you can quickly seek back and forth on the timeline.

The **Label** tab of the resources window lists the timestamp of every label. You can edit the label list and add a title for every item using the popup menu. To open the **Label info** dialog right click on the label icon in the Resources window or directly on the label symbol on the timebar.

With labels you can also select regions.

SHIFT-CTRL-LEFT highlights the region between the insertion point and the previous label.

SHIFT-CTRL-RIGHT highlights the region between the insertion point and the next label.

Double-clicking on the timebar between two labels highlights the region between the labels.

SHIFT-clicking on a label highlights the region between that label and the insertion point. If a region is already highlighted, it extends the highlighted region up to that label.

If you hit the label button when a region is highlighted, labels are created at each end of the highlighted region. However, if one end already has a label, then the existing label is deleted.

Hitting the label button again when a label is selected deletes it. Manually hitting the label button or L key over and over again to delete a series of labels can get tedious. To delete a set of labels, first highlight a region. Second, use the **Edit->Clear labels** function. If in/out points exist, the labels between the in/out points are cleared and the highlighted region is ignored.

In Cut and Paste editing mode only, by enabling **Edit labels** in the settings menu, or by disabling the **Lock labels from moving** button on the program toolbar labels will be cut, copied or pasted along with the selected region of the first armed track.
Similarly, if a selected area of a resource is spliced from the viewer to the timeline in a position before labels, these labels will be pushed to the right on the timebar for the length of the selected area.
To prevent labels from moving on the timebar, just disable the **Edit labels** option or enable the **Lock labels from moving** button.
In Drag and Drop editing mode labels will be always locked to the timebar, even with the **Edit labels** option enabled.

7 Editing

Editing comprises both the time domain and the track domain. Since the timeline consists of a stack of tracks, you need to worry about how to create and sort tracks in addition to what time certain media appears on a track.

In the time domain, Cinelerra offers many ways to approach the editing process. The three main methods are two screen editing, drag and drop editing, and cut and paste editing.

There are several concepts Cinelerra uses when editing which apply to all the methods.

The **timeline** is where all editing decisions are represented. This is a stack of tracks in the center of the main window. It can be scrolled up, down, left and right with the scrollbars on the right and bottom of it. It can also be scrolled up and down with a mouse wheel, left and right with a mouse wheel and the CTRL key.

The **active region** is the range of time which is affected by editing commands on the timeline. The active region is determined first by the presence of in/out points in the timeline. If those do not exist the highlighted region is used. If no highlighted region exists the insertion point is used as the start of the active region. Some commands treat all the space to the right of the insertion point as active while others treat the active length as 0 if no end point for the active region is defined.

Finally, editing decisions never affect source material. This is **non destructive editing** and it became popular with audio because it was much faster than if you had to copy all the media affected by an edit. Editing only affects pointers to source material, so if you want to have a media file at the end of your editing session which represents the editing decisions, you need to **render** it. See Chapter 20 [Rendering files], page 141. See Section 5.4 [Saving project files], page 41.

See Section 24.1.1 [Editing Media shortcuts], page 189, for information about the editing controls keyboard shortcuts.

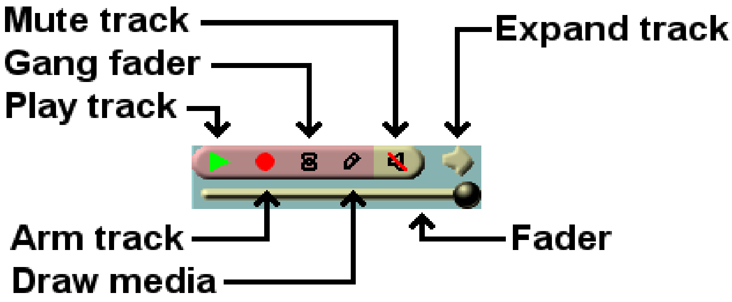
7.1 The patchbay

On the left of the timeline is a region affectionately known as the patchbay. The patchbay enables features specific to each track.

All tracks have a **text area** for naming the track.

All tracks have an **expander** for viewing more options on the patchbay and for viewing the effects represented on the track. Click on the expander to expand or collapse the patchbay and the track. If it is pointing sideways, the track is collapsed. If it is pointing down, the track is expanded. Existing effects appear below the media for the track.

All tracks have the following row of toggles for several features.



Track attributes

If the toggle is colored, the feature is enabled. If the toggle is the background color of most of the windows, it is disabled. Click on the toggle to enable or disable the feature. Several mouse operations speed up the configuration of several tracks at a time.

Click on an attribute and drag the cursor across adjacent tracks to copy the same attribute to those tracks.

Hold down SHIFT while clicking a track's attribute to enable the attribute in the current track and toggle the attribute in all the other tracks.

Hold down SHIFT while clicking an attribute. Click until all the tracks except the selected one are disabled. Then drag the cursor over the adjacent track to enable the attribute in the adjacent track.

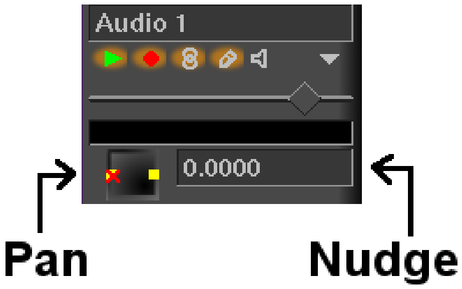
The attributes affect the output of the track:

- **Play track**
  Determines whether the track is rendered or not. If it is off, the track is not rendered. For example if you turn it off in all the video tracks, the rendered media file will have only audio tracks. However, if the track is chained to any other tracks by a shared track effect, the other tracks perform all the effects in this shared track, regardless of play status of the shared track that in this particular case affects the media output but not fade and effects. See Section 14.1 [Realtime effect types], page 87.
- **Arm track**
  Determines whether the track is armed or not. Only the armed tracks are affected by editing operations. Make sure you have enough armed destination tracks when you paste or splice material or some tracks in the material will get left out.
  In addition to restricting editing operations, the armed tracks in combination with the active region determine where material is inserted when loading files. If the files are loaded with one of the insertion strategies which do not delete the existing project, the armed tracks will be used as destination tracks.
  Press TAB while the cursor is anywhere over a track to toggle the track arming status.
  Press *SHIFT-TAB* while the cursor is over a track to toggle the arming status of every other track.
- **Gang fader**
  Causes the fader to track the movement of whatever other fader you are adjusting by dragging either the fader or the curve on the track. It doesn't affect the editing made with menu controls. A fader is only ganged if the **arm track** is also on. This is normally used to adjust audio levels on all the tracks simultaneously. Gang also causes **Nudge** parameters to synchronize across all the ganged tracks.
- **Draw media**
  Determines if picons or waveforms are drawn on the asset in the track. By default, some file formats load with this off while other file formats load with it on. This depends on whether the file format takes a long time to draw on the timeline. Merely set it to on if you want to see picons for any file format.
- **Mute track**
  Causes the output to be thrown away once the track is completely rendered. This happens whether or not **play track** is on. For example if you mute all the video tracks, the rendered media file will have a blank video track.
  Mute track is represented on the timeline with a blue line. Go to **View -> Mute** to make it show. It is a keyframable attribute, but Mute track keyframing is a toggle and it has, unlike curves, only two values: on or off.
  If a track is part of a shared track effect, the output of the track with the shared track effect is overlaid on the final output even though it is routed back to another track (the shared track). Mute track is used to keep the track with the shared track effect from overlapping the output of the source track (the shared track) where the shared track effect is not present. See Section 14.1 [Realtime effect types], page 87.

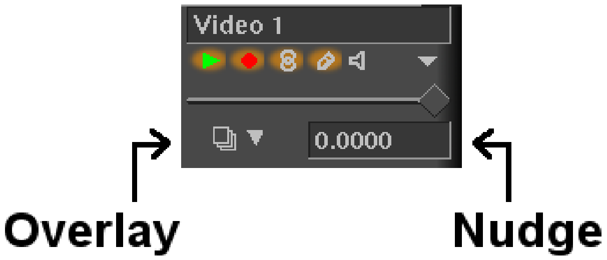
- **Fader**
  Fade values are represented on the timeline with a white curve that is keyframable. All tracks have a fader, but the units of each fader depend on whether it is audio or video.
  Audio fade values are in dB. They represent relative levels, where 0 is the unaltered original sound level, -40 is silence, -80 the minimum value set by default. You can move fader and keyframes down to -80 but the parameter's curve won't go below -40. For your convenience you can set a different fade range with the curve zoom. See Section 6.1.3 [The zoom panel], page 44. Audio faders' main purpose is to "fade out" sound or to lower the sound level smoothly to silence, or "fade in" to make sounds appear gradually instead of suddenly.
  Video fade values are the percentage of opacity of the image in normal overlay mode, the percentage of the layer that is mixed into the render pipeline in the other overlay modes. See Section 8.2.5 [Overlay modes], page 72.
  Click and drag the fader to fade the track in and out. If it is ganged to other tracks of the same media type, with the **arm** option enabled, the other faders should follow. Hold down SHIFT and drag a fader to center it on the original source value (0 for audio, 100 for video).

7.2 Nudging tracks

Each track has a nudge textbox in its patchbay. You may have to expand the track to see it. These are views of the patchbays when expanded.



Pan and nudge for an audio track



Overlay mode and nudge for a video track

The nudge value is the amount the track is shifted left or right during playback. The track is not displayed shifted on the timeline, but it is shifted when it is played back. This is useful for synchronizing audio with video, creating fake stereo, or compensating for an effect which shifts time, all without tampering with any edits.

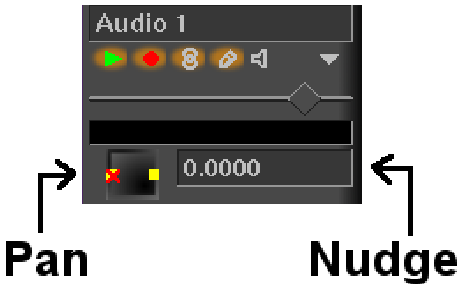
Merely enter the amount of time to shift to instantly shift the track. Negative numbers make the track play later. Positive numbers make the track play sooner. The nudge units are either **seconds** or the native units for the track (**frames** or **samples**). Select the units by **right clicking** on the nudge textbox and using the context sensitive menu.

Nudge settings are ganged with the **Gang faders** toggle and the **Arm track** toggle.

Use the mouse wheel over the nudge textbox to increment and decrement it.

7.3 Panning audio tracks

Audio tracks have a panning box in their patchbays. A patchbay may have to be expanded to see the panning box. The panning box is shown here.



Pan and nudge for an audio track

Position the pointer in the panning box and click/drag to reposition the audio output among the speaker arrangement. The loudness of each speaker is printed on the relative icon during the dragging operation. The panning box uses a special algorithm to try to allow audio to be focused through one speaker or branched between the nearest speakers when more than 2 speakers are used.

7.4 Automatic audio track panning

Several convenience functions are provided for automatically setting the panning to several common standards. They are listed in the **Audio** menu. These functions only affect armed audio tracks. They are:

- **Audio->Map 1:1**
  This maps every track to its own channel and wraps around when all the channels are allocated. It is most useful for making 2 tracks with 2 channels map to stereo and for making 6 tracks with 6 channels map to a 6 channel soundcard.
- **Audio->Map 5.1:2**
  This maps 6 tracks to 2 channels. The project should have 2 channels when using this function. Go to **Settings->format** to set the output channels to 2. This is most useful for down-mixing 5.1 audio to stereo.

See Section 4.3 [Audio attributes], page 31.

7.5 Standard audio mappings

Although Cinelerra lets you map any audio track to any speaker, there are standard mappings you should use to ensure the media can be played back elsewhere. Also, most audio encoders require the audio tracks to be mapped to standard speaker numbers or they will not work.

In the **channel position** widget See Section 4.3 [Audio attributes], page 31, the channels are numbered to correspond to the output tracks they are rendered to. For stereo, the source of channel 1 needs to be the left track and the source of channel 2 needs to be the right track.

For 5.1 surround sound, the sources of the 6 channels need to be in the order of center, front left, front right, back left, back right, low frequency effects. If the right tracks are not mapped to the right speakers, most audio encoders will not encode the right information if they encode anything at all. The low frequency effects track specifically can not store high frequencies in most cases.

7.6 Manipulating tracks

Tracks in Cinelerra either contain audio or video. There is no special designation for tracks other than the type of media they contain. When you create a new project, it contains three default tracks: one video track and two audio tracks. You can still add and delete tracks from the menus. The Tracks menu contains a number of options for dealing with multiple tracks simultaneously. Each track itself has a popup menu which affects one track. See Section 6.1.4 [The track popup menu], page 45.

Operations in the **Tracks** menu affect only tracks which are armed.

- **Move tracks up** and **Move tracks down** shift all the armed tracks up or down the stack.
- **Delete tracks** deletes the armed tracks.
- **Delete last track** deletes the last track, whether it is armed or not. Holding down the D key quickly deletes all the tracks.
- **Concatenate tracks** is more complicated. This operation copies all the assets of every disarmed but playable track and concatenates it by pasting those assets at the end of the first set of armed tracks. They are pasted one after the other, keeping the same order they have on the stack. If there are two armed tracks followed by two disarmed tracks, the concatenate operation copies the assets of the two disarmed tracks and pastes them after the assets of the two armed tracks. If there are three disarmed tracks instead, the assets of two tracks are pasted after the assets of the armed tracks and the assets of the third track are pasted at the end of the first armed track. The destination track wraps around until all the disarmed tracks are concatenated. Disarmed tracks that are not playable are not concatenated.

Finally, you will want to create new tracks. The **Audio** and **Video** menus each contain an option to add a track of their specific type. In the case of audio, the new track is put on the bottom of the timeline and the output channel of the audio track is incremented by one. In the case of video, the new track is put on the top of the timeline. This way, video has a natural compositing order. New video tracks are overlaid on top of old tracks.

7.7 Two screen editing

This is the fastest way to construct a program out of movie files. The idea consists of viewing a movie file in one window and viewing the program in another window. Subsections of the movie file are defined in the viewer window and transferred to the end of the program in the program window.

The way to begin a two screen editing session is to load some resources. In **File->Load files...** load some movies with the insertion mode **Create new resources only**. You want the timeline to stay unchanged while new resources are brought in. Go to the Resource Window and select the **Media** folder. The newly loaded resources should appear. Double click on a resource or drag it from the media side of the window over the Viewer window.

There should be enough armed tracks on the timeline to put the subsections of source material that you want (usually one video track and two audio tracks). If there are not, create new tracks or arm more tracks.

In the viewer window, define a clip out of your movie file:

- Set the starting point with the **in point button**.
- Seek to the ending point of the clip you want to use.
- Set the ending point with the **out point button**.

The two points should now appear on the timebar and define a clip.
There are several things you can do with the clip now:

- **Splice**
  Inserts the selected area in the timeline after the insertion point.

After the splice has taken effect, the insertion point moves to the end of the edit ready to be used as the next splice location. This way you can continuously build up the program by splicing.
If an in point or an out point exists on the timeline the clip is inserted after the in point or after the out point.
If both in and out points are set on the timeline, the clip is inserted after the in point.
If there are edits after your chosen splice location on the timeline, they will be pushed to the right.

- **Overwrite**
  Overwrites the region of the timeline after the insertion point with the clip.
  If an in point or an out point exists on the timeline the clip is overwritten after the in point or after the out point.
  If both in and out points are set on the timeline, the clip is inserted after the in point.
  If a region is highlighted or both in and out points exist they limit the region of the overwriting and the clip may therefore be shortened. This is so clever that it is worth the following detailed description.
  TIP: To overwrite exactly on a precise region of the timeline:
  - Arm only tracks to change.
  - Define the destination region on the timeline with [and].
  - Define the clip you want to use in the viewer with [and].
  - Overwrite from Viewer to the timeline.
  If the destination region is shorter than the clip defined in the viewer, the portion of the clip longer than the destination region won't be inserted. On the timeline the following edits won't move.
  Beware: If the destination region is longer than the clip defined in the viewer, the destination region will shrink. On the timeline the following edits will move to the left.

- **Create a clip**
  Generates a new clip for the resource window containing the affected region but does not change the timeline. Every clip has a title and a description. These are optional.

- **Copy**
  See Section 7.9 [Cut and paste editing], page 57, it behaves the same.

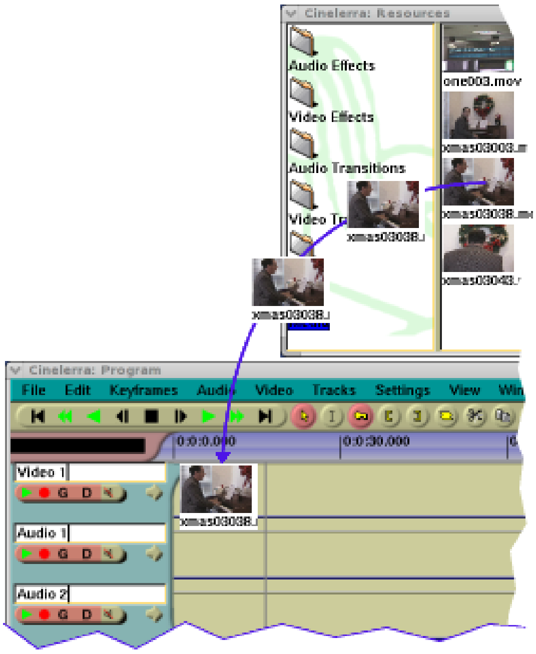
Two screen editing can be done purely by keyboard shortcuts. When you move the mouse pointer over any button a tooltip should appear, showing what key is bound to that button. In the Viewer window, the number pad keys control the transport and the [ ] V keys perform in/out points and splicing.

7.8 Drag and drop editing

Drag and drop editing is a quick and simple way of working in Cinelerra, using only the mouse. The basic idea is to create a bunch of clips, then drag them in order into the timeline building a prototype film that you can watch on the compositor. If after watching it, you wish to re-arrange your clips, set effects, add transition or insert/delete material, just drag and drop them on the timeline.

1. Load some files using **File->Load files...**.
2. Set the insertion mode to **Create new resources only**. This loads the files into the Resource Window.
3. Create some video and audio tracks on the timeline using the **Video** and **Audio** menus.
4. Open the **Media** folder in the resource window.

5. Make sure the necessary tracks are armed and drag a media file from the resource window to the timeline. If the media has video, drag it onto a video track. If the media is pure audio, drag it onto an audio track. If the media is a still image, drag it onto a video track.



Cinelerra fills out the audio and video tracks below the dragging cursor with data from the file. This affects what tracks you should create initially and which track to drag the media onto. To drag and drop a file on the Program window, you need to create on the timeline the same set of tracks of your media file.
A common camcorder file has a set of one video track and two audio tracks. In this case you will need one video track and two audio tracks and the media should be dragged over the first video track.
If the media has audio only you will need one audio track on the timeline for every audio track in the media and the media should be dragged over the first audio track.
If the media is a still image, you will need a video track only.

When you drag your chosen media from the media folder to the timeline, your mouse pointer will drag a thumbnail and, once over the timeline, the outline of a white rectangle, as big as the edit you are going to have.
Drag the media to the desired position of an empty track of the timeline and drop it.
If there are other edits on that track, when you move the white outline over an edit, you will see a bow tie symbol >< appearing at edit boundaries. If you drop the media there, the new edit will start from the edit boundary indicated by the center of the bow tie ><.

Since the mouse pointer is in the middle of the white outline, when this rectangle is bigger than the visible part of the timeline, it is quite cumbersome to precisely insert it. (This will likely happen for long media). Lengthening the duration visible in the timeline by changing the sample zoom in the zoom panel will reduce the size of the white rectangle, making a precise insertion possible.

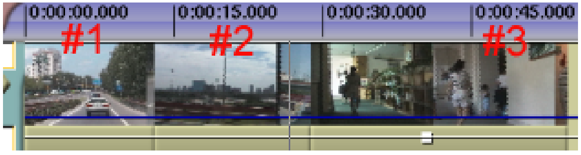
You can also drag multiple files from the resource window. When dropped in the timeline they are concatenated.
The way of selecting multiple files to drag changes depending on if the resources are displayed as text or as icons. To change the display mode right click inside the media list and select either **Display icons** or **Display text**.
When displaying text in the resource window CTRL-CLICKING on media files selects additional files one at a time; SHIFT-CLICKING on media files extends the number of highlighted

selections.
When displaying icons in the resource window SHIFT-CLICKING or CTRL-CLICKING selects media files one at a time; drawing a box around the files selects contiguous files.

In addition to dragging media files, if you create clips and open the **clip** folder you can drag clips on the timeline.

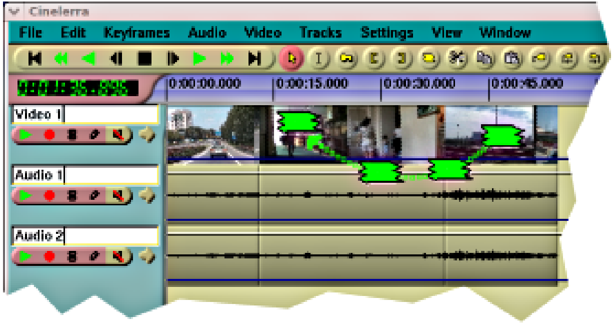
In the timeline there is further dragging functionality. Dragging edits around the timeline allows you to sort music playlists, sort movie scenes, and give better NAB demos but not much else. To enable the dragging functionality of the timeline, select the arrow toggle ↖ on the control bar.

Arm a track with various scenes.

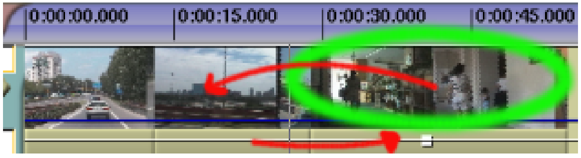


Original track with three scenes.

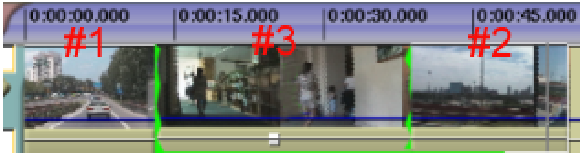
Go to scene #3, click and drag it to the middle.



When you drop scene #3



scene #2 shifts to the right



This is how the finished sequence looks.

If more than one track is armed, Cinelerra will drag any edits which start on the same position as the edit the mouse pointer is currently over. In other words, you can drag and drop a group of edits. Cinelerra recognises as a group the edits of different armed tracks that have aligned beginnings, regardless of whether they have the same source or aligned ends.

When you drag and drop edits within the timeline:
If you drop an edit when bow ties >< are shown, that edit will be cut and pasted starting at the edit boundary indicated by the centre of the bow tie ><. Following edits on the same track will move.
If you drop an edit when there are no bow ties >< shown, the original edit will be muted and pasted where you dropped it. No edits will move. A silence will appear in place of the original edit.
If you have more armed tracks on the timeline than in the asset you are dragging, only the

following edits of the tracks affected by the drag and drop operation will move to the right. This will cause loss of synchronization. To restore it, disarm the tracks affected by the drag and drop operation, highlight the just dropped edit and paste silence over it (**Edit -> Paste Silence**).

In Drag and Drop editing mode you can't drag and drop labels. They will be always locked to the timebar, even with the **Edit labels** option enabled. Still, with the **Edit labels** option enabled, if a selected area of a resource is spliced from the Viewer to the timeline in a position before labels, these labels will be pushed to the right for the length of the selected area.

With in/out points you can perform Cut and Paste operations in Drag and Drop mode as well as in Cut and Paste mode. Go to the **Edit** Menu to view the list and the keyboard shortcuts.

7.9 Cut and paste editing

This is the traditional method of editing in audio editors.
In the case of Cinelerra, you can copy edits in the same track, copy from different tracks in the same instance, start a second instance of Cinelerra and copy from one instance to the other or load a media file into the Viewer and copy from there.

Load some files onto the timeline. To perform cut and paste editing select the ⌶ i-beam toggle. Select a region of the timeline by click dragging on it and select the ✂ cut button to cut it. Move the insertion point to another point in the timeline and select the 📋 paste button. Assuming no in/out points are defined on the timeline this performs a cut and paste operation.

If in/out points are defined, the insertion point and highlighted region are overridden by the in/out points for clipboard operations. Thus, with in/out points you can perform cut and paste in drag and drop mode as well as cut and paste mode.

Most editing operations are listed in the **Edit** Menu. Some of them have a button on the program control toolbar and a keyboard shortcut.

- **Cut** x - Delete the selected area and hold it on the clipboard for future pasting.
- **Copy** c - Copy the selected area and hold it on the clipboard for future pasting.
- **Paste** v - Paste the material held in the clipboard
- **Clear** Del - Clear the selected area. If the insertion point is over an edit boundary and the edits on each side of the edit boundary are the same resource, the edits are combined into one edit comprised by the resource. The start of this one edit is the start of the first edit and the end of this one edit is the end of the second edit. This either results in the edit expanding or shrinking.
- **Paste Silence** Shift+Space - Paste blank audio/video for the length of the selected area. Following edits will be pushed to the right.
- **Mute Region** m - Overwrite blank audio/video on the selected area. Following edits don't move.
- **Trim Selection** - Delete everything but the selected region
- **Select All** a - Select the whole timeline

Other editing operations:

- **Copy&Mute** cm - Mute the selected area and hold it on the clipboard for future pasting.
- **Overwrite** - To perform overwriting within the timeline paste on a selected region (highlighted or between in/out points). The selected region will be overwritten. If the clip pasted from the clipboard is shorter than the selected region, the selected region will be shrunk. Following edits will move. If the clip pasted from the clipboard is longer than the selected region, the selected region will be overwritten with the first part of the clip and the remaining part of the clip will be written after the overwriting. Following edits will move. Alternatively, overwrite from the Viewer. See Section 7.7 [Two screen editing], page 53.

- **Concatenate** - Go to **Tracks -> Concatenate tracks**. This operation copies all the assets of every disarmed but playable track and concatenates it by pasting those assets at the end of the first set of armed tracks. They are pasted one after the other, keeping the same order they have on the stack. See Section 7.6 [Manipulating tracks], page 52.
- **Split** - Cinelerra can't spit an edit in two. To insert a transition in the middle of an edit delete a single frame. To insert a clip in the middle of an edit splice from the Viewer. See Section 7.7 [Two screen editing], page 53.

In Cut and Paste editing mode you can edit labels as well. By enabling **Edit labels** in the Settings Menu, or by disabling the **Lock labels from moving button** on the Program Control Tool Bar labels will be cut, copied or pasted along with the selected regions of the armed tracks.

When editing audio, it is customary to cut from one part of a waveform into the same part of another waveform. The start and stop points of the cut are identical in each waveform and might be offset slightly, while the wave data is different. It would be very hard to highlight one waveform to cut it and highlight the second waveform to paste it without changing the relative start and stop positions.
One option for simplifying this is to open a second copy of Cinelerra, cutting and pasting to transport media between the two copies. This way two highlighted regions can exist simultaneously.
Another option is to set in/out points for the source region of the source waveform and set labels for the destination region of the destination waveform. Perform a cut, clear the in/out points, select the region between the labels, and perform a paste.

7.10 Trimming

With some edits on the timeline it is possible to do trimming. By trimming you shrink or grow the edit boundaries by dragging them. In drag and drop mode or cut and paste mode, move the cursor over an edit boundary until it changes shape. The cursor will either be an expand left or an expand right. If the cursor is an expand left, the dragging operation affects the beginning of the edit. If the cursor is an expand right, the dragging operation affects the end of the edit.

When you click on an edit boundary to start dragging, the mouse button number determines which dragging behavior is going to be followed. 3 possible behaviors are bound to mouse buttons in the interface preferences. See Section 3.7 [Interface], page 29.

The effect of each drag operation not only depends on the behavior button but whether the beginning or end of the edit is being dragged. When you release the mouse button, the trimming operation is performed.

In a **Drag all following edits** operation, the beginning of the edit either cuts data from the edit if you move it forward or pastes new data from before the edit if you move it backward. The end of the edit pastes data into the edit if you move it forward or cuts data from the end of the edit if you move it backward. All the edits thereafter shift. Finally, if you drag the end of the edit past the start of the edit, the edit is deleted.

In a **Drag only one edit** operation, the behavior is the same when you drag the beginning or end of an edit. The only difference is none of the other edits in the track shift. Instead, anything adjacent to the current edit expands or shrinks to fill gaps left by the drag operation.

In a **Drag source only** operation, nothing is cut or pasted. If you move the beginning or end of the edit forward, the source reference in the edit shifts forward. If you move the beginning or end of the edit backward, the source reference shifts backward. The edit remains in the same spot in the timeline but the source shifts.

For all file formats besides still images, the extent of the trimming operation is clamped to the source file length. Attempting to drag the start of the edit beyond the start of the source clamps it to the source start.

In all trimming operations, all edits which start on the same position as the cursor when the drag operation begins are affected. Unarm tracks to prevent edits from being affected.

Most effects in Cinelerra can be figured out just by using them and tweeking. Here are brief descriptions of effects which you might not utilize fully by mere experimentation.

8 Compositor window

This window displays the output of the timeline. It is the interface for most compositing operations or operations that affect the appearance of the timeline output. Operations done in the Compositor affect the timeline but do not affect clips.

8.1 Compositor controls

The video output has several navigation functions. The video output size is either locked to the window size or unlocked with scrollbars for navigation. The video output can be zoomed in and out and panned. Navigating the video output this way does not affect the rendered output; it just changes the point of view in the compositor window.

If it is unlocked from the window size, middle clicking and dragging anywhere in the video pans the point of view.

Hitting the + and - keys zooms in and out of the video output.

Underneath the video output are copies of many of the functions available in the main window. In addition there is a Auto ▼ zoom menu and a ◆ tally light.

The zoom menu jumps to all the possible zoom settings and, through the **Auto** option, locks the video to the window size. The zoom menu does not affect the window size.

The tally light turns red when rendering is happening. This is useful for knowing if the output is current.

Right clicking anywhere in the video output brings up a menu with all the zoom levels and some other options. In this particular case the zoom levels resize the entire window and not just the video.

The **reset camera** and **reset projector** options center the camera and projector See Section 8.2 [Compositing], page 62.

The **Hide controls** option hides everything except the video.

On the left of the video output is a toolbar specific to the compositor window. Here are the functions in the toolbar:

8.1.1 Protect video

This disables changes to the compositor output from clicks in it. It is an extra layer on top of the track arming toggle to prevent unwanted changes.

8.1.2 Magnifying glass

This tool 🔍 zooms in and out of the compositor output without resizing the window. If the video output is currently locked to the size of the window, clicking in it with the magnifying glass unlocks it and creates scrollbars for navigation.

Left clicking in the video zooms in.
Ctrl clicking in the video zooms out.
Rotating the wheel on a wheel mouse zooms in and out.

8.1.3 Masks tool

This tool ⚑ brings up the mask editing tool See Section 8.2.2 [Masks], page 67. Enable the ? tool window to see options for this tool.

8.1.4 Camera

This tool ✥ brings up the camera editing tool See Section 8.2.1 [The camera and projector], page 62. Enable the ? tool window to see options for this tool.

8.1.5 Projector

This tool ✥ brings up the projector editing tool See Section 8.2.1 [The camera and projector], page 62. Enable the ? tool window to see options for this tool.

8.1.6 Crop tool

This tool ✎ brings up the cropping tool See Section 8.2.3 [Cropping], page 71. The ? tool window must be enabled to use this tool.

8.1.7 Eyedropper

This brings up the eyedropper. The eyedropper detects whatever color is under it and stores it in a temporary area. Enabling the ? tool info shows the currently selected color. Click anywhere in the video output to select the color at that point.
The eyedropper not only lets you see areas which are clipped, but its value can be applied to many effects. Different effects handle the eyedropper differently.

8.1.8 Tool info

This tool ? button works only in conjunction with the other controls on the compositor. Based on what compositing control is active the toggle button will activate/deactivate the appropriate control dialog box.

Controls with dialog boxes are:

- Edit mask
- Camera automation
- Projector automation
- Crop control

8.1.9 Safe regions tool

This tool ▣ draws the safe regions in the video output. This does not affect the rendered output See Section 8.2.4 [Safe regions], page 71.

8.2 Compositing

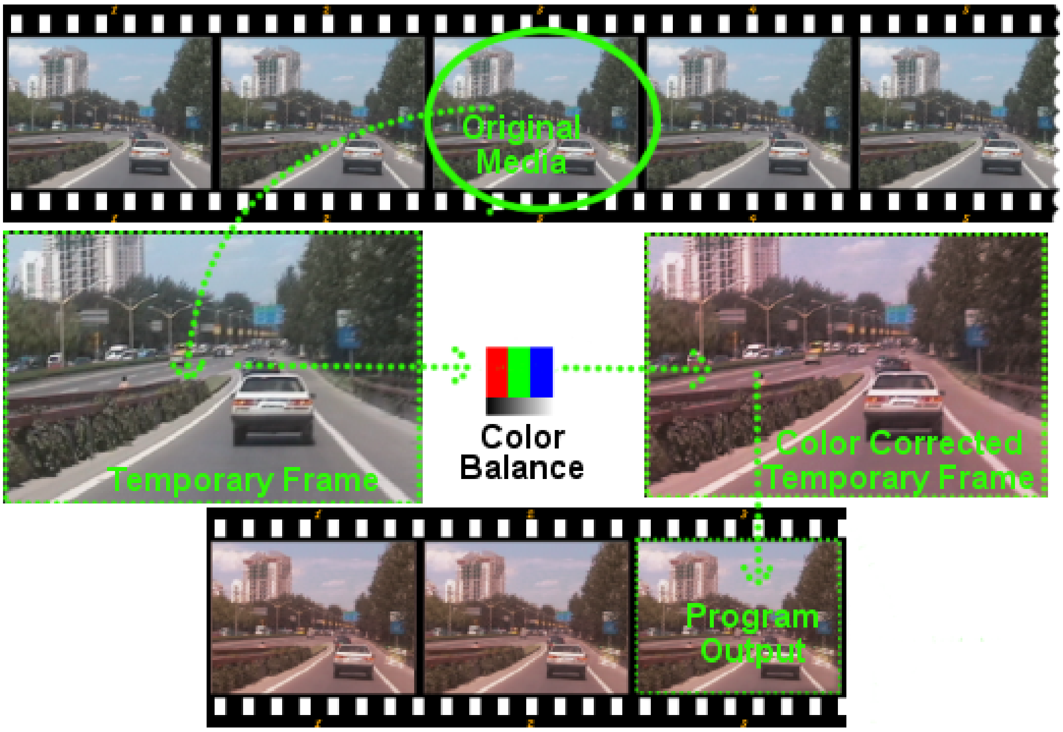
A large amount of Cinelerra's binary size is directed towards compositing. When you remove the letterboxing from a widescreen show, you are compositing. Changing the resolution of a show, making a split screen, and fading in and out among other things are all compositing operations in Cinelerra. Cinelerra detects when it is in a compositing operation and plays back through the compositing engine only then. Otherwise, it uses the fastest decoder available in the hardware.

Compositing operations are done on the timeline and in the Compositor window. Shortcuts exist in the Resource window for changing some compositing attributes. Once some video files are on the timeline, the compositor window is a good place to try compositing.

8.2.1 The camera and projector

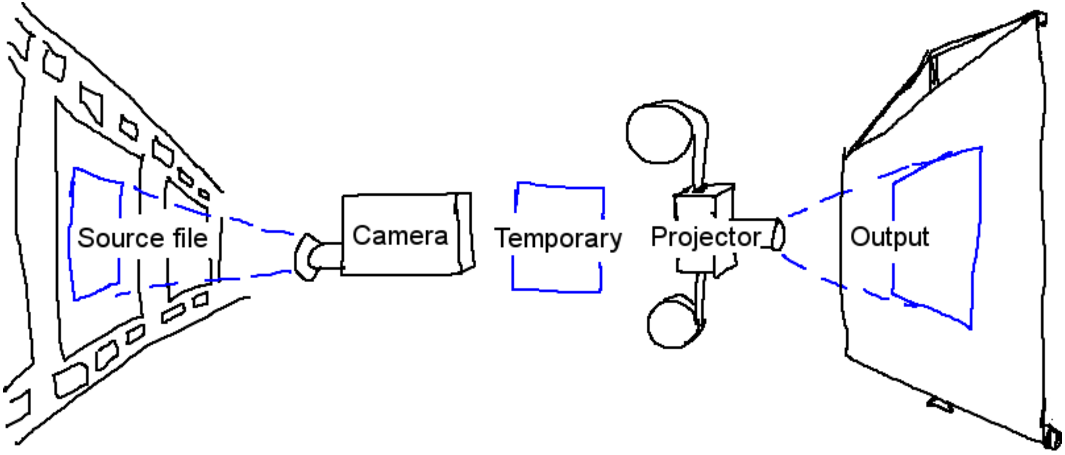
8.2.1.1 The temporary

In the compositor window, the most important functions are the ✥ camera button and the ✥ projector button. These control operation of the camera and projector. Cinelerra's compositing routines use a "temporary", a frame of video in memory where all graphics processing is performed. Inside Cinelerra's compositing pipeline, the camera determines where in the source video the "temporary" is copied from. The projector determines where in the output the "temporary" is copied to.



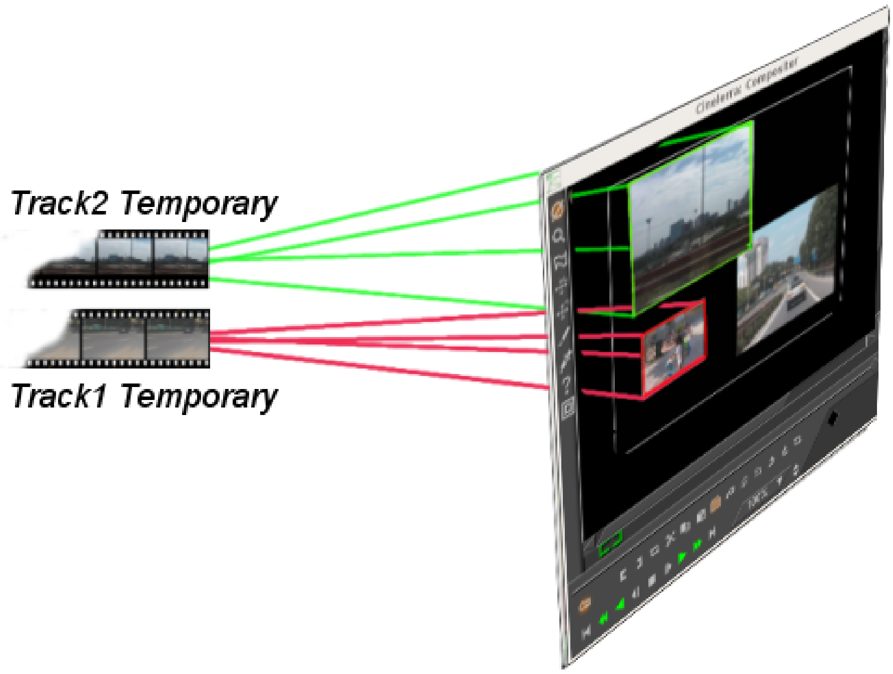
The process is pretty much as if we scanned in a roll of film one frame at a time, then (using Gimp, for example) digitally altered the scanned image with various filters. Once the image has been transformed by the filters (color correction, for example) we then project the finished image back into a new roll of film, thus creating a new "modified" version of the original.

Each track has a different "temporary" which is defined by the track size. By resizing the tracks you can create split screens, pans, and zooms.



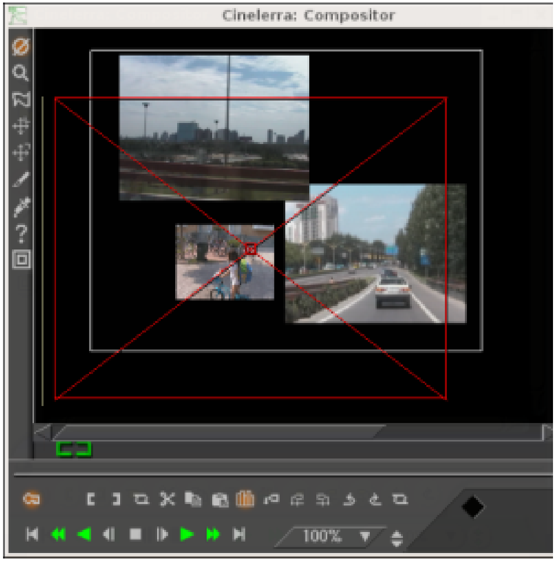
Visual representation of the compositing pipeline

When editing the camera and projector in the compositing window, the first track with **record** enabled is the track affected. Even if the track is completely transparent, it is still the affected track. If multiple video tracks exist, the easiest way to select one track for editing is to **SHIFT-click** on the record icon of the track. This solos the track.



The purpose of the projector is to place the contents of the "temporary" into the project's output. The intent of the projector is to composite several sources from the various tracks into one final output track.

The projector alignment frame is identical to the camera's viewport, except that it guides where on the output canvas to put the contents of each temporary.



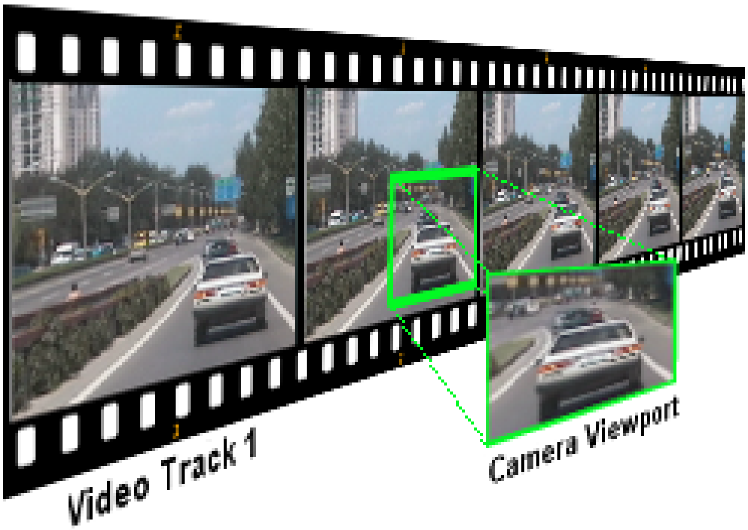
8.2.1.2 Compositing projector controls

When the **projector** button is enabled in the compositor window, you are in projector editing mode. A guide box appears in the video window. Dragging anywhere in the video window causes the guide box to move, hopefully along with the video. **SHIFT-dragging** anywhere in the video window causes the guide box to shrink and grow along with the video. Once you have positioned the video with the projector, you are ready to master the camera.

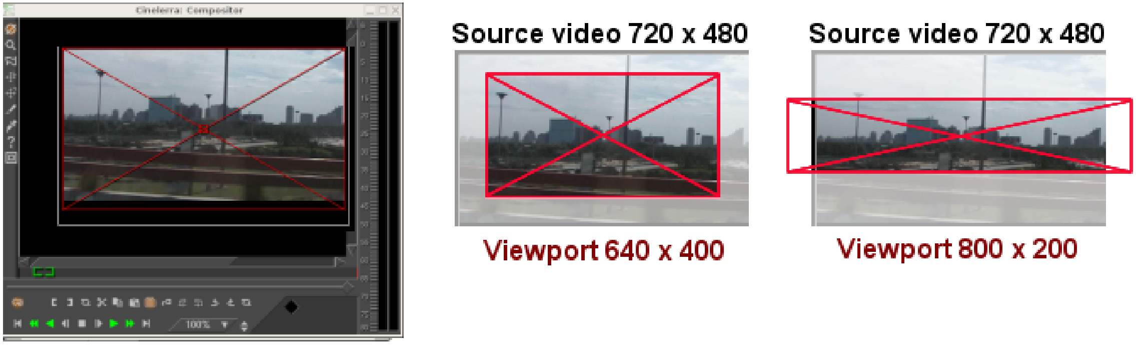
8.2.1.3 Compositing camera controls

Select the ✥ camera button to enable camera editing mode. In this mode, the guide box shows where the camera position is in relation to past and future camera positions but not where it is in relation to the source video. Dragging the camera box in the compositor window does not move the box but instead moves the location of the video inside the box.

The **viewport** is a window on the camera that frames the area of source video to be scanned. The viewport is represented as a red frame with diagonal cross bars.



The viewport



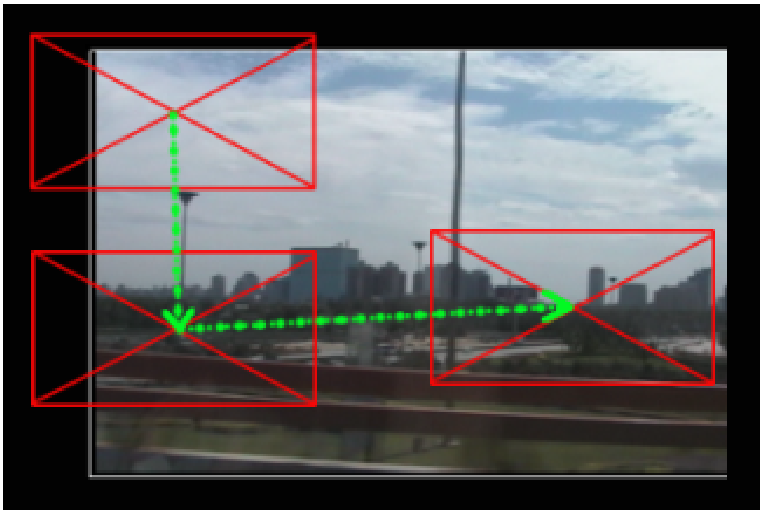
Viewport sizes

The size of the viewport is defined by the size of the current track. A smaller viewport (640x400) captures a smaller area. A larger viewport (800x200) captures an area larger than the source video and fills the empty spaces with blanks.

Once we have our viewport defined, we still need to place the camera right above the area of source video we are interested on. To control the location of the camera:

1. Open the compositor window with a track selected.
2. Select the camera button to enable camera editing mode.
3. Drag over the display window.

When we drag over the viewport in the compositor window (although initially counter-intuitive), the viewport does not moves but the area of video that sits under the camera's location does, like when watching the output of a moving camera.



In the compositor window, the viewport is always shown centered, what moves is the video under it

For example, when you drag the camera down, the viewport in effect is moving downwards on the video, showing its path towards the bottom of the video, but from our perspective on the compositor screen, we see the video moving up. When you drag the camera right, the video seems to move left, and so on.

Note: The guide box shows where the camera position is in relation to past and future camera positions, not where it is in relation to the source video.

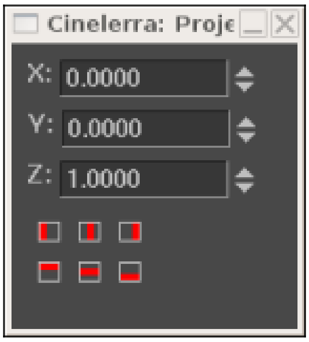
8.2.1.4 Popup menu of options

In the compositing window, there is a popup menu of options for the camera and projector. Right click over the video portion of the compositing window to bring up the menu.

- Reset Camera causes the camera to return to the center position.
- Reset Projector causes the projector to return to the center.

8.2.1.5 The camera and projector tool window

The camera and projector have shortcut operations that do not appear in the popup menu and are not represented in video overlays. These are accessed in the **Tool window**. Most operations in the Compositor window have a tool window which is enabled by activating the ? question mark.



Cinelerra: Proje

X: 0.0000

Y: 0.0000

Z: 1.0000

The camera and projector tool window

In the case of the camera and projector, the tool window shows x, y, and z coordinates. By either tumbling or entering text directly, the camera and projector can be precisely positioned. 9 justification types are also defined for easy access. A popular justification operation is upper left projection after image reduction. This is used when reducing the size of video with aspect ratio adjustment.

- ◧ Left

- Center Horizontal
- Right
- Top
- Center Vertical
- Bottom

The translation effect allows simultaneous aspect ratio conversion and reduction but is easier to use if the reduced video is put in the upper left of the temporary instead of in the center. The track size is set to the original size of the video and the camera is centered. The output size is set to the reduced size of the video. Without any effects, this produces just the cropped center portion of the video in the output.

The translation effect is dropped onto the video track. The input dimensions of the translation effect are set to the original size and the output dimensions are set to the reduced size. To put the reduced video in the center subsection that the projector shows would require offsetting **out x and out y** by a complicated calculation. Instead, we leave **out x and out y** at 0 and use the projector's tool window.

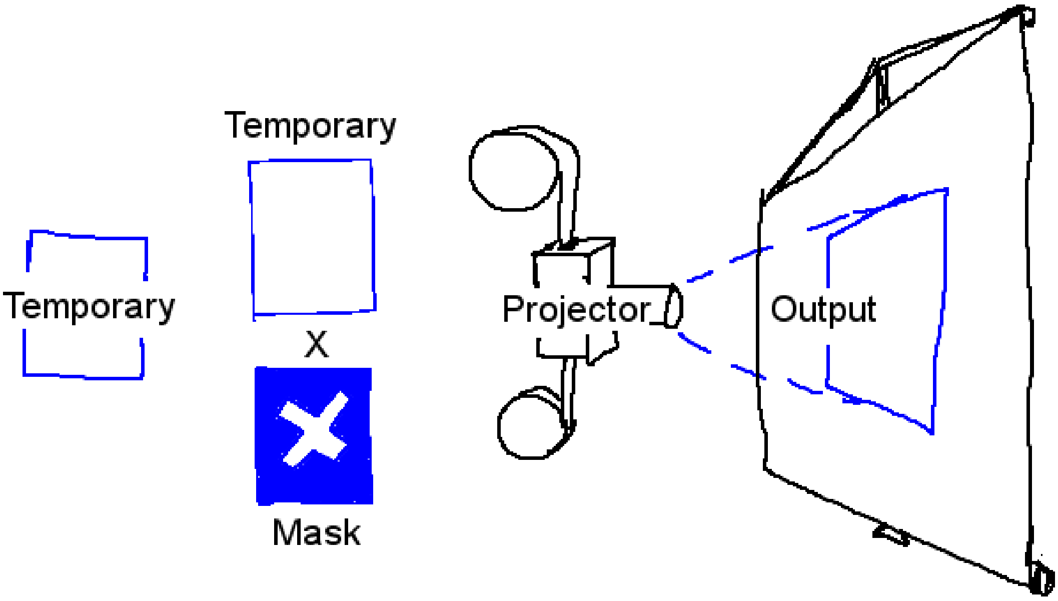
Merely by selecting left justify and top justify, the projector displays the reduced image from the top left corner of the temporary in the center of the output.

8.2.2 Masks

Masks select a region of the video for either displaying or hiding. Masks are also used in conjunction with another effect to isolate the effect to a certain region of the frame. A copy of one video track may be delayed slightly and unmasked in locations where the one copy has interference but the other copy does not. Color correction may be needed in one subsection of a frame but not another. A mask can be applied to just a subsection of the color corrected track while the vanilla track shows through. Removal of boom microphones, airplanes, and housewives are other mask uses.

The order of the compositing pipeline affects what can be done with masks. Mainly, masks are performed on the temporary after effects and before the projector. This means multiple tracks can be bounced to a masked track and projected with the same mask.

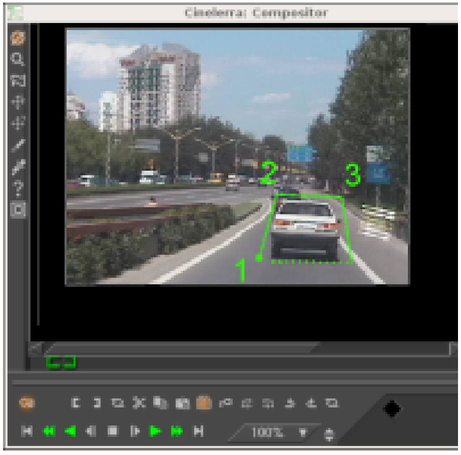
Our compositing pipeline graph now has a masking stage. There are 8 possible masks per track. Each mask is defined separately, although they each perform the same operation, whether it is addition or subtraction.



Compositing pipeline with masks

To define a mask, go into the Compositor window and enable the **mask** toggle. Now go over the video and click-drag.

IMPORTANT: You have to select **automatic keyframes** (See Section 18.3 [Automatic keyframes], page 134,) if you wish to move a mask over time. If you do not select **automatic keyframes**, the mask position will be the same even if you edit at different places on the timeline.



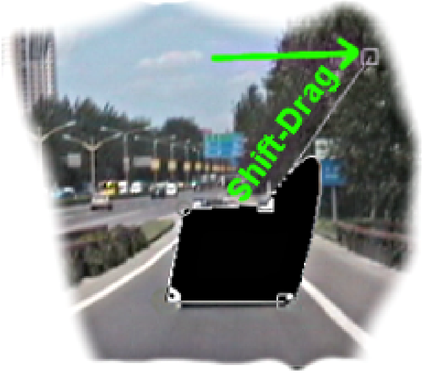
Click-drag again in another part of the image to create each new point of the mask. While it is not the conventional Bezier curve behavior, this masking interface performs in realtime what the effect of the mask is going to be. Creating each point of the mask expands a rubber band curve.

Once points are defined, they can be moved by **CTRL-dragging** in the vicinity of the corner.

CTRL-drag allows you to move existing points to

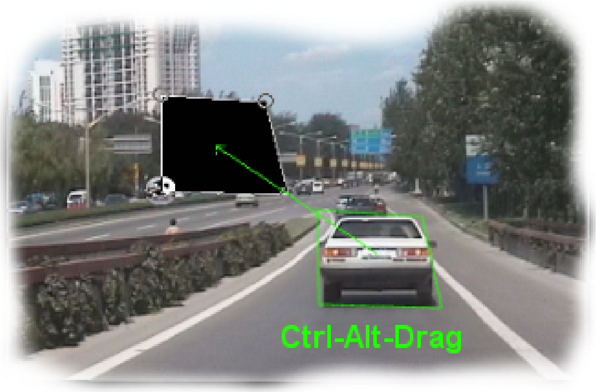
new locations, thus altering the shape of the mask

This, however, does not smooth out the curve. The in-out points of the Bezier curve are accessed by **SHIFT-dragging** in the vicinity of the corner. Then **SHIFT-dragging** near the in or out point causes the point to move.



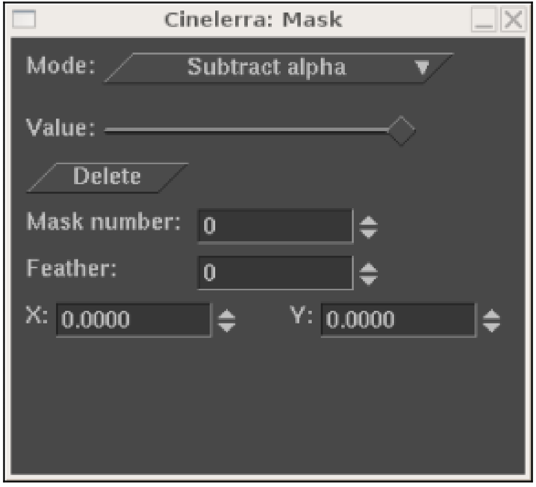
SHIFT-drag activates belzier handles
to create curves between mask points

Finally, once you have a mask, the mask can be translated in one piece by **ALT-dragging** the mask. Mask editing in Cinelerra is identical to how The Gimp edits masks except in this case the effect of the mask is always on.



CTRL-ALT-drag translates an entire mask
to a new location on the screen

The masks have many more parameters which could not be represented with video overlays. These are represented in the tool window for masks. Selecting the ? question mark when the mask toggle is highlighted brings up the mask options.


Cinelerra: Mask

Mode: Subtract alpha

Value:

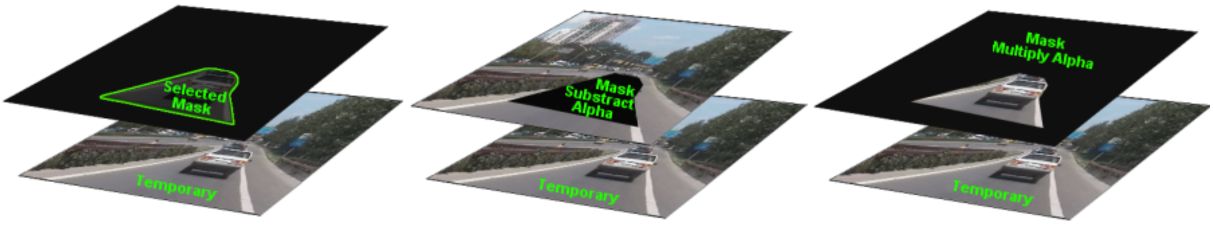
Mask number: 0

Feather: 0

X: 0.0000 Y: 0.0000

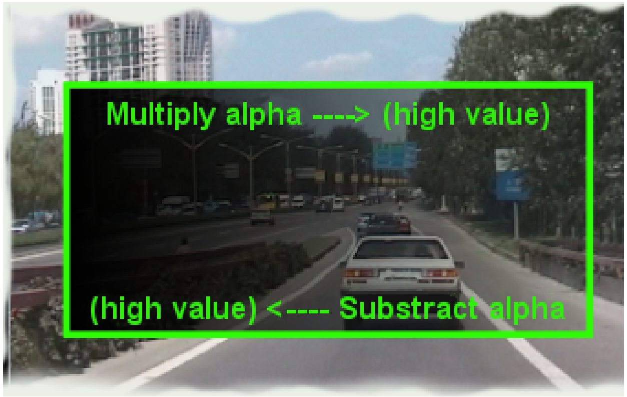
Mask options window

The **mode** of the mask determines if the mask removes data or makes data visible. If the mode is subtractive, the mask causes video to disappear. If the mode is additive, the mask causes video to appear and everything outside the mask to disappear.



Mask mode

The **value** of the mask determines how extreme the addition or subtraction is. In the subtractive mode, higher values subtract more alpha. In the additive mode, higher values make the region in the mask brighter while the region outside the mask is always hidden.

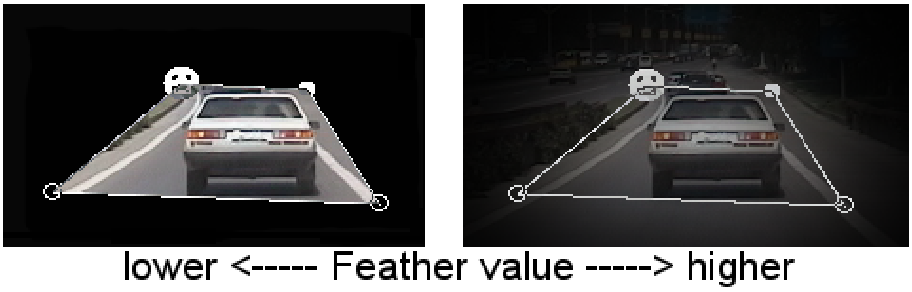

Multiply alpha ----> (high value)
(high value) <---- Substract alpha

Mask value

The mask number determines which one of the 8 possible masks we are editing. Each track has 8 possible masks. When you click-drag in the compositor window, you are only editing one of the masks. Change the value of **mask number** to cause another mask to be edited. The previous mask is still active but only the curve overlay for the currently selected mask is visible.

When multiple masks are used, their effects are ORed together. Every mask in a single track uses the same value and mode.

The edges of a mask are hard by default but this rarely is desired. The **feather** parameter determines how many pixels to feather the mask. This creates softer edges but takes longer to render.



Feather parameter

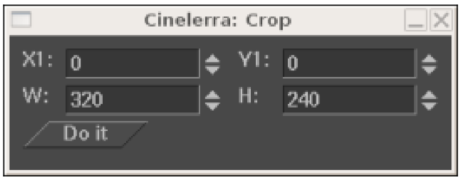
Note: The OpenGL mask renderer is of low quality and only suitable as a preview for initial work. For fine-tuning of masks (with large feather values) OpenGL should be switched off and the software renderer be used.

Finally, there are parameters which affect one point on the current mask instead of the whole mask. These are **Delete, x, y**. The active point is defined as the last point dragged in the compositor window. Any point can be activated merely by **CTRL-clicking** near it without moving the pointer. Once a point is activated, **Delete** deletes it and **x, y** allow repositioning by numeric entry.

8.2.3 Cropping

Cropping reduces the visible picture area of the whole project.
It changes the values of the output dimensions (width and height in pixels) and the X Y values of the projector in a single operation.
Since it changes project settings it affects all the tracks for their entire duration and it is not keyframable.

Enable the ✎ crop toggle and the ? tool window in the **compositor window** to display the **Crop control dialog box**.

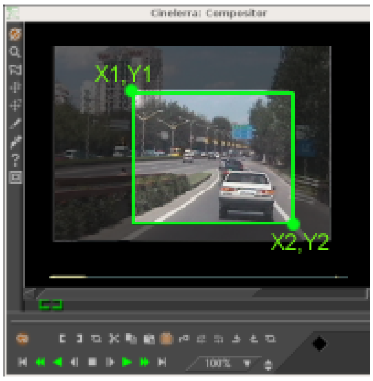


Cinelerra: Crop

X1: 0 Y1: 0
W: 320 H: 240
Do it

Crop control dialog box

Click-drag anywhere in the video to define the crop area. This draws a rectangle over the video.



Crop area defined

Click-drag anywhere in the video to start a new rectangle.
Click-drag over any corner of the rectangle to reposition the corner.
ALT-click in the cropping rectangle to translate the rectangle to any position without resizing it.
The crop control dialog allows also text entry of the top left coordinates (X1,Y1) and bottom right coordinates (X2,Y2) that define the crop rectangle.

When the rectangle is positioned, hit the **Do it** button in the crop control dialog to execute the cropping operation: the portion of the image outside the rectangle will be cut off and the projector will make the output fit the canvas.
The **Set Format** window will show the new project Width and Height values.
The projector tool window will show the new X Y values.
Track size will remain unchanged.
To undo the cropping enter the original project dimensions in the **Set Format** window and click on **Reset projector** in the popup menu of the compositor.

8.2.4 Safe regions

On consumer displays the borders of the image are cut off and within the cut-off point is a region which is not always square like it is in the compositor window. The borders are intended for scratch room and vertical blanking data. You can show where these borders are by enabling the ▣ safe regions toggle. Keep titles inside the inner rectangle and keep action inside the outer rectangle.

8.2.5 Overlay modes

Every video track has an overlay mode, accessible by expanding the track. The overlay mode is a pull-down menu on the left under the fader. When collapsed, it displays an icon representing the current overlay mode.

Select the ⬇ expand track toggle to view all the options for a video track if you can not see the overlay mode. The overlay mode of video tracks is **normal** by default. Select other modes by clicking the overlay button and selecting an item from the popup menu.

Overlay modes are processed inside the projector stage of compositing. The different modes are summarized below.

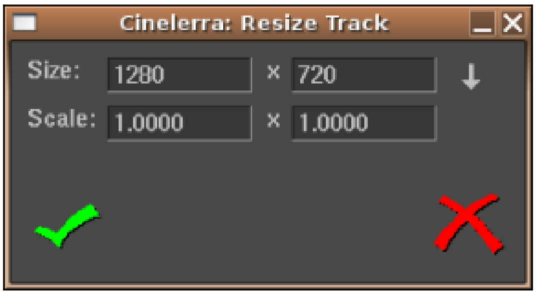
- **Normal**
  This mode uses a traditional Porter-Diff equation to blend tracks with alpha. When no alpha exists in the project color model, the new track always replaces the output.
- **Addition**
  In this mode, whatever is in the output is added to the current track. The result is blended based on the current track's alpha onto the output.
- **Subtraction**
  In this mode, the current track is subtracted from the output and the result is alpha blended onto the output.
- **Multiply**
  This is the most useful operation. The current track is multiplied by the output and the result blended onto the output. Usually a black and white image with no alpha channel or a white title on a black image is used as the current track. With the multiply operation, only the output portions under the white area show.
- **Divide**
  This mode divides the current track by the output and the result is blended into the output. It usually results in overloaded levels.
- **Replace**
  This mode does no blending and overwrites the output with the current track.

8.2.6 Track and output sizes

The size of the temporary and the size of the output in our compositing pipeline are independent and variable. This fits into everything covered so far. The camera's viewport is the temporary size. Effects are processed in the temporary and are affected by the temporary size. Projectors are rendered to the output and are affected by the output size. If the temporary is smaller than the output, the temporary is bordered by blank regions in the output. If the temporary is bigger than the output, the temporary is cropped.

8.2.6.1 Track size

The temporary size is defined as the track size. Each track has a different size. Right click on a track to bring up the track's menu. Select **Resize Track** to resize the track to any arbitrary size. Alternatively you can select **Match output size** to make the track the same size as the output.

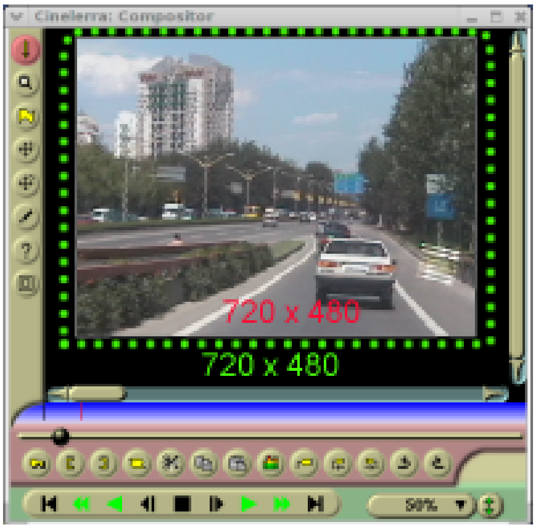


Size: 1280 × 720

Scale: 1.0000 × 1.0000

The resize track window

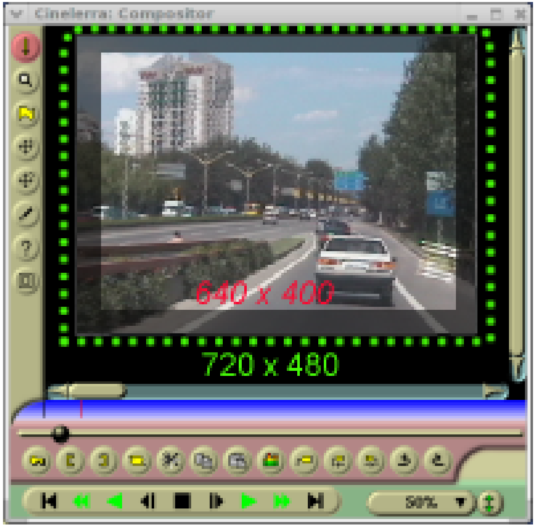
For example, the next image shows how a video track and a project output of equal sizes look when displayed on the compositor.



Project output size and video track with equal dimensions (720x480)

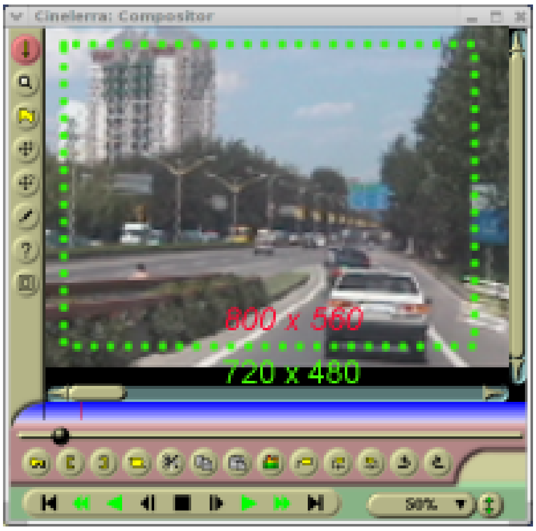
If you resize a track, then its appearance on the compositor changes accordingly.

Reducing the track (to 640 x 400) and leaving the project's output size untouched makes the track show on the compositor smaller and framed by a blank area.



New track (640x400), smaller than the project's output (720x480)

Enlarging the track (to 800 x 560) and leaving the project's output size untouched makes the track show on the compositor larger and cropped to the output's dimension.



New track (800x560), cropped to the project's output size (720x480)

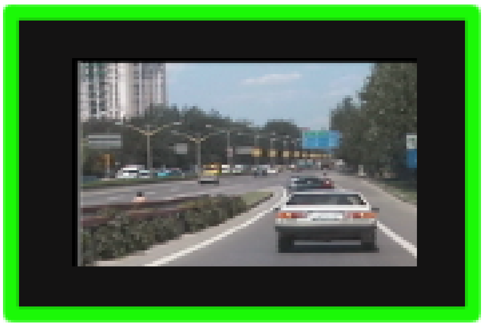
Using this relationship between the track and the project's output size you can effectively reduce or magnify the size of a particular track with regards to the final output and therefore create visual "effects" like split screens, pans, and zooms on the compositor.

8.2.6.2 Output size

The output size is set in either **New** when creating a new project or **Settings->Format**. In the Resource window there is another way to change the output size. Right click on a video asset and select **Match project size** to conform the output to the asset. When new tracks are created, the track size always conforms to the output size specified by these methods.

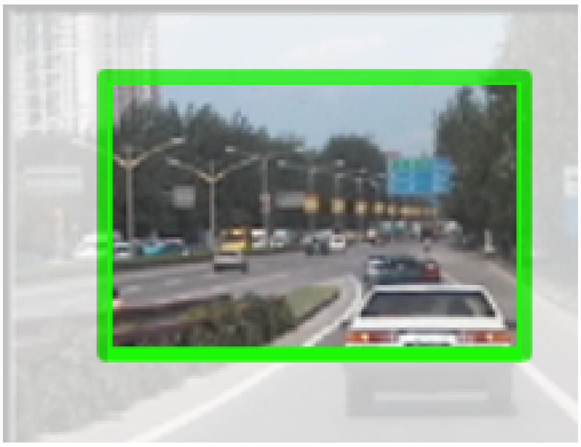
When rendering, the project's output size is the final video track size where the temporary pipeline is rendered into.

If the output size is larger than the temporary then the image transferred from the temporary will fit inside the Output Track. Any space left on the Output is left blank.



Output size (shown in green) larger than the temporary

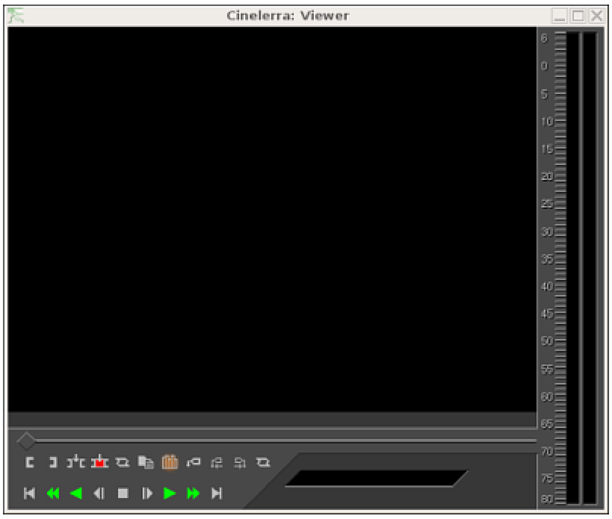
If the output size is smaller than the temporary then some of the temporary video will be cropped out.



Output size too small for the temporary

9 Viewer window

The viewer window is a place to load and preview your source media and clips. Here you can quickly browse through an asset using the **slider control**, focus on an area of work with the **preview region** or you use **editing controls** to cut & paste segments into the project or create a clip for later use.



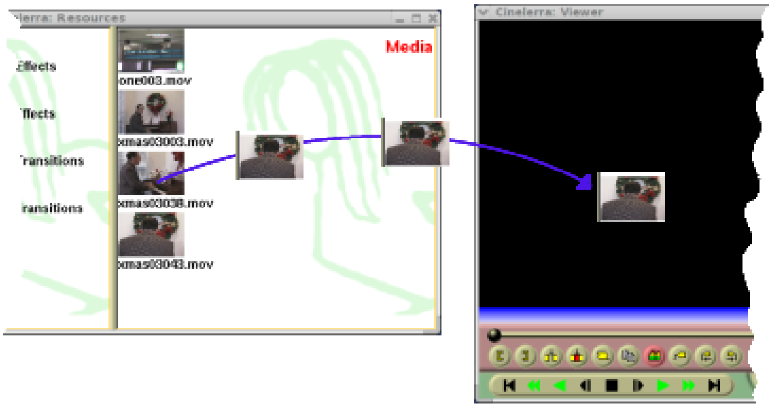
The viewer window

To open the viewer window, go to **Window->Show Viewer**

The display is the area on the viewer where you actually see media playing. Before you can play any media, you first must load it on the viewer.

To load media into the viewer:

1. Open the **resources manager** window and select the **asset manager** or the **clip manager** folder.
2. Drag a file from the **asset manager** or the **clip manager** to the viewer



You can also load media onto the viewer by right clicking on a file in the **asset manager** and selecting **View** from the popup menu or by double clicking on the icon.

Once your media loads you will see it appear on the display. To play, rewind or forward through it use the **slider control** or the **transport controls**.

You can change the media display size by right clicking on the screen to activate the display zoom menu. Select zoom levels of 50%, 100% or 200% of the original media size.

When displaying media, the viewer uses the project's defined output size format settings, not the original assets format. You can change the project's output to match the asset's format using the **match project size** menu option in the **asset manager**.

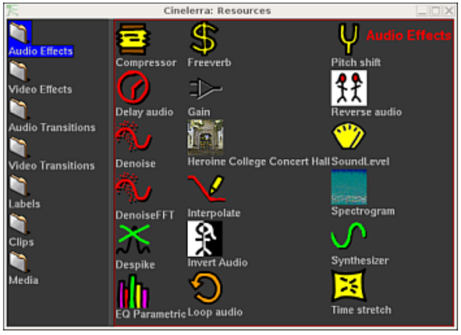
In here you will scrub around source media and clips, selecting regions to paste into the project. Operations done in the viewer affect a temporary EDL or a clip but not the timeline.

10 Resources window

Effects, transitions, clips, and assets are accessed here. Most of the resources are inserted into the project by dragging them out of the resource window. Management of resource allocation is also performed here.

10.1 Navigating the resources

The resource window is divided into two areas. One area lists folders and another area lists folder contents. Going into the folder list and clicking on a folder updates the contents area with the contents of that folder.

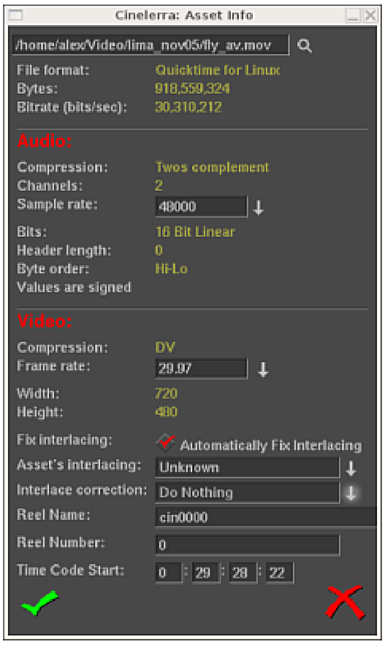


The resources window

The folder and contents can be displayed as icons or text.

Right clicking in the folder or contents area brings up a menu containing formatting options. Select **Display text** to display a text listing. Select **Sort items** to sort the contents of the folder alphabetically.

The **asset info window** displays detailed information about the selected media file. To access it, go to the asset manager folder and right click on the label or icon of the file you are interested on. An asset menu will appear, then click on Info.


Cinelerra: Asset Info

/home/alex/Video/lima_nov05/fly_av.mov

File format: Quicktime for Linux
Bytes: 918,559,324
Bitrate (bits/sec): 30,310,212

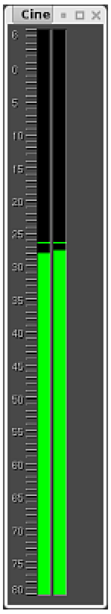
Audio:
Compression: Twos complement
Channels: 2
Sample rate: 48000
Bits: 16 Bit Linear
Header length: 0
Byte order: Hi-Lo
Values are signed

Video:
Compression: DV
Frame rate: 29.97
Width: 720
Height: 480
Fix interlacing: ☑ Automatically Fix Interlacing
Asset's interlacing: Unknown
Interlace correction: Do Nothing
Reel Name: cin0000
Reel Number: 0
Time Code Start: 0 : 29 : 28 : 22

The asset info window

11 Sound level meters window

An additional window, the **levels window** can be brought up from the **Window** menu. The **levels** window displays the output audio levels after all mixing is done.



The sound level meters window

Sound level meters appear in many locations. They can be toggled in the viewer and compositor windows with the level toggle. They appear in the patchbay when a track is expanded (See Section 7.1 [The patchbay], page 49.) They appear in the recording monitor when audio is being recorded.

The sound levels in the **levels window, compositor, and viewer** correspond to the final output levels before they are clipped to the soundcard range. In the **record monitor** they are the input values from the sound card. In the **patchbay** they are the sound levels for each track after all effects are processed and before down-mixing for the output.

Most of the time, audio levels have numerical markings in dB but in the patchbay there is not enough room.

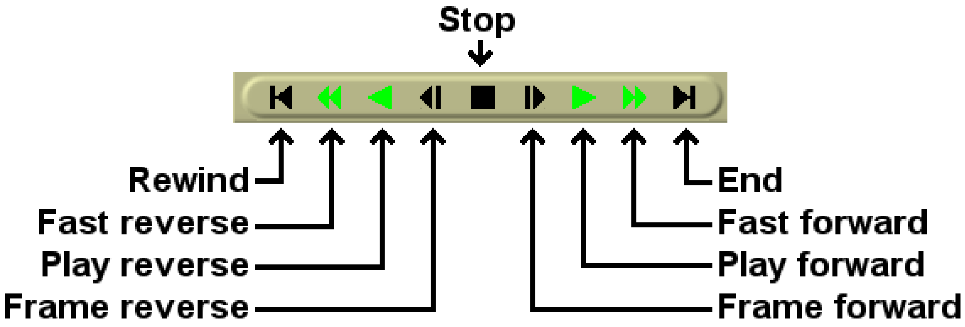
The sound level is color coded as an extra means of determining the sound level. Even without numerical markings, the sound level color can distinguish between several ranges and overload. Look at the color codings in a meter with numerical markings to see what colors correspond to what sound level. Then for meters in the patchbay in expanded audio tracks, use the color codings to see if it is overloading.

Be aware that sound levels in Cinelerra can go above 0 dB. This allows not only seeing if a track is overloading but how much information is being lost by the overloading. Overloading by less than 3 dB is usually acceptable. While overloading is treated as positive numbers in Cinelerra, it is clipped to 0 when sent to a sound card or file.

The visible range of the sound level meters is configurable in **settings->preferences->interface** (See Section 3.7 [Interface], page 29.)

12 Transport controls

Transport controls are just as useful in navigation as they are in playing back footage, hence they are described here in the navigation section. Each of the Viewer, Compositor, and Program windows has a transport panel.



The transport panel.

The transport panel is controlled by the keyboard as well as the graphical interface. For each of the operations it performs, the starting position is the position of the insertion point in the Program window and the slider in the Compositor window. The ending position is either the end or start of the timeline or the end or start of the selected region if there is one.

The orientation of the end or start depends on the direction of playback. If it is forward the end position is the end of the selected region. If it is backward the end position is the start of the selected region.

The insertion point moves to track playback. When playback stops, the insertion point stays where playback stopped. Thus, by playing back you change the position of the insertion point.

The keyboard interface is usually the fastest and has more speeds. The transport keys are arranged in a sideways **T** on the number pad.

4	Frame back	*5*	Reverse Slow	*6*	Reverse	+	Reverse Fast
1	Frame Forward	*2*	Forward Slow	*3*	Play	*Enter*	Fast Forward
0	Stop						

Hitting any key on the keyboard twice pauses it.

When using frame advance functions the behavior may seem odd. If you frame advance forward and then frame advance backward, the displayed frame does not change. This is because the playback position is not the frame but the time between two frames. The rendered frame is the area that the playback position crosses. When you increment the time between two frames by one and decrement it by one, you cross the same frame both times and so the same frame is displayed.

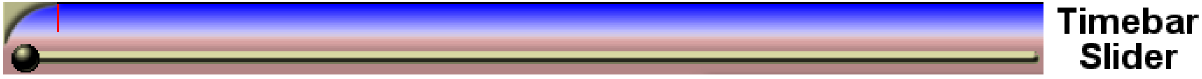
The transport behavior changes if you hold down CTRL when issuing any of the transport commands. This causes the starting point to be the in point if playing forward and the out point if playing backward. If playing forward, the out point becomes the ending point and if playing backward, the in point becomes the ending point. If no in/out points are specified, the behavior falls back to using the insertion point and track boundaries as the starting and ending points.

It is possible to use a hardware JogShuttle[1]

[1] Refer to David Arendt's message posted on the Cinelerra CV mailing-list on the 2003-11-11 for more information

13 Timebar

The navigation features of the Viewer and Compositor behave very similarly. Each has a timebar and slider below the video output. The timebar and slider are critical for navigation.



The timebar represents the entire time covered by the program. When you define labels and in/out points it defines those, too. Finally the timebar defines a region known as the **preview region**.

The **preview region** is the region of the timeline which the slider affects. The slider only covers the time covered by the preview region. By using a preview region inside the entire program and using the slider inside the preview region you can quickly and precisely seek in the compositor and viewer.

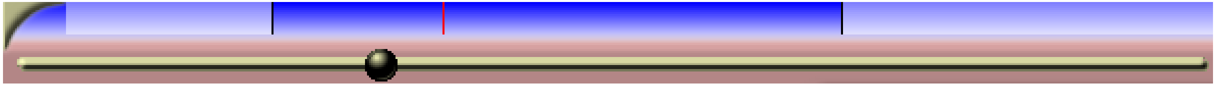
When you replace the current project with a file the preview region automatically resizes to cover the entire file. When you append data or change the size of the current project, the preview region stays the same size and shrinks. Therefore, you need to resize the preview region.

Load a file and then slide around it using the compositor slider. The insertion point in the main window follows the compositor. Move the pointer over the compositor's timebar until it turns into a left resize pointer. The click and drag right. The preview region should have changed and the slider resized proportionally.

Go to the right of the timebar until a right resize pointer appears. Drag left so the preview region shrinks.

Go to the center of the preview region in the timebar and drag it around to convince yourself if can be moved.

Note: When you append data or change the size of the current project, the preview region stays the same size and shrinks. Therefore, you need to resize the preview region.



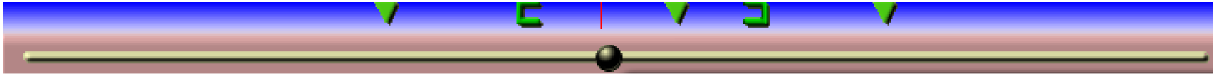
Preview region in compositor

If you go to the slider and slide it around with the preview region shrunk, you will see the slider only affects the preview region. The timebar and slider in the viewer window work exactly the same.

Labels and in/out points are fully supported in the viewer and compositor. The only difference between the viewer and compositor is the compositor reflects the state of the program while the viewer reflects the state of a clip but not the program.

When you hit the **label button** in the compositor, the label appears both in the compositor timebar and the program timebar.

When you select a label or in/out point in the compositor, the insertion point in the program window jumps to that position. To scroll your video and thus move the insertion point into the visible part of the timeline, use the **manual go to** button of the compositor.



Labels and in/out points in the viewer.

In the viewer and compositor, labels and in/out points are displayed in the timebar. Instead of displaying just a region of the program, the timebar displays the entire program here.

Like the program window, the compositor has a zoom capability. First, the pull-down menu on the bottom of the compositor window has a number of zoom options. When set to **Auto** the video is zoomed to match the compositor window size as closely as possible. When set to any other percentage, the video is zoomed a power of 2 and scrollbars can be used to scroll around the output. When the video is zoomed bigger than the window size, not only do scrollbars scan around it but **middle mouse button** dragging in the video output scans around it. This is exactly when The Gimp does.

Furthermore, the zoom 🔍 toggle causes the Compositor window to enter zoom mode. In zoom mode, clicking in the video output zooms in while **ctrl-clicking** in the video output zooms out. If you have a wheel mouse, rotating the wheel zooms in or out too.

Zooming in or out with the zoom tool does not change the rendered output, mind you. It is merely for scrutinizing video or fitting it in the desktop.

Playing video on the compositor when zoomed to any size other that 100%, the original size, requires Cinelerra to do extra processing steps. This could affect performance on slower systems.

14 Realtime effects

These are layered under the track they apply to. They process the track when the track is played back, with no permanent storage of the output except when the project is rendered.

All the realtime effects are listed in the resource window, divided into two groups: audio effects and video effects. Audio effects should be dragged from the resource window onto audio tracks. Video effects should be dragged onto video tracks.

If there is data on the destination track, the effect is applied to the entire track. If there is no data on the track the effect is deleted. Finally, if a region of the track is selected the effect is pasted into the region, regardless of whether there is data.

Some of the effects do not process data but synthesize data. In the case of a synthesis effect, you will want to select a region of the track so the dragging operation pastes it without deleting it.

When dragging more than one effect onto a track, you will see the effects layering from top to bottom, on the bottom of the track. When the track is played back, effects are processed from top to bottom. The output of the top effect becomes the input of the bottom effect and so on and so forth.

In addition to dragging from the resource window, effects may be applied to a track by a popup menu. Right click on a track and select **Attach effect** from the popup. The attach effect dialog gives you more control than pure dragging and dropping. For one thing, the attach effect dialog lets you attach two more types of effects: shared effects and shared tracks. Select a plugin from the **Plugins** column and hit **Attach** under the plugins column to attach it. The effect is the same as if the effect was dragged from the resource window.

When an effect exists under a track, it often needs to be configured. Go to the effect and right click on it to bring up the effect popup. In the effect popup is a **show** option. The show option causes the GUI for the effect to appear under the cursor. Most effects have GUI's but some do not. If the effect does not have a GUI, nothing pops up when the **show** option is selected. When you tweek parameters in the effect GUI, the parameters normally affect the entire duration of the effect.

14.1 Realtime effect types

The two other effect types supported by the Attach Effect dialog are recycled effects. In order to use a recycled effect, three requirements must be met:

- There must be other effects in the timeline.
- The other effects must be of the same type as the track you are attaching an effect to. If the track is an audio track, the effects must be audio effects. If the track is a video track, the effects must be video effects.
- The insertion point or selected region must start inside the other effects.

In the case of a shared effect, these conditions must be true. In the case of a shared track, there merely must be another track on the timeline of the same type as the track you are applying an effect to. If you right clicked on a video track to attach an effect, there will not be anything in the **shared tracks** column if no other video track exists. If you right clicked on an audio track there will not be anything in the shared track column if no other audio track exists.

If shared effects or shared tracks are available, they appear in the **shared effects** and **shared tracks** columns. The **attach** button under each column causes anything highlighted in the column to be attached under the current track.

Shared effects and shared tracks allow very unique things to be done. In the case of a shared effect, the shared effect is treated like a copy of the original effect except in the shared effect the

GUI can not be brought up. All configuration of the shared effect is determined by the GUI of the original effect and only the GUI of the original effect can be brought up.

When a shared effect is played back, it is processed just like a normal effect except the configuration is copied from the original effect. Some effects detect when they are being shared, like the reverb effects and the compressor. These effects determine what tracks are sharing them and either mix the two tracks together or use one track to stage some value. The reverb mixes tracks together to simulate ambience. The compressor uses one of the sharing tracks as the trigger.

When an original track has a **shared track** as one of its effects, the shared track itself is used as a realtime effect. This is more commonly known as **bouncing tracks** but Cinelerra achieves the same operation by attaching shared tracks. The fade and any effects in the shared track are applied to the original track. Once the shared track has processed the data, the original track performs any effects which come below the shared track and then composites it on the output.

In addition, once the shared track has processed the output of the original track like a realtime effect, the shared track mixes itself into the output with it is settings for pan, mode, and projector. Thus, two tracks are mixing the same data on the output. Most of the times you do not want the shared track to mix the same data as the original track on the output. You want it to stop right before the mixing stage and give the data back to the original track. Do this by enabling the 🔇 mute toggle next to each track for whom you do not want to mix on the output.

Suppose you were making video and you did want the shared track to composite the original track's data on the output a second time. In the case of video, the video from the shared track would always appear under the video from the original track, regardless of whether it was on top of the original track. This is because shared tracks are composited in order of their attachment. Since it is part of the original track it has to be composited before the original track is composited.

14.2 Editing realtime effects

Many operations exist for manipulating effects once they are in the timeline. Because mixing effects and media is such complex business, the methods used in editing effects are not as concise as cutting and pasting. Some of the editing happens by dragging in/out points, some of the editing happens through popup menus, and some of it happens by dragging effects.

Normally when you edit tracks, the effects follow the editing decisions. If you cut from a track, the effect shrinks. If you drag edit in/out points, the effect changes length. This behavior can be disabled by selecting **Settings->edit effects** in the project window. This decouples effects from editing operations, but what if you just want to edit the effects?

Move the timeline cursor over the effect borders until it changes to a resize left or resize right icon. In this state, if you drag the end of the effect, it performs an edit just like dragging the end of a track does.

The three editing behaviors of track trimming apply to effect trimming and they are bound to the mouse buttons that you set in **interface preferences**. See Section 3.7 [Interface], page 29. When you perform a trim edit on an effect, the effect boundary is moved by dragging on it. Unlike track editing, the effect has no source length. You can extend the end of an effect as much as desired without being limited.

Also unlike track editing, the starting position of the drag operation does not bind the edit decision to media. The media the effect is bound to does not follow effect edits. Other effects, however, do follow editing decisions made on an effect. If you drag the end of an effect which is lined up to effects on other tracks, the effects on the other tracks will be edited while the media stays the same.

What happens if you trim the end of an effect in, leaving a lot of unaffected time near the end of the track? When you drag an effect in from the Resource Window you can insert the effect in the portion of the row unoccupied by the trimming operation. Realtime effects are organized into rows under the track. Each row can have multiple effects.

In some cases you will want a trimming operation to change only one row of effects. This can be achieved by first positioning the insertion point on the start or end of the effect. Then press SHIFT while beginning the trimming operation. This causes the operation to change only one row of effects.

In addition to trimming, you can move effects up or down. Every track can have a stack of effects under it. By moving an effect up or down you change the order in which effects are processed in the stack. Go to an effect and right click to bring up the effect menu. The **Move up** and **Move down** options move the effect up or down.

When you are moving effects up or down, be aware that if they are shared as **shared effects**, any references will be pointing to a different effect after the move operation.

Finally, there is dragging of effects. Dragging effects works just like dragging edits. You must select the ↖ arrow to enter drag and drop mode before dragging effects. The effects snap to media boundaries, effect boundaries, and tracks. Be aware if you drag a reference to a shared effect, the reference will usually point to the wrong effect afterwards.

Right click on an effect to bring up a menu for the effect. Select **attach...** to change the effect or change the reference if it is a shared effect.

14.3 Realtime audio effects

14.3.1 Compressor

Contrary to computer science experience, the audio compressor does not reduce the amount of data required to store the audio. The audio compressor reduces the dynamic range of the audio. In Cinelerra the compressor actually performs the function of an expander and compressor.

The compressor works by calculating the maximum sound level within a certain time period of the current position. The maximum sound level is taken as the input sound level. For every input sound level there is an output sound level specified by the user. The gain at the current position is adjusted so the maximum sound level in the time range is the user specified value.

The compressor has a graph which correlates every input sound level to an output level. The horizontal direction is the input sound level in dB. The vertical direction is the output sound level in dB. The user specifies output sound levels by creating points on the graph. Click in the graph to create a point. If 2 points exist, drag one point across another point to delete it. The most recent point selected has its vales displayed in textboxes for more precise adjustment.

To make the compressor reduce the dynamic range of the audio, make all the output values greater than the input values except 0 dB. To make the compressor expand the dynamic range of the audio, make all the output values except 0 dB less than the input values. The algorithm currently limits all sound levels above 0 dB to 0 dB so to get an overloaded effect put a gain effect before the compressor to reduce all the levels and follow it with another gain effect to amplify all the levels back over 0 dB.

Reaction secs: This determines where in relation to the current position the maximum sound level is taken and how fast the gain is adjusted to reach that peak. It is notated in seconds. If it is negative the compressor reads ahead of the current position to get the future peak. The gain is ramped to that peak over one reaction time. This allows it to hit the desired output level exactly when the input peak occurs at the current position.

If the reaction time is positive the compressor scans only the current position for the gain and ramps gain over one reaction time to hit the desired output level. It hits the output level exactly one reaction time after detecting the input peak.

Decay secs: If the peak is higher than the current level, the compressor ramps the gain up to the peak value. Then if a future peak is less than the current peak it ramps the gain down. The time taken to ramp the gain down can be greater than the time taken to ramp the gain up. This ramping down time is the decay seconds.

Trigger type: The compressor is a multi-channel effect. Several tracks can share one compressor. How the signal from many tracks is interpreted is determined by the trigger type.

The **Trigger type** uses the value supplied in the **Trigger** textbox as the number of the track to use as input for the compressor. This allows a track which is not even heard to determine the loudness of the other tracks.

The **Maximum** trigger takes the loudest track and uses it as the input for the compressor.

The **Total** trigger type adds the signals from all the tracks and uses the total as the input for the compressor. This is the most natural sounding compression and is ideal when multiple tracks are averaged into single speakers.

Trigger: The compressor is a multichannel effect. Several tracks can share one compressor. Normally only one track is scanned for the input peak. This track is specified by the **Trigger**. By sharing several tracks and playing with the trigger value, you can make a sine wave on one track follow the amplitude of a drum on another track for example.

Smooth only: For visualizing what the compressor is doing to the sound-level, this option causes it to replace the sound wave with just the current peak value. It makes it very easy to see how **reaction secs** affects the detected peak values.

14.3.2 Delay audio

Just tell how much seconds you want to delay the video track.

14.3.3 Denoise

FIXME

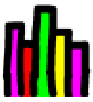
14.3.4 DenoiseFFT

FIXME

14.3.5 Despike

FIXME

14.3.6 EQ Parametric

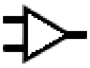


FIXME

14.3.7 Freeverb

FIXME

14.3.8 Gain



FIXME

14.3.9 Heroine College

FIXME

14.3.10 Interpolate

FIXME

14.3.11 Invert Audio

FIXME

14.3.12 Live audio

This effect reads audio directly from the soundcard input. It replaces any audio on the track so it is normally applied to an empty track.

To use Live Audio, highlight a horizontal region of an audio track or define in and out points. Then drop the Live Audio effect into it. Create extra tracks and attach shared copies of the first Live Audio effect to the other tracks to have extra channels recorded.

Live Audio uses the sound driver selected in **Settings->Preferences->Playback->Audio Out** for recording, but unlike recording it uses the **playback buffer size** as the recording buffer size and it uses the **project sample rate** as the sampling rate.

These settings are critical since some sound drivers can not record in the same sized buffer they play back in. Live audio has been most reliable when ALSA is the recording driver and the playback fragment size is 2048.

Drop other effects after Live Audio to process soundcard input in realtime.

Now the bad news. With live audio there is no read-ahead, so effects like compressor will either delay if they have read-ahead enabled or playback will under-run.

Another problem is sometimes the recording clock on the soundcard is slightly slower than the playback clock. The recording eventually falls behind and playback sounds choppy.

Finally, live audio does not work in reverse.

14.3.13 Loop audio

FIXME

14.3.14 Overlay

FIXME

14.3.15 Pitch shift

Like the time stretching methods, there are three pitch shifting methods: **Pitch shift**, **Resample**, and **Asset info dialog**. Pitch shift is a realtime effect which can be dragged and dropped onto recordable audio tracks. Pitch shift uses a fast Fourier transform to try to change the pitch without changing the duration, but this introduces windowing artifacts.

Because the windowing artifacts are less obtrusive in audio which is obviously pitch shifted, Pitch shift is mainly useful for extreme pitch changes. For mild pitch changes, use **Resample** from the **Audio->Render Effect** interface. Resample can change the pitch within 5% without a noticeable change in duration.

Another way to change pitch slightly is to go to the **Resources** window, highlight the **media** folder, right click on an audio file, click on **Info**. Adjust the sample rate in the **Info** dialog to adjust the pitch. This method also requires left clicking on the right boundary of the audio tracks and dragging left or right to correspond to the length changes.

14.3.16 Reverse audio

Apply **reverse audio** to an audio track and play it backwards. The sound plays forward.

Be aware when reversing audio that the waveform on the timeline does not reflect the actual reversed output.

14.3.17 SoundLevel

FIXME

14.3.18 Spectrogram

FIXME

14.3.19 Synthesizer

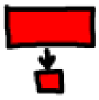
FIXME

14.3.20 Time stretch

FIXME

14.4 Realtime video effects

14.4.1 1080 to 480



Most TV broadcasts are received with a 1920x1080 resolution but originate from a 720x480 source at the studio. It is a waste of space to compress the entire 1920x1080 if the only resolvable details are 720x480. Unfortunately resizing 1920x1080 video to 720x480 is not as simple as shrinking it.

At the TV station the original 720x480 footage was first converted to fields of 720x240. Each field was then scaled up to 1920x540. The two 1920x540 fields were finally combined with interlacing to form the 1920x1080 image. This technique allows a consumer TV to display the re-sampled image without extra circuitry to handle 720x480 interlacing in a 1920x1080 image.

If you merely deinterlace the 1920x1080 images, you would end up with resolution of 720x240. The **1080 to 480** effect properly extracts two 1920x540 size fields from the image, resizes them separately, and combines them again to restore a 1920x480 interlaced image. The **scale** effect must then be applied to reduce the horizontal size to 960 or 720 depending on the original aspect ratio.

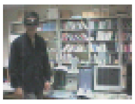
The tracks to which **1080 to 480** is applied need to be at 1920x1080 resolution. The project settings in **settings->format** should be at least 720x480 resolution.

The effect does not know if the first row in the 1920x1080 image belongs to the first row of the 720x480 original. You have to specify what the first row is in the effect configuration.

The output of this effect is a small image in the middle of the original 1920x1080 frame. Use the projector to center the output image in the playback.

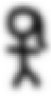
Finally, once you have 720x480 interlaced video you can either apply **frames to fields** of **inverse telecine** to further recover original progressive frames.

14.4.2 Aging TV



This effect is the one to use if you want to achieve an "old movie" or TV show look. It will put moving lines up and down the movie as well as putting "snow" on the video. Use is along with Brightness/Contrast and Color Balance to make your movie look like a really old black and white movie.

14.4.3 Blur



This effect blurs a video track. The parameters are:

- **Horizontal and vertical**
  Those parameters are used to tell which one of field blurring affects. It can be be both fields.

- **Radius**
  Use this slider to define the amount of blur to apply.
- **Blur alpha, red, green, blue**
  Specifies which color channels has to be blurred.

14.4.4 Brightness/contrast

If you want to brighten a dark shot, or add light, this is the tool to use. Do not overuse the effect or you risk degrading your video quality. Use the effect along with Keyframing to brighten a long shot that is dark at the beginning but bright at the end. Generally you will want to change the brightness and contrast about the same amount (eg darkness 28 contrast 26) so that your original colors are kept intact.

14.4.5 Burning TV

The video burning effect makes your video "burn" where there are small light colored patches of video, on the edge of a white T-shirt for example. It can be a great asset to a music video and just a great outlet to help free your imagination in your video.

14.4.6 Chroma key

This effect erases pixels which match the selected color. They are replaced to black if there is no alpha channel and transparency if there is an alpha channel. The selection of color model is important to determine the behavior.

Chroma key uses either the lightness or the hue to determine what is erased. **Use value** singles out only the lightness to determine transparency. Select a center color to erase using the **Color** button. Alternatively a color can be picked directly from the output frame by first using the **color picker** in the compositor window and then selecting the **Use color picker** button. This sets the chroma key color to the current color picker color.

Be aware that the output of the chroma key is fed back to the compositor, so selecting a color again from the compositor will use the output of the chroma key effect. The chroma key should be disabled when selecting colors with the color picker.

If the lightness or hue is within a certain threshold it is erased. Increasing the threshold determines the range of colors to be erased. It is not a simple on/off switch, however. As the color approaches the edge of the threshold, it gradually gets erased if the slope is high or is rapidly erased if the slope is low. The slope as defined here is the number of extra values flanking the threshold required to go from opaque to transparent.

Normally threshold is very low when using a high slope. The two parameters tend to be exclusive because slope fills in extra threshold.

The slope tries to soften the edges of the chroma key but it does not work well for compressed sources. A popular softening technique is to use a maximum slope and chain a blur effect below the chroma key effect to blur just the alpha.

14.4.7 Chroma key (HSV)

FIXME

14.4.8 Color balance

Video Color Balance is a great effect to use along with Brightness/contrast and Hue/Saturation to try and compensate for possible errors in filming (low lighting, etc). It can only do so much without greatly lowering the quality of the video, however. It is just like the color balance effect on a picture editing program, such as GIMP. With it you can change the colors being sent to output CMY (Cyan, Magenta, Yellow) or RGB (Red, Green, Blue).

14.4.9 Decimate

This effect drops frames from a track which are most similar in order to reduce the frame rate. This is usually applied to a DVD to convert the 29.97 fps video to the 23.97 fps film rate but this decimate effect can take any input rate and convert it to any lower output rate.

The output rate of **decimate** is the project frame rate. The input rate is set in the **decimate** user interface. To convert 29.97 fps progressive video to 23.97 fps film, apply a decimate effect to the track. Set the decimate input rate to 29.97 and the project rate to 23.97.

Be aware every effect layered before decimate processes video at the decimate input rate and every effect layered after decimate processes video at the project frame rate. Computationally intensive effects should come below decimate.

14.4.10 Deinterlace

The deinterlace effect has evolved over the years to deinterlacing and a whole lot more. In fact two of the deinterlacing methods, **Inverse Telecine** and **Frames to Fields**, are separate effects. The deinterlace effect offers several variations of line replication to eliminate comb artifacts in interlaced video. It also has some line swapping tools to fix improperly captured video or make the result of a reverse effect display fields in the right order.

14.4.11 Delay video

FIXME

14.4.12 Denoise video

FIXME

14.4.13 Denoise video2

FIXME

14.4.14 Difference key

The difference key creates transparency in areas which are similar between 2 frames. The Difference key effect must be applied to 2 tracks. One track contains the action in front of a constant background and another track contains the background with nothing in front of it. Apply the difference key to the track with the action and apply a shared copy of it to the track with the background. The track with the background should be muted and underneath the track with the action and the colormodel should have an alpha channel.

Pixels which are different between the background and action track are treated as opaque. Pixels which are similar are treated as transparent. Change **threshold** in the difference key window to make more pixels which are not the same color transparent. Change **slope** to change the rate at which the transparency tapers off as pixels get more different.

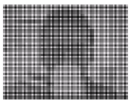
The slope as defined here is the number of extra values flanking the threshold required to go from opaque to transparent. A high slope is more useful with a low threshold because slope fills in extra threshold.

Use value causes the intensity of pixels to be compared instead of the color.

Applying a blur to the top track with just the alpha channel blurred can soften the transparency border.

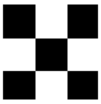
Note: Currently this effect is known to crash when using YUV modes.

14.4.15 DotTV



Another effect by Kentaro (effectTV).

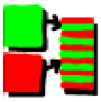
14.4.16 Downsample



Downsampling is the process of reducing the size of an image by throwing out data, reducing sampling rate.

Parameters refers to:
Horizontal
Horizontal offset
Vertical
Vertical offset
Channels

14.4.17 Fields to frames

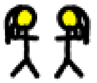


This effect reads frames at twice the project framerate, combining 2 input frames into a single interlaced output frame. Effects preceding **fields to frames** process frames at twice the project frame rate. Each input frame is called a field.

Fields to frames needs to know what field corresponds to what lines in the output frame. The easiest way to figure it out is to try both options in the window. If the input fields are the result of a line doubling process like **frames to fields**, the wrong setting results in blurrier output. If the input fields are the result of a standards conversion process like **1080 to 480**, the wrong setting will not make any difference.

The debobber which converts 720x480 interlaced into 1920x1080 interlaced or 1280x720 progressive seems to degrade the vertical resolution to the point that it can not be recovered.

14.4.18 Flip



This effect permits to flip a video track (or a portion of) from left to right, right to left, up to down, down to up.

The dialog window is simple, since only the vertical and horizontal parameters are needed.

14.4.19 Frames to fields

This plugin applies the operation reverse to the "Fields to Frames" plugin: it extracts the two interlaced fields stored in alternating lines of interlaced source footage and outputs them as separate full frames. The alternating lines missing on each output frame are interpolated. (The naming of this pair of plugins is obviously misleading with respect to the common usage of the terms "field" and "frame"; normally, "fields" denotes the interlaced half images and "frame" denotes the full image).

This plugin is only usefull if its output is pulled with doubled framerate with respect to the source footage. One typical usage secenario is to do masking, scaling and translating on interlaced footage without the need to destroy the additional temporal information contained in such source material. This is helpful if your intended target format is interlaced. If on the other hand, you just want to target a progressive display (e.g. you create video for display on computer monitor solely) then it is much more convienient to de-interlace the source material prior to any further processing.

Processing interlaced footage without deinterlacing

1. Create a new project with doubled frame rate. I.e make it 50fps if your source footage is 25i
2. Insert your source footage onto a video track in the timeline. Now, Cinelerra will playback each frame of your footage twice.
3. Apply the "Frames to Fields" effect. Be sure to choose the correct field order. Typical values beeing "bottom field first" for DV and "top field first" for HDV.
4. Then apply any further effects afterwards, including translations, scaling, slow motion, precise frame-wise masking or use of the motion tracker plugin.
5. Render your project to a intermediate clip. Be sure to choose a rather lossless video codec, e.g. Motion-JPEG-A or even uncompressed yuv if you have plenty of storage.
6. Insert the intermediate clip into your original project. Make sure the doubled framerate has been detected correctly by Cinelerra (by looking in the clip's media info in the media resources folder)
7. Apply the "Fields to frames" effect to the intermediate clip. This will combine two adjacent fields into one interlaced field with the original frame rate.
8. Do the final render on your original project

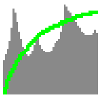
14.4.20 Freeze frame

In its simplest form, highlight a region of the track to freeze, drop the freeze frame effect on the highlighted region, and the lowest numbered frame in the affected area will play throughout the entire region.

Freezeframe has an **enabled** option which can be keyframed. Regions of a freeze frame effect which are enabled repeat the lowest numbered frame since the last keyframe. This has unique possibilities.

- If a freeze frame effect has a keyframe in the middle of it set to **enabled**, the frame in the middle is repeated in the entire effect.
- If a freeze frame effect has several keyframes, each set to **enabled**, every time a keyframe is encountered the frame under it becomes the frozen one.
- If a freeze frame effect alternates between **enabled** and **disabled**, each time an **enabled** keyframe is encountered the frame under it is replicated until the next **disabled** keyframe. The disabled regions play through.

14.4.21 Gamma



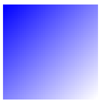
Raw camera images store colors in a logarithmic scale. The blacks in these images are nearly 0 and the whites are supposed to be infinity. The graphics card and most video codecs store colors in a linear scale but Cinelerra keeps raw camera images in their original logarithmic scale when it renders them. This is necessary because the raw image parser can not always decode the proper gamma values for the images. It also does its processing in 16 bit integers, which takes away a lot of information.

The gamma effect converts the logarithmic colors to linear colors through a gamma value and a maximum value. The gamma value determines how steep the output curve is and the maximum value is where 1.0 in the output corresponds to maximum brightness in the input.

The gamma effect has 2 more parameters to simplify gamma correction. The **automatic** option causes it to calculate **max** from the histogram of the image. Use this when making a preview of a long list of images since it changes for every image.

The **use color picker** option uses the value currently in the color picker to set the **max** value. Note that every time you pick a color from the compositor window, you need to hit **use color picker** to apply the new value.

14.4.22 Gradient

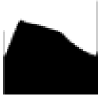


The gradient effect overlays a smooth color gradient on top of every video frame. It is usefull for all sorts of backgound fills, for partially filtering or for adding moving highlights. The Gradient effect can generate linear or circular color fills. For linear fills, you can choose the angle, for circular fills the center of the created gradient pattern. Moreover, you can control the slope of the color transition by selecting a transition function (linear, logarithmic, squared) and by changing the "start" and "stop" radius. Note that both colors used in this color transition can contain an arbitrary Alpha value (transparency). All parameters can be keyed and will be interpolated between keyframes.

Note the following well known problems:

- When using limited color models in your project, the Gradient fill can create color bands or steps.
- When using a project format with anamorphotic storage, Cinelerra won't do any internal corrections for this. This can result in a circular fill showing up elliptical. A common example is the HDV 1080i format, which is stored as 1440x1080 pixels, but displayed as 1920x1080 (16:9 aspect ratio). As Cinelerra does its calculations on a 1440x1080 pixel bitmap, any circular fill will be streched out horizontally when displaying the final output.

14.4.23 Histogram



This shows the number of occurrences of each color on a histogram plot.

It is always performed in floating point RGB regardless of the project color-space. The histogram has two sets of transfer parameters: the input transfer and the output transfer.

4 histograms are possible in the histogram viewer. The red, green, blue histograms show the input histograms for red, green, blue and multiply them by an input transfer to get the output red, green, blue. Then the output red, green, blue is scaled by an output transfer. The scaled red, green, blue is converted into a value and plotted on the value histogram. The value histogram thus changes depending on the settings for red, green, blue. The value transfers are applied uniformly to R, G, B after their color transfers are applied.

Select which transfer to view by selecting one of the channels on the top of the histogram.

The input transfer is defined by a graph overlaid on the histogram. The horizontal direction corresponds to every possible input color. The vertical direction corresponds to the output color for every input color. Video entering the histogram is first plotted on the histogram plot, then it is translated so output values now equal the output values for each input value on the input graph.

The input graph is edited by adding and removing any number of points. Click and drag anywhere in the input graph to create a point and move it. Click on an existing point to make it active and move it. The active point is always indicated by being filled in. The active point's input and output color are given in text boxes on top of the window. The input and output color of the point can be changed through these text boxes.

Points can be deleted by first selecting a point and then dragging it to the other side of an adjacent point. They can also be deleted by selecting them and hitting **delete**.

After the input transfer, the image is processed by the output transfer. The output transfer is simply a minimum and maximum to scale the input colors to. Input values of 100% are scaled down to the output's maximum. Input values of 0% are scaled up to the output minimum.

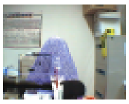
Input values below 0 are always clamped to 0 and input values above 100% are always clamped to 100%. Click and drag on the output gradient's triangles to change it. It also has textboxes to enter values into.

Enable the **automatic** toggle to have the histogram calculate an automatic input transfer for the red, green, blue but not the value. It does this by scaling the middle 99% of the pixels to take 100% of the histogram width. The number of pixels permitted to pass through is set by the **Threshold** textbox. A threshold of 0.99 scales the input so 99% of the pixels pass through. Smaller thresholds permit fewer pixels to pass through and make the output look more contrasty.

Automatic input transfer is calculated for the R, G, and B channels but not the value.

Plot histogram
Split output

14.4.24 HolographicTV



By Kentarou effectTV

14.4.25 Hue saturation

With that effect you can change hue, saturation and value. The parameters are modified using 3 simple sliders.

- The hue control shifts the colors circularly in the color plane, normally resulting in "false" colors.
- The saturation control can be used to reduce color footage to black and white.
- The value control makes any given colors more bright or more subdued.

14.4.26 Interpolate video

The interpolate effect tries to create the illusion of a higher frame rate from source footage of very low framerates by averaging frames over time. It averages two input frames for each output frame. The input frames are at different times, resulting in a dissolve for all output frames between the input frames. There are two ways of specifying the input frames. You can specify an input frame rate which is lower than the project frame rate. This causes input frames to be taken at even intervals.
You can also specify keyframe locations as the positions of the input frames. In this mode the output frame rate is used as the input frame rate and you just create keyframes wherever you want to specify an input frame.

14.4.27 Interpolate pixels

Note: this effect works only for float color models.

FIXME

14.4.28 Inverse telecine

This is the most effective deinterlacing tool when the footage is a video transfer of a film. Here the film was converted from 24 fps to 60 fps. Then the 60 fps was down-sampled to 30 fps by extracting odd and even lines and interlacing the lines. The IVTC effect is primarily a way to convert interlaced video to progressive video. It undoes three patterns of interlacing.

```
A AB BC CD D
AB CD CD DE EF
Automatic
```

The first two options are fixed patterns and affected by the **pattern offset** and **odd field first** parameters. The last option creates several combinations of lines for each frame and picks the most progressive combination. It is a brute force algorithm.

This technique does not rely on a pattern like other techniques and is less destructive but the timing is going to be jittery because of the lack of a frame rate reduction. In order to smooth out the timing, you need to follow inverse telecine with a decimate effect.

14.4.29 Invert video

Also called invert video, it is a method of reversing the colors of a video track.

The three parameters refer to channels (Red, Blue, Green, Alpha)

14.4.30 Linear blur

Blur has three styles: Linear, Radial, and Zoom

Parameters refer to:

- **Length**
  Distance between original image and final blur step
- **Angle**
  Angle of motion, for linear blur
- **Steps**
  Number of blur steps
- **Channels**
  Which channel(s) to blur.

14.4.31 Live video

This effect reads video directly from the capture card input. It replaces any video on the track so it is normally applied to an empty track. The configuration for the capture card is taken from the recording preferences. Go to **Settings->Preferences->Recording** to set up the capture card.

Go to the **Video In** section where it says **Record driver**. It must be set to either **Video4Linux2** or **IEC 61883**. Other video drivers have not been tested with Live Video and probably will not work.

For live video, the selection for **File Format** and **Video** needs to be set to a format the timeline can use. The file format must be **Quicktime for Linux** and video recording must be enabled for it. Click on the wrench 🔧 to set the video compression.

The video compression depends on the recording driver. For the **Video4Linux2** recording driver, the compression must be **Motion JPEG A**. For the **IEC 61883** driver, the compression must be **DV**. This gets the driver to generate output in a colormodel that the timeline can use.

Some cards provide color and channel settings. Live video takes the color settings from the values set in the **Video In** window. Go to **File->Record** to bring up the recording interface and the Video In window. Values set in the **Video in** window are used by **Live Video**. Any channels the capture card supports need to be configured in the **Video in** interface since the same channels are used by the **Live Video** effect.

With the video recording configured, highlight a horizontal region of a video track or define in and out points. Then drop the Live Video effect into it. Drop other effects after Live Video to process the live video in realtime. For best results, you should use OpenGL and a video card which supports GL shading language. Go to **Settings->Preferences->Playback->Video Out** to enable the OpenGL driver.

Only one Live Video effect can exist at any time on the timeline. It can not be shared by more than one track.

14.4.32 Loop video

Sections of video can be looped by dropping a **loop** effect on them. Contrary to the **settings->loop playback** option, the loop effects can be rendered where the **settings->loop playback** option can not be. The loop effects are also convenient for short regions.

The loop effects have one option: the number of **frames** or **samples** to loop. This specifies the length of the region to loop starting from either the beginning of the effect or the latest keyframe. The region is replicated for the entire effect.

Every time a keyframe is set in a loop effect, the keyframe becomes the beginning of the region to loop. Setting several keyframes in succession causes several regions to loop. Setting a single keyframe causes the region after the keyframe to be looped throughout the effect, no matter where the keyframe is. The end of an effect can be looped from the beginning by setting the keyframe near the end.

14.4.33 Motion

The motion tracker is almost a complete application in itself. The motion tracker tracks two types of motion: translation and rotation. It can track both simultaneously or one only. It can do 1/4 pixel tracking or single pixel tracking. It can stabilize motion or cause one track to follow the motion of another track.

Although the motion tracker is applied as a realtime effect, it usually must be rendered to see useful results. The effect takes a long time to precisely detect motion.

The motion tracker works by using one region of the frame as the region to track. It compares this region between 2 frames to calculate the motion. This region can be defined anywhere on the screen. Once the motion between 2 frames has been calculated, a number of things can be done with that motion vector. It can be scaled by a user value and clamped to a maximum range. It can be thrown away or accumulated with all the motion vectors leading up to the current position.

To save time the motion result can be saved for later reuse, recalled from a previous calculation, or discarded.

The motion tracker has a notion of 2 tracks, the master layer and the target layer. The master layer is where the comparison between 2 frames takes place. The target layer is where motion is applied either to track or compensate for the motion in the master layer.

The intricacies of motion tracking are enough to sustain entire companies and build careers around. The motion tracker in Cinelerra is not as sophisticated as some world class motion trackers but it is enough to sweeten some camcorder footage.

Here is a brief description of the motion tracking parameters:

- **Track translation**
  Enables translation operations. The motion tracker tracks X and Y motion in the master layer and adjusts X and Y motion in the target layer.
- **Translation block size**
  For the translation operations, a block is compared to a number of neighboring blocks to find the one with the least difference. The size of the block to search for is given by this parameter.
- **Translation search radius**
  The size of the area to scan for the translation block.
- **Translation search steps**
  Ideally the search operation would compare the translation block with every other pixel in the translation search radius. To speed this operation up, a subset of the total positions is searched. Then the search area is narrowed and rescanned by the same number of search steps until the motion is known to 1/4 pixel accuracy.
- **Block X, Y**
  These coordinates determine the center of the translation block based on percentages of the width and height of the image. The center of the block should be part of the image which is visible at all times.
- **Maximum absolute offset**
  The amount of motion detected by the motion tracker is unlimited if this is 100. If it is under 100 the amount of motion is limited by that percentage of the image size.
- **Settling speed**
  The motion detected between every frame can be accumulated to form an absolute motion vector. If the settling speed is 100 the absolute vector is added to the next frame. If the settling speed is less than 100 the absolute vector is downscaled by the settling amount before being added to the next frame.
- **Track rotation**
  Enables rotation operations. The motion tracker tracks rotation in the master layer and adjusts rotation in the target layer.
- **Rotation block size**
  For rotation operations a single block is compared to equally sized blocks, each rotated by a different amount. This is the size of the rotation block.
- **Rotation search radius**
  This is the maximum angle of rotation from the starting frame the rotation scanner can detect. The rotation scan is from this angle counterclockwise to this angle clockwise. Thus the rotation search radius is half the total range scanned.
- **Rotation search steps**
  Ideally every possible angle would be tested to get the rotation. To speed up the rotation search, the rotation search radius is divided into a finite number of angles and only those angles compared to the starting frame. Then the search radius is narrowed and an equal number of angles is compared in the smaller radius until the highest possible accuracy is achieved.

Normally you need one search step for every degree scanned. Since the rotation scanner scans the rotation search radius in two directions, you need two steps for every degree in the search radius to search the complete range.

- **Draw vectors**
  When translation is enabled, 2 boxes are drawn on the frame. One box represents the translation block. Another box outside the translation block represents the extent of the translation search radius. In the center of these boxes is an arrow showing the translation between the 2 master frames.
  When rotation is enabled a single box the size of the rotation block is drawn rotated by the amount of rotation detected.
- **Track single frame**
  When this option is used the motion between a single starting frame and the frame currently under the insertion point is calculated. The starting frame is specified in the **Frame number** blank. The motion calculated this way is taken as the absolute motion vector. The absolute motion vector for each frame replaces the absolute motion vector for the previous frame. Settling speed has no effect on it since it does not contain any previous motion vectors. Playback can start anywhere on the timeline since there is no dependence on previous results.
- **Track previous frame**
  Causes only the motion between the previous frame and the current frame to be calculated. This is added to an absolute motion vector to get the new motion from the start of the sequence to the current position. After every frame processed this way, the block position is shifted to always cover the same region of the image. Playback must be started from the start of the motion effect in order to accumulate all the necessary motion vectors.
- **Previous frame same block**
  This is useful for stabilizing jerky camcorder footage. In this mode the motion between the previous frame and the current frame is calculated. Instead of adjusting the block position to reflect the new location of the image, like Track Previous Frame does, the block position is unchanged between each frame. Thus a new region is compared for each frame.
- **Master layer**
  This determines the track which supplies the starting frame and ending frame for the motion calculation. If it is **Bottom** the bottom track of all the tracks sharing this effect is the master layer. The top track of all the tracks is the target layer.
- **Calculation**
  This determines whether to calculate the motion at all and whether to save it to disk. If it is **Don't Calculate** the motion calculation is skipped. If it is **Recalculate** the motion calculation is performed every time each frame is rendered. If it is **Save** the motion calculation is always performed but a copy is also saved. If it is **Load**, the motion calculation is loaded from a previous save calculation. If there is no previous save calculation on disk, a new motion calculation is performed.
- **Action**
  Once the motion vector is known this determines whether to move the target layer opposing the motion vector or following the motion vector. If it is **Do Nothing** the target layer is untouched. If it is **Track...** the target layer is moved by the same amount as the master layer. This is useful for matching titles to objects in the frame. If it is **Stabilize...** the target layer is moved opposite to the motion vector. This is useful for stabilizing an object in the frame. The motion operations can be accurate to single pixels or subpixels by changing the action setting.

14.4.33.1 Secrets of motion tracking

Since it is a very slow effect, there is a method to applying the motion tracker to get the most out of it. First disable playback for the track to do motion tracking on. Then drop the effect on a region of video with some motion to track. Then rewind the insertion point to the start of the region. Set **Action -> Do Nothing**. Set **Calculation -> Don't calculate**. Enable **Draw vectors**. Then enable playback of the track to see the motion tracking areas.

Enable which of **translation motion** or **rotation motion** vectors you want to track. By watching the compositor window and adjusting the **Block x,y** settings, center the block on the part of the image you want to track. Then set search radius, block size, and block coordinates for translation and rotation.

Once this is configured, set the calculation to **Save coords** and do test runs through the sequence to see if the motion tracker works and to save the motion vectors. Once this is done, disable playback for the track, disable **Draw vectors**, set the motion action to perform on the target layer and change the calculation to **Load coords**. Finally enable playback for the track.

When using a single starting frame to calculate the motion of a sequence, the starting frame should be a single frame with the least motion to any of the other frames. This is rarely frame 0. Usually it is a frame near the middle of the sequence. This way the search radius need only reach halfway to the full extent of the motion in the sequence.

If the motion tracker is used on a render farm, **Save coords** and **previous frame** mode will not work. The results of the save coords operation are saved to the hard drives on the render nodes, not the master node. Future rendering operations on these nodes will process different frames and read the wrong coordinates from the node filesystems. The fact that render nodes only visualize a portion of the timeline also prevents **previous frame** from working since it depends on calculating an absolute motion vector starting on frame 0.

14.4.33.2 2 pass motion tracking

The method described above is 2 pass motion tracking. One pass is used just to calculate the motion vectors. A second pass is used to apply the motion vectors to the footage. This is faster than a single pass because errors in the motion vector calculation can be discovered quickly.

This also allows the motion tracking to use a less demanding colormodel like RGB888 in the scanning step and a more demanding colormodel like RGB Float in the action step. The scanning step takes much longer than action.

This suffers the disadvantage of not being practical for extremely long sequences where some error is acceptable and the picture quality is lousy to begin with, like stabilizing camcorder footage.

The slower method is to calculate the motion vectors and apply them simultaneously. This method can use one track as the motion vector calculation track and another track as the target track for motion vector actions. This is useful for long sequences where some error is acceptable.

14.4.33.3 Using blur to improve motion tracking

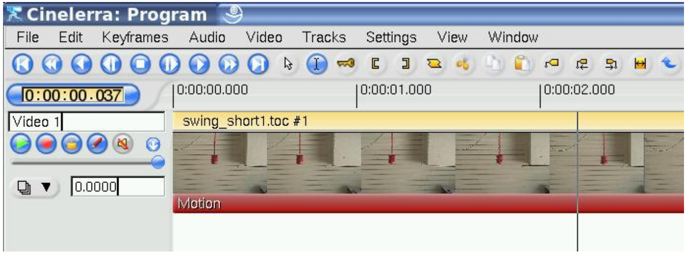
With extremely noisy or interlaced footage, applying a blur effect before the motion tracking can improve accuracy. Either save the motion vectors in a **tracking pass** and disable the blur for the **action pass** or apply the blur just to the **master layer**.

14.4.33.4 Using histogram to improve motion tracking

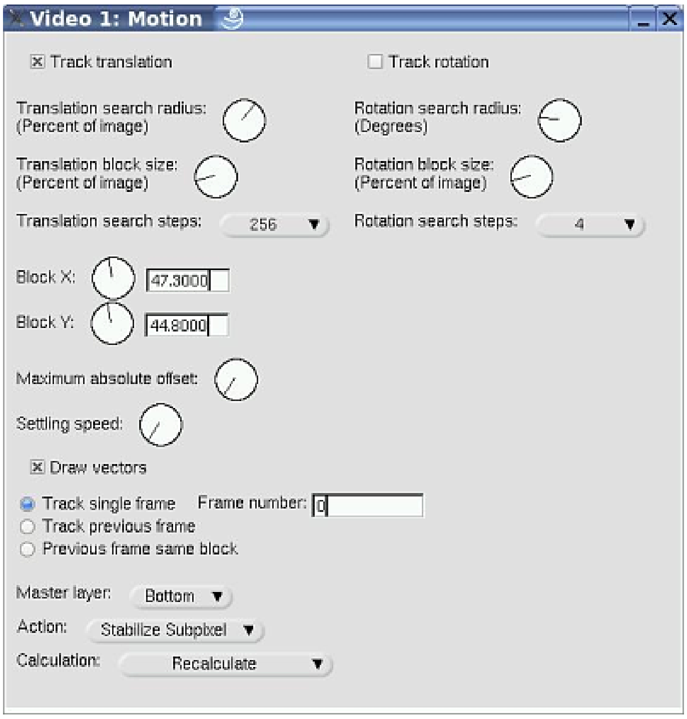
A histogram is almost always applied before motion tracking to clamp out noise in the darker pixels. Either save the motion vectors in a **tracking pass** and disable the histogram for the **action pass** or apply the histogram just to the **master layer**.

14.4.33.5 Motion tracking in action

First, add a motion effect to the track. Drag it from the resource window and drop it directly over the video in Cinelerra's main window. You should see something similar to this:



Then right-click on the motion effect marker in the timeline and select show to see the motion tracker dialog:



☒ Track translation

□ Track rotation

Translation search radius: (Percent of image)

Rotation search radius: (Degrees)

Translation block size: (Percent of image)

Rotation block size: (Percent of image)

Translation search steps: 256

Rotation search steps: 4

Block X: 47.3000

Block Y: 44.8000

Maximum absolute offset:

Settling speed:

☒ Draw vectors

● Track single frame Frame number: 0

○ Track previous frame

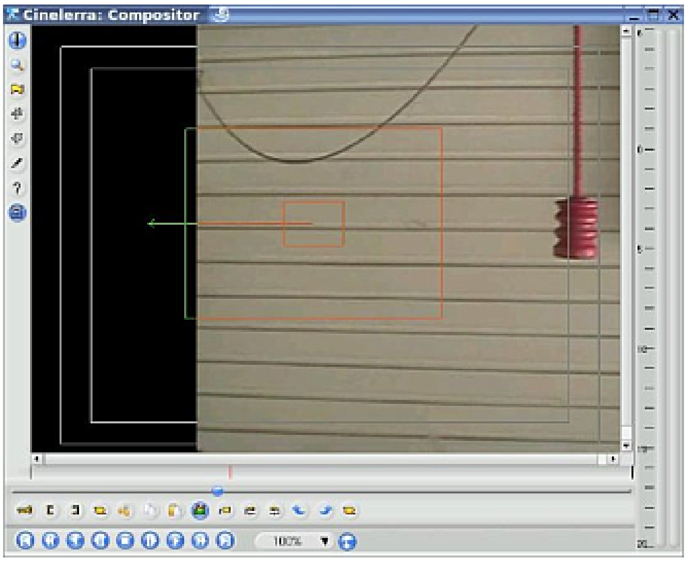
○ Previous frame same block

Master layer: Bottom

Action: Stabilize Subpixel

Calculation: Recalculate

Start by looking at your Compositor. You will see some new boxes overlaid on the video. These are important to control the motion tracker. Here is a quick shot of what it will look like when working:



The image above shows the motion tracker losing track of the object because of a search window that is too small. We will talk about this more later, but quickly:

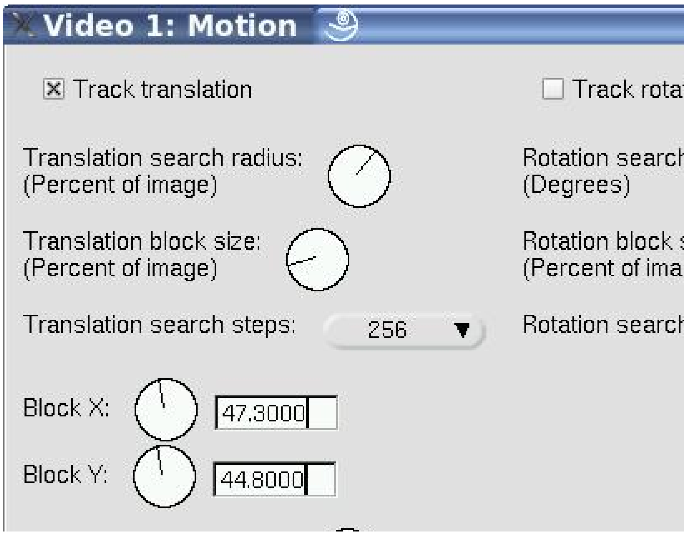
- The middle small box is the target of the tracker.
- The middle larger box is the search range for the tracker. It should contain the full range of motion for the tracking target.
- In this example, we are trying to track the hanging handle. We have failed in this video frame, because the handle is far right of the center of frame.
- The left pointing vector indicates the motion tracker attempting to find the target. More on this later.

Move to the beginning of your video clip

Make sure the motion tracker dialog is open

Look at the Compositor

Start adjusting these four knobs:



Video 1: Motion

☒ Track translation   □ Track rota

Translation search radius: (Percent of image)   Rotation search (Degrees)

Translation block size: (Percent of image)   Rotation block s (Percent of ima

Translation search steps: 256   Rotation search

Block X: 47.3000

Block Y: 44.8000

Make sure you check Track Translation

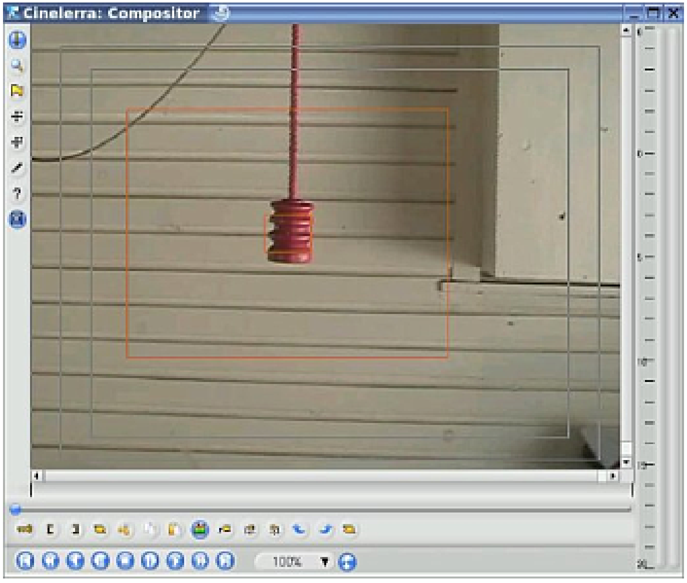
Uncheck Track Rotation

Start with knob two - Translation block size - and spin it to get an idea for what is changing. Notice that both boxes resize. Look at the small inside box. Adjust it to the size of the target (the object you want to track). Do not worry if it does not cover the object yet.

Go on to knobs three and four - Block X and Block Y. Use these to put the target designator over the target itself.

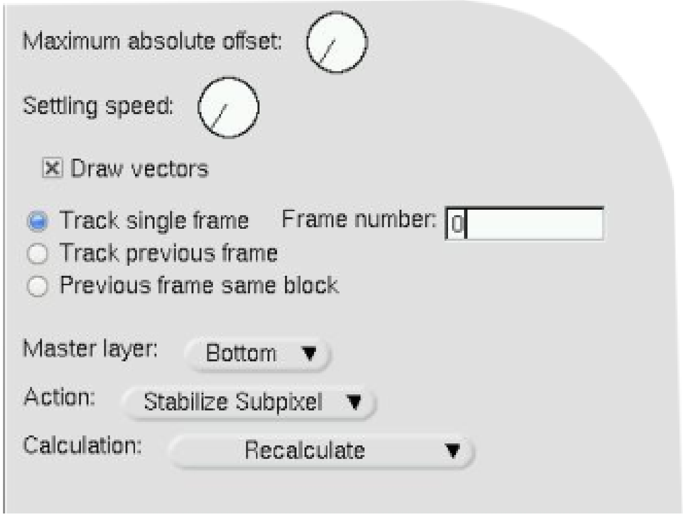
Finally, use the top knob - Translation search radius. Expand it to include the full range of travel you expect for the target. If you look back at my original action shot, the search radius was to small and the target moved outside the range. You can test this by playing the timeline and viewing the results (if your machine is fast enough for realtime) or by rendering and viewing the stabilized handle in the output.

Make the first video frame look similar to:



This image shows a lot of detail. Notice that the small frame is centered over the handle and sized to just include it. Those settings are control by knobs two through four. Finally, the outer frame is larger than the back and forth movement of the handle in the entire video clip.

Finally, here are other settings needed to see the effect:



Maximum absolute offset:

Settling speed:

☒ Draw vectors

● Track single frame   Frame number: 0

○ Track previous frame

○ Previous frame same block

Master layer: Bottom ▼

Action: Stabilize Subpixel ▼

Calculation: Recalculate ▼

- **Draw vectors** Uncheck this to prevent rendering of the target boxes and motion vectors in your rendered video. If checked, the vectors and boxes are rendered in output video.
- **Track Single Frame** For this example it is set with a Frame number of 0 (first frame)
- **Master Layer** If the effect is shared between two tracks it specifies which of those tracks will be the one where motion is tracked (Master Layer) and which layer will be affected by the resulting translation vectors (Target Layer). If there is no second track sharing motion tracker then the Master=Target.
- **Action** Select the stabilize options to have the rendered video follow the motion of the target. Select a Track option to run motion tracking without adjusting the video.

- **Calculation**
  - **Don't Calculate** select this option to turn off adjustment of video.
  - **Recalculate** Perform motion tracking and update video per Action setting.
  - **Save and Load** Saves/Loads the translation/rotation vectors (absolute or relative) to/from files. Each frame gets an separate file in /tmp directory which contains its vector.

14.4.33.6 Tracking stabilization in action

In this section, we will explain how to stabilize a video. Such a need can arise when the video was taken from a vehicle for example.

First select on the timeline the part of the footage you want to stabilize, using the in and out points. Then apply the motion effect on that part of the video.

Select the "Previous frame same block" option. That option is recommended for stabilizing jerky camcorder footage. Its goal is not to "follow" an object. The block stays exactly at the same place during all the effect length.

Enlarge the block and select almost half the size of the video. Select the "Stabilize subpixel" option: it will give a finer stabilization. Reduce the "Maximum absolute offset" value to limit the stabilization amplitude. You probably prefer to get a non-perfect stabilization on some places on the video, than having a very large black border on one side of the picture during big shakes. Set the "Translation search steps" value to 128. Increasing that value will not give a better result, but will considerably increase the rendering time. Make sure the "Draw vectors" option is selected, and render the part of the video where the motion effect is applied.

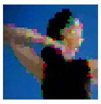
If the result is good, deselect the "Draw vectors" option. The block and vectors were not drawn anymore on the video. Then, render your video to a '.dv' file, and import it into your project.

You will notice the video is stabilized but there are black borders which appear on sides of the frame. You have to zoom in and define projector keyframes to move the projector around the screen, in order to remove those black borders. The more your footage is jerky, the more you have to zoom in to discard the black borders. That is why the result is better with HDV footage than with DV footage.

14.4.34 Motion blur

FIXME

14.4.35 Oil painting



This effect makes video tracks appears as a painting. It can be controlled by Radius slider. Intensity of colors can be chosen as option.

14.4.36 Overlay video

This effect can combine several tracks by using the so called Overlayer. This is a basic internal device normally used by Cinelerra to create the (dissolve) transitions and for compositing the final output of every track onto the output bitmap. The Overlayer has the ability to combine one or several image layers on top of a "bottom layer". It can do this combining of images in several different (and switchable) output modes: Normal, Additive, Subtractive, Multiply (Filter), Divide, Max and Replace. For a detailed explanation of the several overlay modes See Section 8.2 [Compositing], page 62.

Now, the overlay plugin enables the use of this Overlayer device in the middle of any plugin stack, opening endles filtering and processing possibilities. It is only usefull as a shared plugin (i.e. a multitrack plugin). So, to use the overlay plugin

1. Add the effect to Track A.
2. Choose "attach effect" from the context menu of another track (Track B).
3. Choose "Track A:Overlay" as a shared plugin.
4. Manipulate the plugin parameters in Track A.

In the Overlay Plugin's parameter window you can choose the overlay order, i.e. which track plays the role of the "bottom layer" and which plays the role of the "top layer". For some overlay modes, this can make quite a difference, e.g. the top layer is subtracted from the bottom layer for "Subtractive" mode. Further on, you can choose on which of the tracks to overlay the combined output. (Hint: in most cases, you will want to mute the other track and only retain this combined output).

14.4.37 Perspective

The perspective effect allows you to change the perspective of an object, and is perfect for making objects appear as if they are fading into the distance.

14.4.38 Polar

The Polar effect bends and warps your video in weird ways. Mathematically, it converts your video from either polar coordinates to rectangular coordinates, or the reverse.

14.4.39 RGB-601

For analog video or MPEG (including DVD) output, the maximum range for R,G,B is [16, 235] (8-bit). For YUV, the maximum range for intensity (Y) is [16, 235] (8-bit). This range corresponds to gray levels from 6% to 92%. When rendering, values outside of these ranges will be clipped to these limits.

To render to MPEG, add the RGB-601 effect to all video tracks where material uses the full intensity scale (0-100%), and enable **RGB -> 601 compression**. Consider adding the Videoscope effect after RGB-601 to see how RGB-601 affects your dynamic range. See Section 14.4.57 [Videoscope], page 120.

(To preview how your rendered MPEG would look *without* RGB-to-601 compression, instead enable **601 -> RGB expansion** – you will observe a noticable contrast increase.)

Although RGB-601 will reduce contrast in your video tracks, the contrast will be restored during MPEG playback.

14.4.40 Radial blur

It creates a whirlpool blur that simulates a swirling camera. You can vary the location, type, and quality of the blur.

14.4.41 ReframeRT

ReframeRT changes number of frames in a sequence of video directly from the timeline. It has 2 modes, selected by the 2 toggles in the GUI.

Stretch mode multiplies the current frame number of its output by the scale factor to arrive at the frame to read from its input. If its current output frame is #55 and the scale factor is 2, frame #110 is read from its input. The stretch mode has the effect of changing the length of output video by the inverse of the scale factor. If the scale factor is greater than 1, the output will end before the end of the sequence on the timeline. If it is less than 1, the output will end after the end of the sequence on the timeline. The ReframeRT effect must be lengthened to the necessary length to accommodate the scale factor. Change the length of the effect by clicking on the endpoint of the effect and dragging.

Although stretch mode changes the number of the frame read from its input, it does not change the frame rate of the input. Effects before ReframeRT assume the same frame rate as ReframeRT.

The ReframeRT in stretch mode can be use to create a **fast play effect**. Select Stretch mode and enter a value greater than 1 to get accelerated playback.

For **slow motion effect**, use a ReframeRT effect in stretch mode with a value less than 1. **Example**: you have a clip that you want to put in slow motion. The clip starts at 33.792 seconds and ends at 39.765. The clip is 5.973 seconds long. You want to play it at 4/10ths normal speed. You divide the clip length by the playback speed (5.973/.4) to get a final clip length of 14.9325 seconds. You create an in point at the start of your clip: 33.792 seconds. You put an out point 14.9325 seconds later, at 48.7245 seconds (33.792 + 14.9325). You attach a ReframeRT effect, set it to .4 and stretch. You change the out point at 48.7245 to an in point. You start your next clip after the slow motion effect at the 48.7245 out point.

You can also change the frame rate of the clip if you right click on it in the **media viewer** and go to **Info**. If you do not hit the drop down first, you can type in a desired frame rate as well. Cinelerra will pick the right frames out for the project frame rate, effectively doing the time-lapsing as well

Downsample mode does not change the length of the output sequence. It multiplies the frame rate of the output by the scale factor to arrive at a frame rate to read the input. This has the effect of replicating the input frames so that they only change at the scaled frame rate when sent to the output. It does not change the length of the sequence. If the scale factor is 0.5 and the output frame rate is 30 fps, only 15 frames will be shown per second and the input will be read at 15 fps. Downsample is only useful for scalefactors below 1, hence the name downsample.

Downsample mode changes the frame rate of the input as well as the number of the frame to read, so effects before ReframeRT see the frame rate * the scale factor as their frame rate. If the scale factor is 2 and the output frame rate is 30, the input frame rate will be 60 and the input frame number will by doubled. This will not normally do anything but some input effects may behave differently at the higher frame rate.

14.4.42 Reroute

FIXME

It enables to selectively transfer the Alpha channel or the Components (RGB or YUV) or both from a source track to a target track, partially overwriting the target's contents. It works as a shared plugin. The typical usage scenario is to build up a possibly animated Mask in one track and then to transfer the Alpha channel to another content track.

14.4.43 Reverse video

Media can be reversed on the timeline in realtime. This is not to be confused with using the reverse playback on the transport. The reverse effects reverse the region covered by the effect regardless of the transport direction.

The region to be reversed is first determined by what part of the track the effect is under and second by the locations of keyframes in the effect. The reverse effects have an **enabled** option which allows you to set keyframes. This allows may possibilities.

Every **enabled** keyframe is treated as the start of a new reversed region and the end of a previous reversed region. Several **enabled** keyframes in succession yield several regions reversed independent of each other. An **enabled** keyframe followed by a **disabled** keyframe yields one reversed region followed by a forward region.

14.4.44 Rotate

The Rotate filter can rotate the video in 90 degree increments, reverse and flip the video.

14.4.45 SVG via Inkscape

FIXME

14.4.46 Scale

FIXME

14.4.47 Selective temporal averaging

This plugin is designed to smooth out non-moving areas of a video clip. The smoothing is performed by averaging the color component for each pixel across a number of frames. The smoothed value is used if both the standard deviation and the difference between the current component value and the average component value are below a threshold.

The average and standard deviation are calculated for each of the components of the video. The type of components averaged is determined by the color model of the entire project. The average and standard deviation of the frames can be examined by selecting the specific radio button in the plugin options window.

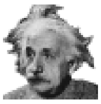
The region over which the frames are averaged is determined by either a fixed offset or a restart marker system. In a restart marker system, certain keyframes are marked as beginning of sections. Then for each section, the frames surrounding the current frame are used as the frames to average over, except when approaching the beginning and end of a section, whereby the averaging is performed over the *N* beginning or ending frames respectively.

Common usage:

If you have to select the number of frames you wish to average.

1. Enter a reasonable number of frames to average (e.g. 10).
2. Select the **Selective Temporal Averaging** method and enter 1 and 10 for all the **Av. Thres.** and **S.D. Thres.** respectively. This basically causes all pixels to use the average value.
3. Turn the mask for a the first component on. This should make the whole frame have a solid color of that specific component.
4. Slowly reduce the **S.D. Thres.** value. As you do so, you will notice that the regions vastly different from the average will have a flipped mask state. Continue to reduce the threshold until you reach the point at which non-moving regions of the video have a flipped masked state. This value is known as the **noise-floor** and is the level of natural noise generated by the CCD in the camera.
5. Repeat the same procedure for the **Av. Thres.**
6. Turn off the mask
7. Repeat this for all channels

14.4.48 Sharpen

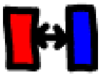


FIXME

14.4.49 ShiftInterlace

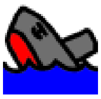
FIXME

14.4.50 Swap channels



FIXME

14.4.51 Threshold



Threshold converts the image to pure luminance, and replaces pixels with one of three colors based on the luminance. Pixels with luminance values in the low range are replaced with black, pixels in the middle range are replaced with white, and pixels in the high range are replaced with black. Color and alpha for each range are configurable and interpolate according to keyframes.

The threshold window shows a histogram of luminance values for the current frame. Click dragging inside the histogram creates a range to convert to white. **SHIFT-clicking** extends one border of this range. Values for the threshold range can also be specified in the text boxes.

This effect is basically a primitive luminance key. A second track above the track with the threshold effect can be multiplied, resulting in only the parts of the second track within the threshold being displayed.

14.4.52 Time average

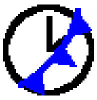
Time average is one effect which has many uses besides creating nifty trail patterns of moving objects. It is main use is reducing noise in still images. Merely point a video camera at a stationary subject for 30 frames, capture the frames, and average them using **time average** and you will have a super high quality print. In floating point colormodels, time average can increase the dynamic range of lousy cameras.

Inside the time average effect is an accumulation buffer and a divisor. A number of frames are accumulated in the accumulation buffer and divided by the divisor to get the average.

Because the time average can consume enormous amounts of memory, it is best applied by first disabling playback for the track, dropping the time average in it, configuring time average for the desired number of frames, and re-enabling playback for the track.

- **Frames to average**
  This determines the number of frames to be accumulated in the accumulation buffer. For extremely large integrations it is easier to edit the EDL in a text editor and put in the number of frames.
- **Accumulate**
  This outputs the accumulation buffer without dividing it.
- **Average**
  This causes the accumulation buffer to be divided before being output. This results in the average of all the frames.
- **Inclusive Or**
  This causes the accumulation buffer to be replaced by any pixels which are not transparent. In combination with motion tracking it allows entire sequences to be combined to form panoramas.
- **Reprocess frame again**
  If an effect before the time average is adjusted the time average normally does not reread the accumulation buffer to get the change. This forces it to reread the accumulation buffer when other effects change.
- **Disable subtraction**
  In order to represent the accumulation of only the specified number of frames, the time average retains all the previous frames in memory and subtracts them out as it plays forward. It would run out of memory if it had to accumulate thousands of frames. By disabling subtraction the previous frames are not stored in memory and only the average function is affected by the frame count.

14.4.53 TimeFront



This is a warping framework plugin based on this article:
http://www.vision.huji.ac.il/videowarping/HUJI-CSE-LTR-2005-10_etf-tr.pdf

14.4.54 Title

While it is possible to add text to movies by importing still images from The Gimp and compositing them, the Titler allows you to add text from within Cinelerra.

The titler has standard options for **font, size, and style**. The best font is a generic, normal font like Arial in a large size.

The titler also has options you will only find in moving pictures. The **Justify** operation justifies the text relative to the entire frame. Once justified, the **X and Y** offset is applied. This allows text to be justified while at the same time letting you push it within the title safe region.

The **motion type** scrolls the text in any of the four directions. When using this, the text may disappear. Make sure the speed is set to a reasonably high value (try 150) and move the insertion point along the timeline until the text is far enough along the animation to reappear. The text scrolls on and scrolls off.

Setting **loop** causes the text to scroll completely off and repeat. Without **loop** the text scrolls off and never reappears.

The speed of the animation is determined by **speed**, in pixels per second. Set it higher to speed up the animation.

Drop shadow draws a black copy of the text to the bottom right of the original text. This is useful when drawing text over changing video to keep the border always visible.

In addition to the scrolling, **Fade in/Fade out** are a second type of animation. If the fade seconds are 0, no fading is done.

Color picks the color to draw the text in. Usually white is the only practical color.

Stamp timecode replaces the text with the current position on the timeline in seconds and frames.

Text options can only be applied to all the text as a whole. If you want your title text formatted with a mixture of fonts, sizes, styles, alignments etc. you need to use multiple tile effects.

The title effect supports keyframes only for **Justify** and **Text**, with no interpolation.

To add subtitles to your movie can set a single title effect and then define keyframes. If you enable the automatic keyframes toggle 🔑, a new keyframe is created each time you edit the text. Check **View -> Plugin autos** to make them visible on the timeline. In the text input box you will see the subtitle displayed under the insertion point.

To correct an existing subtitle, the automatic keyframes toggle must be off. To adjust the timing of subtitles simply drag the keyframes.

Note: For adding subtitles on a separate stream, you need an external subtitle editor. See Section 21.13 [Adding subtitles], page 166, for more information.

To create special effects for your title you can place it on a dedicated track and insert other realtime video effects just under the title effect or/and use camera and projector. Thanks to keyframing you can animate your title and make it change position, size, colour, transparency, texture, shape over time.

For improving playback performances of titles with effects, you can reduce the size of the dedicated track. Right click on the track and select **Resize track...**. Enter the smallest resolution that still keeps the title visible. For moving your title use the compositor projector.

To included graphical elements like logos, you may want to import your title as a PNG image (alpha channel transparency is possible), move it with camera and projector or add effects.

The titler input is limited to 1023 characters. Titles longer than 1023 characters will be accepted by the software, but they will likely cause lock-ups. See `http://bugs.cinelerra.org/show_bug.cgi?id=155|bug 155` to know more.

14.4.54.1 Adding fonts to the titler

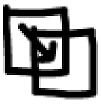
The X Window system originally did not have a suitable font renderer for video. It also is restricted to the current bit depth. It does not have a convenient way to know which fonts work with the suitable font renderer in the desired bit depth. The easiest way we have found to support fonts in the titler is to have a directory for them at '`/usr/lib/cinelerra/fonts`'.

The titler supports mainly **`TTF`**, true type fonts. It supports others but TTF are the most reliable. To add true type fonts, copy the '`.TTF`' files to the '`/usr/lib/cinelerra/fonts`' directory. In that directory run `ttmkfdir && mv fonts.scale fonts.dir` and restart Cinelerra. The new fonts should appear. The usage of ttmkfdir changes frequently so this technique might not work.

14.4.54.2 The title-safe region

If the video is displayed on a consumer TV, the outer border is going to be cropped by 5% on each side. Moreover, text which is too close to the edge looks sloppy. Make sure when adding titles to have the **title-safe** ⧈ tool active in the **compositor** window. The text should not cross the inner rectangle.

14.4.55 Translate



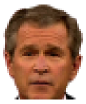
This effect allows displacing, cropping, and/or scaling the source video horizonally and/or vertically. The In and Out parameters operate similar to the camera and projector functions in the Compositor:

- In X/Y specifies how many pixels from the left/top of the source you want to start (camera) while Out X/Y defines where on the screen you want the output to start (projector)
- In W/H defines how many pixels of the source you want to include in each direction while Out W/H defines how many pixels on the screen you want that source to take up. Identical values for both In and Out that are less than the source dimension will simply crop the source. Different values will stretch (or compress if Out > In) the source in that direction (and crop if In is less than the source dimension.)

This effect supports keyframes so these parameters can change smoothly over time.

You can use this effect for many things such as having a cropped inset clip move across the screen, or have it change size or stretch while doing so. Be forewarned though, that for interlaced footage horizontal displacements are likely to destroy the field order, resulting in all sort of flickering and jumping movements.

14.4.56 Unsharp



This effect applies a traditional darkroom techique, the so called unsharp mask to every video frame. With different parameter values, this can be used to soften or to sharpen the image. Its parameters are:

- **Amount**
  Moving the slider to the right makes dark areas get darker and light areas get lighter.

- **Radius**
  This slider controls how much blurring is used in the edge-finding stage. The practical effect of this is to specify how large a region is darkened or lightened.
- **Threshold**
  This slider permits to control how big is a difference between a pixel in the blurred copy and the original copy is needed before any darkening or lightening will be applied.

14.4.57 Videoscope

The Videoscope summarizes intensity and color on a calibrated display. The Videoscope can be used in conjunction with other Cinelerra plugins such as YUV, HUE, Brightness, Color Balance or Histogram to accurately correct video for contrast, clarity, conformance (to normalize various videos shot under different light settings), or for cinematic purposes. The human eye is not specialized to match precise level of light and color, but Videoscope is.

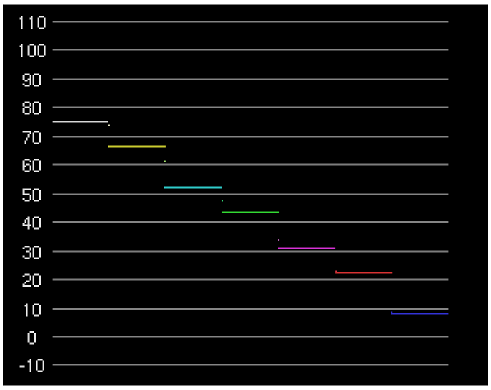
Some thought is being given to having a video scope for recording. Unfortunately, this would require a lot of variations of the video scope for all the different video drivers.

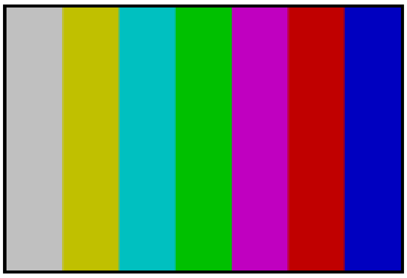
The Videoscope contains two displays: the **waveform scope** and the **vectorscope**

14.4.57.1 The waveform scope

The Waveform Scope displays image intensity (luminance) versus image X position. The Waveform Scope appears on the left side of the Videoscope window.

The display is calibrated vertically from 0% intensity (black) at the bottom up to 100% intensity at the top. Each column of pixels in the image corresponds to one column of pixels in the Waveform Scope.





The color bar test image is plotted in the waveform display as a stair step set of lines. In this example, the waveform display and the test image are aligned to show that each stair step corresponds with one color bar.

The waveform display shows the white bar at the 75% level because the colors in the test image are 75% values. The white bar has the highest luminance because it contains all color components. In more complex images, multiple levels in the same column are represented with multiple pixels on the scope.

The Waveform scope helps correct image light levels for contrast range or for conforming light levels on various scenes originally shot on different light settings.

Adjusting light levels (adjusting luminance):

1. Insert the Brightness/Contrast, YUV, or another video adjustment effect on your track.
2. Insert the Videoscope effect on the track below. Make sure that it is placed below so it can see the adjustment effect's results. If it is not, right-click and move it down.
3. Show both the effect and Videoscope.
4. Adjust the effect while observing the waveform to match the desired light level.

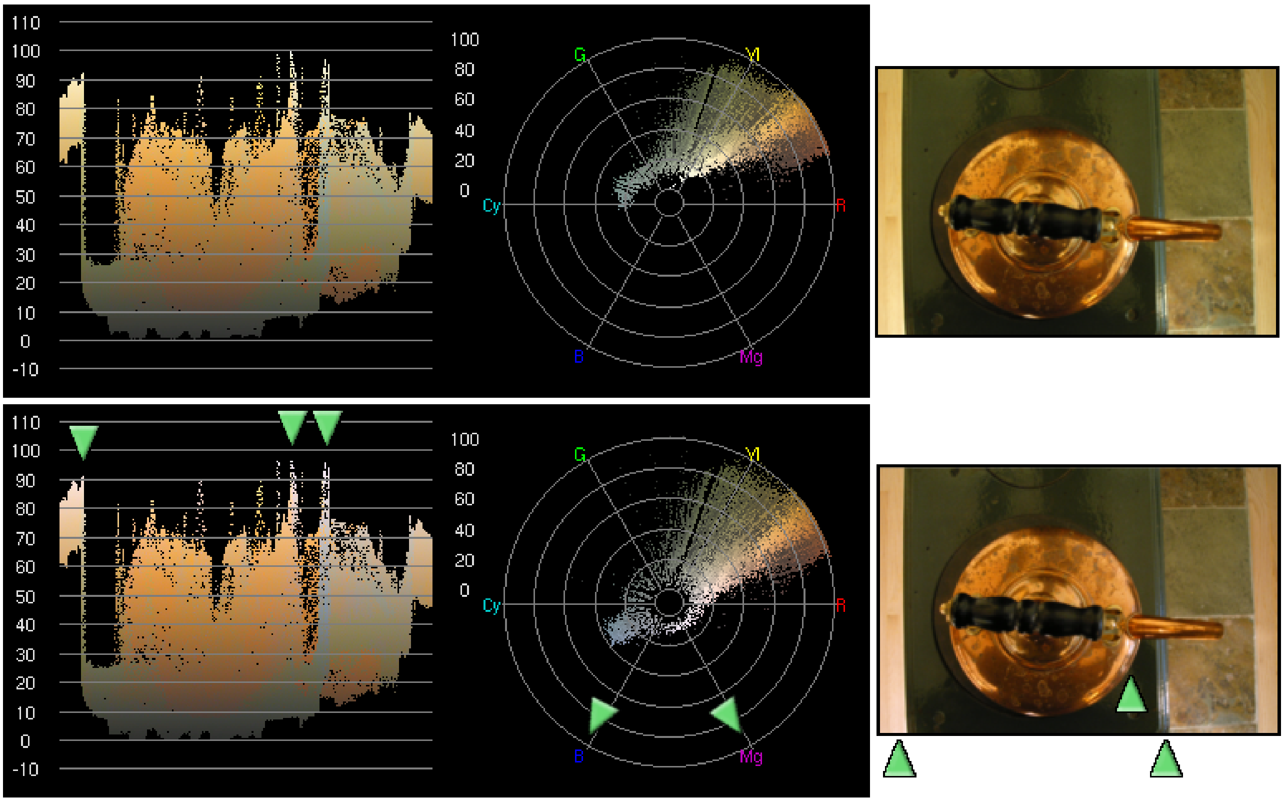
If you are looking for maximum contrast range, adjust the Brightness/Contrast levels to align the darkest point on the scope with the 0% level and the brightest portion with 100%. Anything above 100% is over saturated. Limits which may be highlighted with checkbox controls:

- **HDTV or sRGB (ITU-R BT.709)**
  The maximum pixel range for HDTV or sRGB is [0, 255]. This range corresponds with levels 0% and 100%.
- **MPEG or Analog video (ITU-R BT.601)**
  For analog video or MPEG (including DVD), the maximum range for RGB is [16, 235] (8-bit). For YUV, the maximum range for intensity (Y) is [16, 235] (8-bit). This range corresponds to gray levels from 6% to 92%. See Section 14.4.39 [RGB-601], page 112.
- **NTSC Television broadcast**
  If you are producing a video for NTSC television broadcast, keep the intensity between 7.5% and 100%. The minimum black value which can be broadcast is IRE 7.5% (indicated by the "7.5" level), and values below this level are no darker.

14.4.57.2 The vectorscope

The Vectorscope displays color and color saturation. Each pixel in the source image is drawn as a point on the color wheel. The distance from the center is the color saturation. Gray values are close to the center, and high saturation values are near the perimeter.

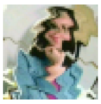
The Vectorscope is used with other plugins to correct color, adjust image tint, and apply other effects for cinematic effects, image correction, or to conform images to look the same.



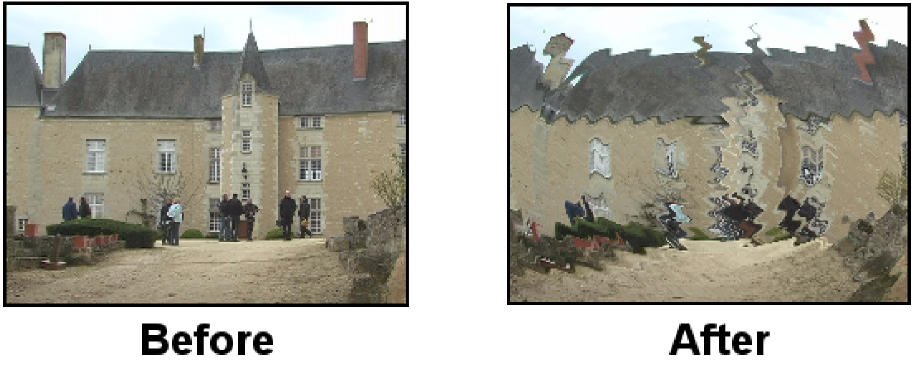
In this example, the top image is white balanced. Vectorscope shows many pixels in the yellow region and few in the white region. To remove the yellow tint, the Color Balance effect is used to first shift the vectorscope plot towards magenta (Mg), and then towards blue (B) until the region previously near the center surrounds the center. In the bottom image, yellow highlights have become white highlights (arrows). Note that the corresponding features in waveform also appear whiter (arrows).

The Vectorscope can also be used to verify that the video output will display properly on various monitors. Any points along the inner radius will be displayed as pure white and any points above the 100% radius, will probably not be correctly displayed on the screen.

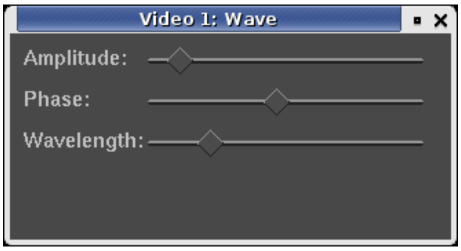
14.4.58 Wave



The wave effect adds waves on the image.


Before
After

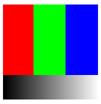
You can adjust the following parameters:



14.4.59 Whirl

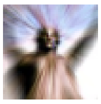
FIXME

14.4.60 YUV



FIXME

14.4.61 Zoom blur



FIXME

15 Rendered effects

Another type of effect is performed on a section of the track and the result stored somewhere before it is played back. The result is usually pasted into the track to replace the original data.

The rendered effects are not listed in the resource window but instead are accessed through the **Audio->Render effect** and **Video->Render effect** menu options. Each of these menu options brings up a dialog for the rendered effect. Rendered effects apply to only one type of track, either audio or video. If no tracks of the type exist, an error pops up.

A region of the timeline to apply the effect to must be defined before selecting **Render effect...**. If no in/out points and no highlighted region exist, the entire region after the insertion point is treated as the affected region. Otherwise, the region between the in/out points or the highlighted region is the affected region.

Secondly, the tracks to apply the rendered affect to need to be **armed**. All other tracks are ignored.

Finally, the rendered affect processes certain track attributes when it reads its input data but not others. Transitions in the affected track are applied. Nudge is not and effects are not. This allows the new data to be pasted into the existing position without changing the nudge value.

In the render effect dialog is a list of all the realtime and all the rendered effects. The difference here is that the realtime effects are rendered to disk and not applied under the track. Highlight an effect in the list to designate it as the one being performed.

Define a file to render the effect to in the **Select a file to render to** box. The 🔍 magnifying glass allows file selection from a list.

Select a file format which can handle the track type. The 🔧 wrench allows configuration specific to the file format.

There is also an option for creating a new file at each label. If you have a CD rip on the timeline which you want to divide into different files, the labels would become dividing points between the files if this option were selected. When the timeline is divided by labels, the effect is re-initialized at every label. Normalize operations take the peak in the current file and not in the entire timeline.

Finally there is an insertion strategy just like in the render dialog. It should be noted that even though the effect applies only to audio or video, the insertion strategy applies to all tracks just like a clipboard operation.

When you click **OK** in the effect dialog, it calls the GUI of the effect. If the effect is also a realtime effect, a second GUI appears to prompt for acceptance or rejection of the current settings. After accepting the settings, the effect is processed.

15.1 Rendered audio effects

15.1.1 Resample

This multiplies the number of each output sample by a scale factor to arrive at the number of the input sample. The output file's sample rate is set to the project sample rate but its length is changed to reflect the scaled number of samples. It also filters the resampled audio to remove aliasing.

If the scale factor is 2, every 2 input samples will be reduced to 1 output sample and the output file will have half as many samples as the input sequence. If it is 0.5, every 0.5 input samples will be stretched to 1 output sample and the output file will have twice as many samples as the input sequence.

15.2 Rendered video effects

15.2.1 Reframe

This does exactly the same thing as **ReframeRT** in **Stretch** mode. It multiplies the output frame number by the scale factor to arrive at the input frame number and changes the length of the sequence. Unlike ReframeRT, this must run from the **Video** menu and render its output.

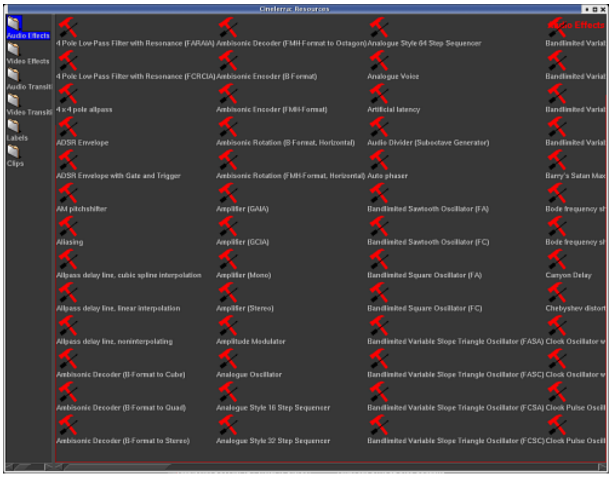
Be aware **Reframe** does not write the scaled frame rate as the frame rate of the rendered file. It produces a file of scaled length and equal frame rate as the project. The new length is 1/scale factor as big as the original sequence.

To create a slow-motion of fast moving video:

1. Select the video clip you wish to re-frame and put it on a video track
2. Select the area you wish to reframe
3. From the Video menu, select the Render Effect option
4. From the effect list, select Reframe
5. Enter the output format and insertion strategy for the new clip to be created
6. Press ok
7. At the popup menu, enter the scale factor 2 to run twice as fast, and .5 to run at half speed

16 Ladspa effects

LADSPA effects are supported in realtime and rendered mode for audio. The LADSPA plugins you get from the internet vary in quality. Most can not be tweeked in realtime very easily and work better when rendered. Some crash and some can only be applied to one track due to a lack of re-entrancy. Although Cinelerra implements the LADSPA interface as accurately as possible, multiple tracks of realtime, simultaneous processing go beyond the majority of LADSPA users. LADSPA effects appear in the audio folder as the hammer and screwdriver, to signify that they are Plugins for GNU/Linux Audio Developers.


Cinelerra: Resources
Audio Effects
Video Effects
Audio Transiti
Video Transiti
Labels
Clips
Audio Effects
4 Pole Low-Pass Filter with Resonance (FARAIA)
Ambisonic Decoder (FMH-Format to Octagon)
Analogue Style 64 Step Sequencer
Bandlimited Variat
4 Pole Low-Pass Filter with Resonance (FCRCIA)
Ambisonic Encoder (B-Format)
Analogue Voice
Bandlimited Variat
4 x 4 pole allpass
Ambisonic Encoder (FMH-Format)
Artificial latency
Bandlimited Variat
ADSR Envelope
Ambisonic Rotation (B-Format, Horizontal)
Audio Divider (Suboctave Generator)
Bandlimited Variat
ADSR Envelope with Gate and Trigger
Ambisonic Rotation (FMH-Format, Horizontal)
Auto phaser
Barry's Satan Max
AM pitchshifter
Amplifier (GAIA)
Bandlimited Sawtooth Oscillator (FA)
Bode frequency sh
Aliasing
Amplifier (GCIA)
Bandlimited Sawtooth Oscillator (FC)
Bode frequency sh
Allpass delay line, cubic spline interpolation
Amplifier (Mono)
Bandlimited Square Oscillator (FA)
Canyon Delay
Allpass delay line, linear interpolation
Amplifier (Stereo)
Bandlimited Square Oscillator (FC)
Chebyshev distort
Allpass delay line, noninterpolating
Amplitude Modulator
Bandlimited Variable Slope Triangle Oscillator (FASA)
Clock Oscillator w
Ambisonic Decoder (B-Format to Cube)
Analogue Oscillator
Bandlimited Variable Slope Triangle Oscillator (FASC)
Clock Oscillator w
Ambisonic Decoder (B-Format to Quad)
Analogue Style 16 Step Sequencer
Bandlimited Variable Slope Triangle Oscillator (FCSA)
Clock Pulse Oscil
Ambisonic Decoder (B-Format to Stereo)
Analogue Style 32 Step Sequencer
Bandlimited Variable Slope Triangle Oscillator (FCSC)
Clock Pulse Oscil

Ladspa audio effects in the audio folder

LADSPA Effects are enabled merely by setting the `LADSPA_PATH` environment variable to the location of your LADSPA plugins:

```
export LADSPA_PATH=/usr/lib/ladspa
```

or putting them in the ‘`/usr/lib/cinelerra`’ directory.

If you use Debian, you can get a lot of plugins using apt:

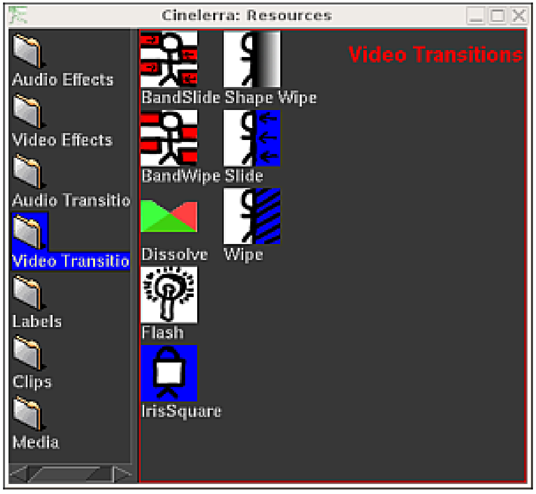
```
apt-cache search ladspa
apt-get install jack-rack cmt blop swh-plugins
```

17 Transitions

17.1 Using transitions

When one edit ends and another edit begins, the default behavior is to have the first edit's output immediately become the output of the second edit when played back. Transitions are a way for the first edit is output to become the second edit is output with different variations.

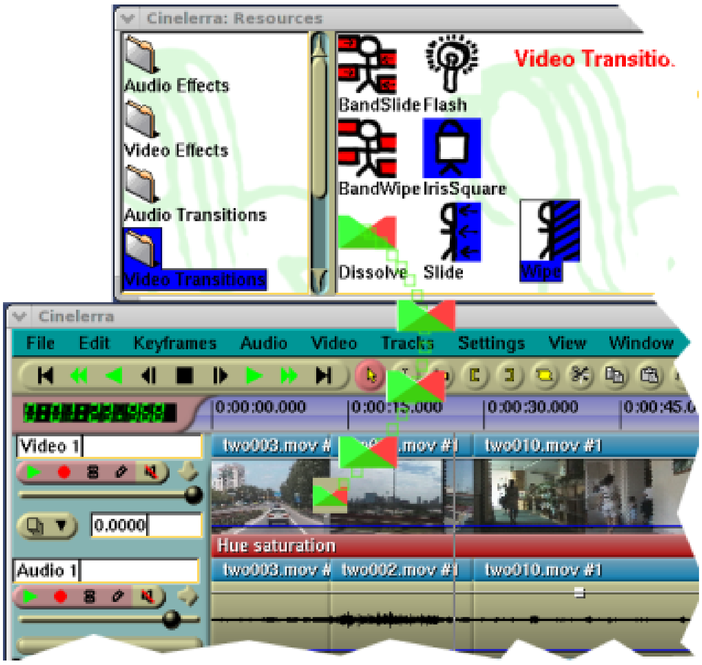
Cinelerra supports audio and video transitions, all of which are listed in the resource window.



Video transitions in the resources window

Transitions may only apply to the matching track type. Transitions under **audio transitions** can only apply to audio tracks. Transitions under **video transitions** can only apply to video tracks.

Load two video files. Alternatively load a single video file and cut away a section from the center so that you make two edits out of a single file. Make sure the edit boundary between the two edits is visible on the timeline.
Go to the Resource window and click on the **Video transitions** folder. Drag a transition from the transition list onto the second video edit on the timeline. A box highlights over where the transition will appear. Releasing it over the second edit applies the transition between the first and second edit.



Dragging a dissolve transition to the timeline

You can now scrub over the transition with the transport controls and watch the output in the **Compositor window**.

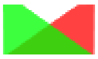
Once the transition is in place, it can be edited similarly to an effect. Move the pointer over the transition and right click to bring up the transition menu.
The **show** option brings up specific parameters for the transition in question if any.
The **length** option adjusts the length of the transition in seconds.
Once these two parameters are set, they are applied to future transitions until they are changed again. Finally, the **detach** option removes the transition from the timeline.

Dragging and dropping transitions from the Resource window to the Program window can be really slow and tiring. Fortunately, once you drag a transition from the Resource window, the **U** and **u** keys will paste the same transition. The **U** key pastes the last video transition and the **u** key pastes the last audio transition on all the recordable tracks. If the insertion point or the in point is over an edit, the beginning of the edit is covered by the transition.

Transitions make two edits overlap for a certain amount of time. Some consumer single track applications literally move backward the second edit to make it partially overlay the first edit. This behavior is not possible on multitrack editors where the synchrony among track is vital. Cinelerra don't move edits during transitions. Instead it uses spare frames from the source file to lengthen the first edit enough to make it overlap the second edit for the duration of the transition.
The exact point in time when the transition takes effect is the beginning of the second edit. The transition lasts a set amount of time into the second edit. For example, if you set a duration of 1 second for a dissolve transition, it **will not** start at the last 0.5 second of the first edit and continue 0.5 second into the second edit. In fact, it will start exactly at the beginning of the second edit and last for 1 second into that second edit.
On the timeline a brown bar over the transition symbol visually represents the position and the duration of the transition.
The most important consequence of this behavior is that the first asset needs to have enough spare data after the end boundary to fill the transition into the second edit. Spare data duration should be equal or greater than the length of the transition effect set in the **Length** parameter of the transition popup menu.
If the last frame shown on the timeline is the last frame of the source file Cinelerra will lengthen the first edit using the last frame only, with the unpleasant result of having the first edit freezing into the transition.

It should be noted that when playing transitions from the timeline to hardware accelerated video device, the hardware acceleration will usually be turned off momentarily during the transition and on after the transition in order to render the transition. Using an un-accelerated video device for the entire timeline normally removes the disturbance.

17.2 Dissolve video transition



This is a soft dissolve transition between two video segments, which we call in and out segments. The in segment turns increasingly transparent while the out segment materializes into its place. The length of time for the full effect to take place can be controlled by the "Transition Length" control.

Available controls:
By right-clicking on the transition icon in the timeline, a menu will pop-up with the following controls

- **Show:** Pop up the transition specific menu (not available on this transition)
- **On:** Toggle on/off the transition effect
- **Transition length:** Set the span in seconds for the transition to complete
- **Detach:** Remove the transition from the timeline

18 Keyframing

The term "keyframe" is borrowed from the world of animation where it refers to an essential (key) drawing in a sequence. Typically this would be a starting or an ending point of a smooth transition in a series of frames. The keyframes would be drawn by the more senior artists and their assistants would draw the "inbetweens". The word keyframe has since been used to suggest similar concepts in other fields.

In non-linear digital video editing and video compositing software a keyframe represents a certain value set by the user at a certain point in the timeline. For example you could use keyframes to fade in a clip by setting the transparency to 100% at the first keyframe and adding another keyframe 5 seconds later in the timeline with a transparency of 0%. A keyframe is used to manipulate changes made to the signal over time, essentially acting as a control point for the user to set parameters e.g. of effects. Cinelerra interpolates the intermediate values making the change happen smoothly and gradually over time.

When you change the fade, camera, projector, or other parameters for a track, they stay by default the same for the entire duration of the project. Their value is stored in a keyframe. The keyframe it is stored in by default is known as the **default keyframe**. The default keyframe applies to the entire duration only if no other keyframes are present and it is not drawn on the timeline.

The only way change occurs over time is if additional keyframes are created.
Setting static parameters with the default keyframe is only useful if you don't want to change anything over time. Normally you need to move the camera around or change mask positions e.g. if a mask needs to follow an object. Defining additional keyframes to the default one is a very convenient technique for creating dynamic changes.

In Cinelerra, there are keyframes for almost every compositing parameter and effect parameter.
Parameters can be graphically represented in many forms: curves, toggles, modes, and so on.
The relative keyframe can be represented on the timeline as a little square on a curve (e.g. fade) or as a symbol (e.g. mask).
In Cinelerra the term keyframe can be misleading: it doesn't refer to a frame, but to a point between two frames.

To display the graphical representation of parameters and the relative keyframes use the **View** menu.
A faster way to toggle multiple parameters types is to bring up **Window -> Show Overlays**. This window allows toggling of every parameter in the view menu. When parameters are selected, they are drawn on the timeline over the tracks they apply to.

How to handle the different types of keyframes is described here.

18.1 Curve keyframes

Many parameters are stored in Bezier curves. Go to **view->fade** or **view->...zoom** to show curves on the timeline for those parameters. In either arrow editing mode or i-beam editing mode, move the cursor over the curves in the timeline until it changes shape. Then merely by clicking and dragging on the curve you can create a keyframe at the position.

After the keyframe is created, click drag on it again to reposition it. When you click-drag a second keyframe on the curve, it creates a smooth ramp. **CTRL-dragging** on a keyframe changes the value of either the input control or the output control. This affects the sharpness of the curve. While the input control and the output control can be moved horizontally as well as vertically, the horizontal movement is purely for legibility and is not used in the curve value.

You may remember that The Gimp and the Compositing masks all use SHIFT to select control points so why does the timeline use CTRL? When you **SHIFT-drag** on a timeline curve, the keyframe snaps to the value of either the next or previous keyframe, depending on which exists. This lets you set a constant curve value without having to copy the next or previous keyframe.

18.1.1 Navigating curve keyframes

There is not much room on the timeline for a wide range of curve values. You need to zoom the curves in and out vertically to have any variability. This is done by 2 tools: the automation fit button and automation zoom menu .

-1.20 - 1.20

The automation fit button scales and offsets the vertical range so the selected curve area appears in the timeline. If a region of the timeline is highlighted by the cursor, only that region is scaled. In/out points do not affect the zoomed region. *ALT-f* also performs automation fitting.

The automation zoom menu manually changes the vertical scaling of the curves in multiples of 2. Click on its tumbler to change the zoom. *ALT-UP* and *ALT-DOWN* change the automation zoom from the keyboard.

18.2 Toggle keyframes

Mute is the only toggle keyframe. Mute keyframes determine where the track is processed but not rendered to the output. Click-drag on these curves to create a keyframe. Unlike curves, the toggle keyframe has only two values: on or off. CTRL and SHIFT do nothing on toggle keyframes.

18.3 Automatic keyframes

You may have noticed when a few fade curves are set up, moving the insertion point around the curves causes the faders to reflect the curve value under the insertion point. This is not just to look cool. The faders themselves can set keyframes in automatic keyframe mode. Automatic keyframe mode is usually more useful than dragging curves.

Enable automatic keyframe mode by enabling the automatic keyframe toggle. In automatic keyframe mode, every time you tweek a key-framable parameter it creates a keyframe on the timeline. Since automatic keyframes affect many parameters, it is best enabled just before you need a keyframe and disabled immediately thereafter.

It is useful to go into the **View** menu and make the desired parameter visible before performing a change. The location where the automatic keyframe is generated is under the insertion point. If the timeline is playing back during a tweek, several automatic keyframes will be generated as you change the parameter.

When automatic keyframe mode is disabled, a similarly strange thing happens. Adjusting a parameter adjusts the keyframe immediately preceding the insertion point. If two fade keyframes exist and the insertion point is between them, changing the fader changes the first keyframe.

There are many parameters which can only be keyframed in automatic keyframe mode. These are parameters for which curves would take up too much space on the track or which can not be represented easily by a curve.

Effects are only key-framable in automatic mode because of the number of parameters in each individual effect.

Camera and projector translation can only be keyframed in automatic keyframe mode while camera and projector zoom can be keyframed with curves. It is here that we conclude the discussion of compositing, since compositing is highly dependant on the ability to change over time.

18.4 Compositor keyframes

Camera and projector translation is represented by two parameters: x and y. Therefore it is cumbersome to adjust with curves. Cinelerra solves this problem by relying on automatic keyframes. With a video track loaded, move the insertion point to the beginning of the track and enable automatic keyframe mode.

Move the projector slightly in the compositor window to create a keyframe. Then go forward several seconds. Move the projector a long distance to create another keyframe and emphasize motion. This creates a second projector box in the compositor, with a line joining the two boxes. The joining line is the motion path. If you create more keyframes, more boxes are created. Once all the desired keyframes are created, disable automatic keyframe mode.

Now when scrubbing around with the compositor window's slider, the video projection moves over time. At any point between two keyframes, the motion path is red for all time before the insertion point and green for all time after the insertion point. It is debatable if this is a very useful feature but it makes you feel good to know what keyframe is going to be affected by the next projector tweek.

Click-drag when automatic keyframes are off to adjust the preceding keyframe. If you are halfway between two keyframes, the first projector box is adjusted while the second one stays the same. Furthermore, the video does not appear to move in step with the first keyframe. This is because halfway between two keyframes the projector translation is interpolated. In order to set the second keyframe you will need to scrub after the second keyframe.

By default the motion path is a straight line, but it can be curved with control points. **CTRL-drag** to set either the in or out control point of the preceding keyframe. Once again, we depart from The Gimp because SHIFT is already used for zoom. After the in or out control points are extrapolated from the keyframe, **CTRL-dragging** anywhere in the video adjusts the nearest control point. A control point can be out of view entirely yet still controllable.

When editing the camera translation, the behavior of the camera boxes is slightly different. Camera automation is normally used for still photo panning. The current camera box does not move during a drag, but if multiple keyframes are set, every camera box except the current keyframe appears to move. This is because the camera display shows every other camera position relative to the current one.

The situation becomes more intuitive if you bend the motion path between two keyframes and scrub between the two keyframes. The division between red and green, the current position between the keyframes, is always centered while the camera boxes move.

18.5 Editing keyframes

IMPORTANT: when copying and pasting keyframes, make sure there is **no IN or OUT point defined on the timeline**.

Keyframes can be shifted around and moved between tracks on the timeline using similar cut and paste operations to editing media. Only the keyframes selected in the **view** menu are affected by keyframe editing operations, however.

The most popular keyframe editing operation is replication of some curve from one track to the other, to make a stereo pair. The first step is to solo the source track's record ● patch by **SHIFT-clicking** on it. Then either set in/out points or highlight the desired region of keyframes. Go to **keyframes->copy keyframes** to copy them to the clipboard. Solo the destination track's record ● patch by **SHIFT-clicking** on it and go to **keyframes->paste keyframes** to paste the clipboard.

The media editing commands are mapped to the keyframe editing commands by using the SHIFT key instead of just the keyboard shortcut.

This leads to the most complicated part of keyframe editing, the default keyframe. Remember that when no keyframes are set at all, there is still a default keyframe which stores a global parameter for the entire duration. The default keyframe is not drawn because it always exists. What if the default keyframe is a good value which you want to transpose between other non-default keyframes? The **keyframes->copy default keyframe** and **keyframes->paste default keyframe** allow conversion of the default keyframe to a non-default keyframe.

Keyframes->copy default keyframe copies the default keyframe to the clipboard, no matter what region of the timeline is selected. The **keyframes->paste keyframes** function may then be used to paste the clipboard as a non-default keyframe.

If you have copied a non-default keyframe, it can be stored as the default keyframe by calling **keyframes->paste default keyframe**. After using paste default keyframe to convert a non-default keyframe into a default keyframe, you will not see the value of the default keyframe reflected until all the non-default keyframes are removed.

Finally, there is a convenient way to delete keyframes besides selecting a region and calling **keyframes->clear keyframes**. Merely click-drag a keyframe before its preceding keyframe or after its following keyframe on the track.This is the only way you can simultaneously delete keyframes on ganged tracks.

19 Capturing media

19.1 Capturing using Cinelerra

19.1.1 Cinelerra recording functions

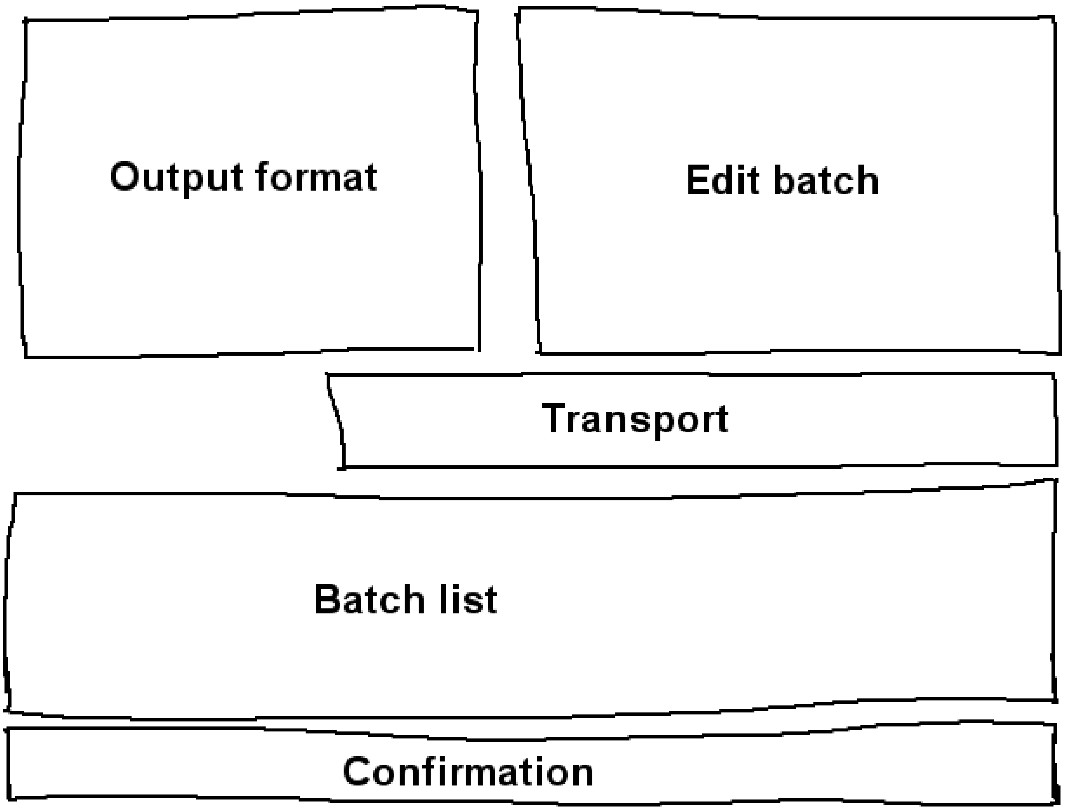
Ideally, all media would be stored on hard drives, CD-ROM, flash, or DVD and loading it into Cinelerra would be a matter of loading a file. In reality, very few sources of media can be accessed like a filesystem but instead rely on tape transport mechanisms and dumb I/O mechanisms to transfer the data to computers. These media types are imported into Cinelerra through the Record dialog.

The first step in recording is to configure the input device. In **Settings->preferences** are a number of recording parameters described in configuration See Section 3.5 [Recording], page 25. These parameters apply to recording no matter what the project settings are, because the recording parameters are usually the maximum capability of the recording hardware while project settings come and go.

Go to **File->record** to record a dumb I/O source. This prompts for an output format much like rendering does. Once that is done, the record window and the record monitor pop up.

The record window has discrete sections. While many parameters change depending on if the file has audio or video, the discrete sections are always the same.

- The output format area describes the format of the output file and the current position within it.
- The edit batch area lets you change parameters in the current batch.
- The transport controls start and stop recording different ways.
- The batch list displays all the defined batches.
- The confirmation area lets you determine how the output files are imported into the timeline and quit.



Recording window areas

Recording in Cinelerra is organized around batches. A batch essentially defines a distinct output file for the recording. For now you can ignore the batch concept entirely and record merely by hitting the record button ●.

The record button opens the current output file if it is not opened and writes captured data to it. Use the stop button to stop the recording. Recording can be resumed with the record button without erasing the file at this point. In the case of a video file, there is a single frame record button ❶ which records a single frame.

When enough media is recorded, choose an insertion method from the **Insertion Strategy** menu and hit **close**.

19.1.2 Batch recording

Now we come to the concept of batches. Batches try to make the dumb I/O look more like a filesystem. Batches are traditionally used to divide tape into different programs and save the different programs as different files instead of recording straight through an entire tape. Because of the high cost of developing frame-accurate deck control mechanisms, the only use of batches now is recording different programs during different times of day. This is still useful for recording TV shows or time lapse movies as anyone who can not afford proper appliances knows.

The record window supports a list of batches and two recording modes: interactive and batch recording. Interactive recording happens when the record button is pressed. Interactive recording starts immediately and uses the current batch to determine everything except start time. By default, the current batch is configured to behave like tape.

Batch recording happens when the **start** button is pressed. In batch recording, the **start time** is the time the batch starts recording.

First, you will want to create some batches. Each batch has certain parameters and methods of adjustment.

- **On**
  Determines whether the batch is included in batch recording operations. Click the list row under **On** to enable or disable batches.
- **Path**
  It is the file the batch is going to be recorded to. The filename specified in the record dialog is the name of the first batch, to simplify interactive recording, but the filename may be changed in the record window for any batch in the **edit batch** area.
- **News**
  Shows whether the file exists or not. This is a very important attribute since there is no confirmation dialog if the file exists. The first time you hit record, the file is opened. If the file exists at this point it is erased. News says **File exists** if it exists and **OK** if it does not. Every time you resume recording in the same batch, the news should say **Open**, indicating the file is already opened and will not be erased in the next record button press.
  If you change out of the current batch after recording, the file is closed. Next time you change into the batch, the file will be erased.
- **Start time**
  It is the 24 hour time of day the batch will start recording if in batch mode. The start time may become a time of tape and reel number if deck control is implemented but for now it is a time of day.
- **Duration**
  This is the length of the batch. It only has meaning if the **Mode** of the batch is **Timed**. Once the recording length reaches **duration** the recording stops, whether in interactive or batch mode.

- **Source**
  This has meaning only when the capturing hardware has multiple sources. Usually the source is a tuner channel or input. When the current batch finishes and the next batch begins recording, the source is changed to what the next batch is set to. This way multiple TV stations can be recorded at different times.

The record window has a notion of the **current batch**. The current batch is not the same as the batch which is highlighted in the batch list. The current batch text is colored red in the batch list. The highlighted batch is merely displayed in the edit batch section for editing.

By coloring the current batch red, any batch can be edited by highlighting it, without changing the batch to be recorded.

All recording operations take place in the current batch. If there are multiple batches, highlight the desired batch and hit **activate** to make it the current batch. If the **start** button is pressed, the current batch flashes to indicate it is waiting for the start time in batch mode. If the **record** button is pressed, the current batch is recorded immediately in interactive mode.

In batch and interactive recording modes, when the current batch finishes recording the next batch is activated and performed. All future recording is done in batch mode. When the first batch finishes, the next batch flashes until its start time is reached.

Interrupt either the batch or the interactive operation by hitting the stop button.

Finally there is the ⏮ rewind button. In either interactive or batch recording, the rewind button causes the current batch to close its file. The next recording operation in the current batch deletes the file.

19.1.3 Editing tuner information

Sometimes in the recording process and the configuration process, you will need to define and select tuner channels to either record or play back to. In the case of the Video4Linux and Buz recording drivers, tuner channels define the source. When the Buz driver is also used for playback, tuner channels define the destination.

Defining tuner channels is accomplished by pushing the 📡 channel button. This brings up the channel editing window. In this window you add, edit, and sort channels. Also, for certain video drivers, you can adjust the picture quality.

The **add** operation brings up a channel editing box. The title of the channel appears in the channel list. The source of the channel is the entry in the physical tuner's frequency table corresponding to the title.

Fine tuning in the channel edit dialog adjusts the physical frequency slightly if the driver supports it. The norm and frequency table together define which frequency table is selected for defining sources. If the device supports multiple inputs, the input menu selects these.

To sort channels, highlight the channel in the list and push **move up** or **move down** to move it.

Once channels are defined, the **source** item in the record window can be used to select channels for recording. The same channel selecting ability also exists in the record monitor window. Be aware channel selections in the record monitor window and the record window are stored in the current batch.

For some drivers an option to **swap fields** may be visible. These drivers do not get the field order right every time without human intervention. Toggle this to get the odd and even lines to record in the right order.

19.2 Capturing using dvgrab

dvgrab is great and simple to use a command line tool to capture videos from a DV camcorder. When invoked it will automatically put your camera in play mode, and start storing the videos on your hard disk. Video files will be labeled sequentially, as: '`001.avi`', '`002.avi`' and so on.

To install dvgrab, use your distribution preferred installation mechanism (apt, rpm, deb, etc) or refer to the dvgrab webpage.

Capturing videos in four easy steps:

1. Create a directory where you want the capture videos to be stored
2. `cd` to that directory
3. Type: `dvgrab --buffers 500` and *RETURN*
4. Press *CTRL-C* to stop capturing video

The '`--autosplit`' option is very useful. It splits scenes according to the timecode. However, that only works when grabbing from a DV camcorder. It will not work when grabbing from a analog/digital converter such as a Canopus ADVC110.

Read the dvgrab manual to get more information about dvgrab features.

20 Rendering files

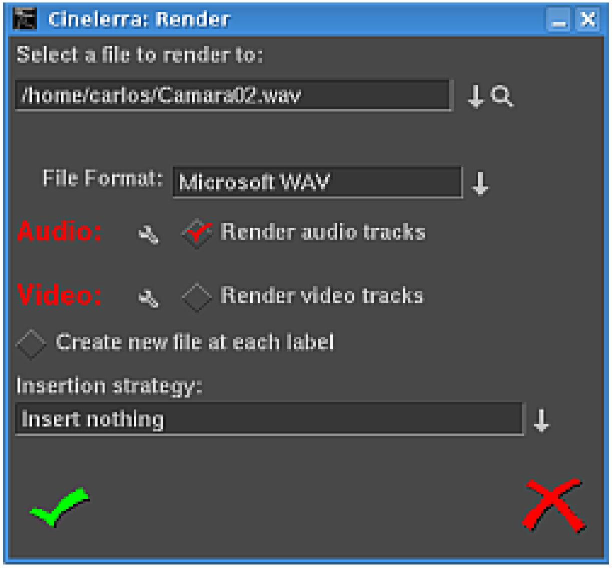
Rendering takes a section of the timeline, performs all the editing, effects and compositing, and stores it in a pure movie file. You can then delete all the source assets, play the rendered file in a movie player, or bring it back into Cinelerra for more editing. It is very difficult to retouch any editing decisions in the pure movie file, however, so keep the original assets and XML file around several days after you render it.

All rendering operations are based on a region of the timeline to be rendered. You need to define this region on the timeline. The navigation section describes methods of defining regions. See Chapter 13 [Timebar], page 85. The rendering functions define the region based on a set of rules. When a region is highlighted or in/out points are set, the affected region is rendered. When no region is highlighted, everything after the insertion point is rendered. Merely by positioning the insertion point at the beginning of a track and unsetting all in/out points, the entire track is rendered.

20.1 Single file rendering

The fastest way to get media to disk is to use the single file rendering function.

Go to **File->render** or press *SHIFT-R* to bring up the render dialog. Select the magnifying glass 🔍 to bring up a file selection dialog. This determines the filename to write the rendered file to and the encoding parameters.



Select a file to render to: /home/carlos/Camara02.wav

File Format: Microsoft WAV

☑ Render audio tracks

◇ Render video tracks

◇ Create new file at each label

Insertion strategy: Insert nothing

The render window

In the render dialog select a format from the **File Format** menu. The format of the file determines whether you can render audio or video or both. Select the **Render audio tracks** toggle to generate audio tracks and **Render video tracks** to generate video tracks.

Select the wrench 🔧 next to each toggle to set compression parameters. If the file format can not store audio or video the compression parameters will be blank. If **Render audio tracks** or **Render video tracks** is selected and the file format does not support it, trying to render will pop up an error.

20.2 Separate files rendering

The **Create new file at each label** option causes a new file to be created when every label in the timeline is encountered. This is useful for dividing long audio recordings into individual tracks. When using the renderfarm, **Create new file at each label** causes one renderfarm job to be created at every label instead of using the internal load balancing algorithm to space jobs.

When **Create new file at each label** is selected, a new filename is created for every output file. If the filename given in the render dialog has a 2 digit number in it, the 2 digit number is overwritten with a different incremental number for every output file. If no 2 digit number is given, Cinelerra automatically concatenates a number to the end of the given filename for every output file.

In the filename '`/hmov/track01.wav`' the '`01`' would be overwritten for every output file. The filename '`/hmov/track.wav`'; however, would become '`/hmov/track.wav001`' and so on and so forth. Filename regeneration is only used when either renderfarm mode is active or creating new files for every label is active.

20.3 Insertion strategy of rendered files

Finally the render dialog lets you select an insertion mode. The insertion modes are the same as with loading files. In this case if you select **insert nothing** the file will be written out to disk without changing the current project. For other insertion strategies be sure to prepare the timeline to have the output inserted at the right position before the rendering operation is finished. See Chapter 7 [Editing], page 49. Editing describes how to cause output to be inserted at the right position.

It should be noted that even if you only have audio or only have video rendered, a **paste** insertion strategy will behave like a normal paste operation, erasing any selected region of the timeline and pasting just the data that was rendered. If you render only audio and have some video tracks armed, the video tracks will get truncated while the audio output is pasted into the audio tracks.

20.4 Batch rendering

Batch Rendering is one of Cinelerra's great but lesser-known strengths. It allows you to eliminate manual repetitive keystrokes and mouse clicks, and automate the rendering of audio-video files. It even allows for Cinelerra to be completely driven by external programs, with no need for the user to manually interact with the Cinelerra user interface.

If you want to render many projects to media files without having to repeatedly attend to the **Render** dialog, **batch rendering** is the function to use. In this function, you specify one or more Cinelerra project XML files (EDL) to render and the unique output files for each. Then Cinelerra loads each project file and renders it automatically, without any user intervention. Each Cinelerra project XML file, combined with the settings for rendering an output file, are called a **batch**. This allows a huge amount of media to be processed and greatly increases the value of an expensive computer.

The first thing to do when preparing to do batch rendering is to create one or more Cinelerra projects (EDL) to be rendered and save them as normal Cinelerra project ('`myproject.cin.xml`') files. The batch renderer requires a separate Cinelerra project file for every batch to be rendered. You can use the same Cinelerra project file if you are rendering to different output files, for example, creating the same output video in different file formats.

To create a Cinelerra project file which can be used in batch render, set up a Cinelerra project and define the region to be rendered either by highlighting it, setting in/out points around it, or positioning the insertion point before it. Then save the project in the normal way to a '`myproject.cin.xml`' file (EDL). Define as many projects as needed this way. The batch renderer takes the active region from the EDL file for rendering.

With all the Cinelerra project files (EDL) prepared with active regions, go to **File->batch render**. This brings up the batch rendering dialog. The interface for batch rendering is a bit more complex than for single file rendering.

A list of batches must be defined before starting a batch rendering operation. The table of batches appears on the bottom of the batch render dialog and is called **batches to render**. Above this are the configuration parameters for a single batch.
A batch is simply a pairing of a Cinelerra project file with a choice of output file and render settings.

Set the **output path**, **file format**, **Audio**, **Video**, and **Create new file at each label** parameters as if you were rendering a single file. These parameters apply to only one batch. In addition to the standard rendering parameters, you must select the Cinelerra project file ('`myproject.cin.xml`') to be used in the batch. Do this by setting the **EDL path**. Use the magnifier to bring a drop down menu with your files or write manually the path to your regular Cinelerra project file ('`myproject.cin.xml`'). In this case, **EDL path** has nothing to do with EDL files as created by **File/Export EDL**.
Cinelerra in batch render mode will not overwrite an existing output file. The batch render will simply fail. Make sure that no files with the same name as the output files exist before starting the render.

If the **batches to render** list is empty or nothing is highlighted, click **New** to create a new batch. The new batch will contain all the parameters you just set.
Repeatedly press the **New** button to create more batches with the same parameters. Highlight any batch and edit the configuration on the top of the batch render window. The highlighted batch is always synchronized to the information displayed.
Click and drag batches to change the order in which they are rendered. Hit **delete** to permanently remove the highlighted batch.
In the list box is a column which enables or disables the batch. This way batches can be skipped without being deleted. Click on the **Enabled** column in the list box to enable or disable a batch. If it is checked, the batch is rendered. If it is blank, the batch is skipped.

The other columns in the batch list are informative.

- **Output** The output path of the batch.
- **EDL** The source EDL of the batch.
- **Elapsed** The amount of time taken to render the batch if it is finished.

To start rendering from the first enabled batch, hit **Start**.
Once rendering, the main window shows the progress of the batch. Once the batch finishes, the elapsed column in the batch list is updated and the next batch is rendered until all the enabled batches are finished. The currently rendering batch is always highlighted red.
To stop rendering before the batches are finished without closing the batch render dialog, hit **Stop**.
To stop rendering before the batches are finished and close the batch render dialog, hit **Cancel**.
To exit the batch render dialog whether or not anything is being rendered, hit **Cancel**.

You can automate Cinelerra batch renders from other programs. In the Cinelerra batch render dialog, once you have created your list of batch render jobs, you can click the button **Save List** and choose a file to save your **batch render list** to. We suggest you use a filename like '`myrenderlist.batchrender.cin.xml`'. Once you have created this file, you can start up a batch render without needing to interact with the Cinelerra user interface. From a shell prompt (or from a script, or other program), execute:

```
cinelerra -r myrenderlist.batchrender.cin.xml
```

(changing '`myrenderlist.batchrender.cin.xml`' to whatever filename you chose for saving your batch render list).
When invoked with these parameters, Cinelerra will start up and perform the rendering jobs in that list, without creating its usual windows.

Programmers, please note: this is a powerful feature indeed. It means that if you can create valid Cinelerra project xml files and Cinelerra render list files from other programs (which requires just a small amount of skill with your favourite XML library), then you can gain full automated access to all of Cinelerra's functionality without needing to interact with the Cinelerra user interface. The possibilities for this are endless. You can leverage the power of Cinelerra and incorporate it into your own programs. It's a good idea if you can create simple Cinelerra project files and batch render files and study the XML format. By trial and error, you'll be able to generate valid Cinelerra xml files for projects and batch render lists, and thus create your own Cinelerra automation library in your favourite programming language.

20.5 The render farm

When bicubic interpolation and HDTV was first done on Cinelerra, the time needed to produce the simplest output became unbearable even on the fastest dual 1.7 GHz Xeon of the time. Renderfarm support even in the simplest form brings HDTV times back in line with SD while making SD faster than real-time.

While the renderfarm interface is not spectacular, it is simple enough to use inside an editing suite with less than a dozen nodes without going through the same amount of hassle you would with a several hundred node farm. Renderfarm is invoked transparently for all file->render operations when it is enabled in the preferences.

Cinelerra divides the selected region of the timeline into a certain number of jobs which are then dispatched to the different nodes depending on the load balance. The nodes process the jobs and write their output to individual files on the filesystem. The output files are not concatenated. It is important for all the nodes to have access to the same filesystem on the same mount point for assets.

If a node can not access an input asset it will display error messages to its console but probably not die. If it can not access an output asset it will cause the rendering to abort.

It should be noted that in the render dialog, the **Create new file at each label** option causes a new renderfarm job to be created at each label instead of by the load balancer. If this option is selected when no labels exist, only one job will be created.

A Cinelerra renderfarm is organized into a master node and any number of slave nodes. The master node is the computer which is running the GUI. The slave nodes are anywhere else on the network and are run from the command line. Run a slave node from the command line with `cinelerra -d`

That is the simplest configuration. Type `cinelerra -h` to see more options. The default port number may be overridden by passing a port number after the '`-d`'.

Most of the time you will want to bring in the rendered output and fine tune the timing on the timeline. Also some file formats like MPEG can not be direct copied. Because of this, the jobs are left in individual files.

You can load these by creating a new track and specifying **concatenate to existing tracks** in the load dialog. Files which support direct copy can be concatenated into a single file by rendering to the same file format with renderfarm disabled. Also to get direct copy, the track dimensions, output dimensions, and asset dimensions must be equal.

MPEG files or files which do not support direct copy have to be concatenated with a command line utility. MPEG files can be concatenated with **cat**.

Configuration of the renderfarm is described in the configuration chapter See Section 3.6.2 [Renderfarm], page 28. The slave nodes traditionally read and write data to a common filesystem over a network, thus they do not need hard drives.

Ideally all the nodes on the renderfarm have similar CPU performance. Cinelerra load balances on a first come first serve basis. If the last segment is dispatched to the slowest node, all the fastest nodes may end up waiting for the slowest node to finish while they themselves could have rendered it faster.

20.6 Command line rendering

The command line rendering facility consists of a way to load the current set of batch rendering jobs and process them without a GUI. This is useful if you are planning on crashing X repeatedly or want to do rendering on the other side of a low bandwidth network. You might have access to a supercomputer in India but still be stuck in America, exiled you might say. A command line interface is ideal for this.

To perform rendering from the command line, first run Cinelerra in graphical mode. Go to **file->batch render**. Create the batches you intend to render in the batch window and close the window. This saves the batches in a file. Set up the desired renderfarm attributes in **settings->preferences** and exit Cinelerra. These settings are used the next time command line rendering is used.

On the command line run: `cinelerra -r`

to processes the current batch jobs without a GUI. Setting up all the parameters for this operation is hard. That is why the command line aborts if any output files already exist.

Other parameters exist for specifying alternative files for the preferences and the batches. Attempting to use anything but the defaults is very involved so it has not been tested.

20.7 Rendering videos for the internet

If you want to encode a video in order to put it on the internet, we recommend to render it as a Quicktime4linux file, and then encode that file in MPEG4 of FLV formats. The Quicktime4linux file rendered from Cinelerra must have the following properties:

- Audio option Two Complements 16bits (PCM)
- Video option DV

20.7.1 Encoding a video in MPEG4 format for the internet

To get the best quality, you should encode your Quicktime4linux file with mencoder in two passes.

First pass:

```
mencoder input.mov -ovc xvid -xvidencopts bitrate=600:pass=1 \
-vf scale=320:240 -oac mp3lame -lameopts abr:br=64 -o output.avi
```

Second pass:

```
mencoder input.mov -ovc xvid -xvidencopts bitrate=600:pass=2 \
-vf scale=320:240 -oac mp3lame -lameopts abr:br=64 -o output.avi
```

Do not forget to change the output size of the video, set with the '`-vf scale=`' option.

Here are some other command lines. They give output video files whose weight is around 13 Mb for 3 minutes.

First pass:

```
mencoder -oac pcm -sws 2 -vf scale=${width}:${height},hqdn3d=2:1:2 \
-ovc lavc -lavcopts vcodec=mpeg4:vbitrate=${video_bitrate}:vlelim=-4:\
vcelim=7:lumi_mask=0.05:dark_mask=0.01:scplx_mask=0.3:naq:v4mv:mbd=2:\
trell:cmp=3:subcmp=3:mbcmp=3:aspect=4/3:sc_threshold=1000000000:\
vmax_b_frames=2:vb_strategy=1:dia=3:predia=3:cbp:mv0:preme=2:\
last_pred=3:vpass=1:cgop -ofps 25 -of avi movie.mov -o /dev/null\
-ffourcc DIVX
```

Second pass:

```
mencoder -srate 32000 -oac mp3lame -lameopts cbr:br=${audio_bitrate}:\
aq=0 -sws 2 -vf scale=${width}:${height},hqdn3d=2:1:2 -ovc lavc\
-lavcopts vcodec=mpeg4:vbitrate=${video_bitrate}:vlelim=-4:vcelim=7:\
lumi_mask=0.05:dark_mask=0.01:scplx_mask=0.3:naq:v4mv:mbd=2:trell:\
cmp=3:subcmp=3:mbcmp=3:aspect=4/3:sc_threshold=1000000000:\
vmax_b_frames=2:dia=3:predia=3:cbp:mv0:preme=2:last_pred=3:vpass=3:\
cgop -ofps 25 -of avi movie.mov -o movie.avi -ffourcc DIVX
```

You probably have to adapt those command lines if your material is noisy; have a look at mencoder's pre-processing filters. The *_mask parameters are really important when encoding at low bitrate.

If you want your video file to be displayed properly on a well know media player which runs on Windows you should be aware that:

- the aspect ratio information contained in the AVI header will not be taken into account by that player. That is why you must scale the image to the right aspect ratio. Width and height must be multiples of 16. Those are the recommended resolutions for 4/3 PAL material: 384:288, 448:336, 512:384 or 704:528.
- the media player running on Windows will loose A/V sync if a VBR audio bitrate is used instead of CBR.
- the '`-ffourcc`' parameter is needed for the video codec to be recognized as Divx.

20.7.2 Encoding a video in FLV format for the internet

FLV files (FLash Video) weight is very small and the only thing needed to play those files is an internet browser with flash plugin version 7 or higher installed. That format is really useful when one wants to share a video with a wide audience over the internet.

First pass:

```
ffmpeg -i movie.mov -b 430k -s 320x240 -aspect 4:3 -pass 1 -ar 22050 movie.flv
```

Second pass:

```
ffmpeg -i movie.mov -b 430k -s 320x240 -aspect 4:3 -pass 2 -ar 22050 movie.flv
```

Pay attention to the output file extension. Ffmpeg uses it to determine the output format. The audio sampling frequency to use is 22050 and the '`-ar`' parameter must be used for the video to be properly encoded. Ffmpeg does not write metadata information in the flv file. The duration has to be written in the metadata information in order for some flash players to display a progress bar. FLVTool2 (`http://www.inlet-media.de/flvtool2`) can be used to insert that information:

```
cat input_file.flv | flvtool2 -U stdin output_file.flv
```

There are a number of options for embedding the flv file in a web page. You can use ming or flv2swf to create an swf file.
`http://klaus.geekserver.net/flash/streaming.html` has detailed instructions for ming and `http://search.cpan.org/~clotho/FLV-Info-0.17/bin/flv2swf` can be installed with cpan> install FLV::ToSWF. Or you can use the Creative Commons Non-Commercial licenced JW FLV Player `http://www.jeroenwijering.com/?item=JW_FLV_Player`, or the Apache Licenced FlowPlayer `http://flowplayer.org`. Both of these allow you to use the flv as created above, and have controls for stopping and playing the movie etc.

20.8 Quicktime for GNU/Linux compatibility chart

Scott Frase wrote a Quicktime for GNU/Linux compatibility chart. It contains an exhaustive list of all the Quicktime compression schemes available and their compatibility in Cinelerra, Mplayer and some other media players. That document has two main sections, one based on an HDV resolution-formatted project and another based on a DV resolution-format project.

It is available here:
`http://content.serveftp.net/video/qtcompatibility.ods`

Some interesting notes:

- Mplayer does behave better with smaller, DV resolution video
- Cinelerra compatibility with files rendered from a DV project is not much different than its compatibility with files rendered from an HDV project.
- Comparison chart of DV/HDV mplayer/cinelerra compatibility included

20.9 Making a DVD

20.9.1 Rendering to mpeg2

Here is a method to export mpeg2 video for DVD. This method allows you to precisely set the encoding option you want and produces an mpeg2 file which is 100% compatible with all DVD standalone players. For how to make a DVD from the output See Section 20.9.3 [Authoring a DVD], page 151.

Audio and video are rendered seperately and combined later in a procedure external to Cinelerra.
Audio is rendered into **.ac3**, and **video** is rendered into a **yuv4mpeg stream** which is piped through either **mpeg2enc** or **ffmpeg** into a **.m2v** file. Both variants are described in detail below.

(Apparently depending on footage and player engine, one or the other variant may produce better results. Check out which one works best for you by rendering a short test edit of a few seconds length, authoring to DVD according to the sections below, and playing it in your cheapest standalone player to really see wether it is foolproof or displays errors.)

In both cases, make sure you properly defined your Cinelerra project format before rendering your video (menu **Settings->Format...**), preferably even before loading any raw footage.
TV standards:
PAL is 720x576 at 25 frames per second,
NTSC is 720x480 at 29.97 frames per second.

20.9.1.1 yuv4mpeg pipe through mpeg2enc

The mplex program from **mjpegtools** must be installed. The mjpegtools package is built in the hvirtual distribution and the mplex utility may be extracted from there.

1. Create a script '`~/cine_render.sh`'
2. Copy in '`~/cine_render.sh file`' the following lines:
   ```
   #/bin/bash
   mpeg2enc -v 0 -K tmpgenc -r 16 -4 1 -2 1 -D 10 -E 10 -g 15 -G 15 -q 6 -b 8600 -f 8
   -o $1
   ```
3. Put the execute permissions on that file: `chmod 777 ~/cine_render.sh`
4. Within Cinelerra, and select the part of the project you want to render with the [and] points
5. Press *`SHIFT-R`*
6. Select the **YUV4MPEG Stream** file format
7. Deselect **Render audio tracks** and select **Render video tracks**

8. Click on the wrench
9. In the newly opened window, indicate the name of the 'm2v' file you want to create. That file will contain video only.
10. Click on **Use pipe** and write this command: `/home/<your_user>/cine_render.sh %`
11. Click OK to close the second window, and OK again to render your 'm2v' file
12. When the m2v file is rendered, open the rendering window again, and render an AC3 file at 224kbits
13. Finally, combine video and audio with this command:
    `mplex -f 8 your_video_file.m2v your_audio_file.ac3 -o video_audio_file.mpeg`
    If you obtain errors while using mplex, increase the quantizer ('-q' option, see below).

You can modify the mpeg2enc parameters if you want to. Look at the mpeg2enc manpage. Some details about the settings:

- '-b 8600' : This is the maximum bitrate of your 'm2v' file (it does not include the audio bitrate). We recommend you to do not increase that value or you could get errors when mplexing the video and the audio.
- '-q 6' : This is the quantizer setting. If you reduce it (do not go below 3), the quality increases. But the bitrate will increase. It's recommended to keep the medium bitrate achieved (that's displayed when mplexing the audio and video files) around 10% lower than the bitrate defined with the '-b' setting.
- '-K tmpgenc' : invokes the TMPGEnc matrices. It reduces the average bitrate by about 10% compared to the default tables. For very-high quality material, you can try removing this option.

If your material is noisy (Hi8 analog material for example), you can add some mjpegtools in the command line written in '~/cine_render.sh':

- `y4mshift` and `y4mscaler` can be used to remove the noisy borders around the video. For example, those commands added at the beginning of the command line in 'cine_render.sh' remove the black borders around a Hi8 video:
  `yuvscaler -v 0 -I ACTIVE_700x560+8+8 | y4mshift -n 2 |`
- `yuvdenoise` and `yuvmedianfilter` can help removing noise. Example:
  `yuvdenoise -F | yuvmedianfilter -T 3 |`
  Denoising is a complex task, and the options given above are just an example. Please read the mjpegtools'manual and subscribe to its mailing-list for more information.

20.9.1.2 yuv4mpeg pipe through ffmpeg

1. Select **File->Render...** or press SHIFT-R. The render dialog pops up.
2. In the render dialog, you have the choice to render 1. the entire project, or 2. the highlighted selection, or 3. from In-point "[" to Out-point "]".
3. Make sure the **Insertion strategy** is "Create new resources only".
4. Select the **AC3** audio output file format.
5. Specify the audio output file name and path (example: `your-movie.ac3`).
6. Select **Render audio tracks** and deselect **Render video tracks**.
7. Click on the wrench next to "Audio:". A new dialog "Cinelerra: Audio Compression" pops up.
8. Set the bitrate to **128 kbps** (or leave it there).
9. Click OK, the compression dialog disappears.
10. In the render dialog, click OK, the dialogu disappears. Audio is rendered. Rendering audio is much faster than rendering video but might still take some seconds. Watch the progress bar in the main window's lower right corner.

11. Again, press SHIFT-R. The render dialog pops up again.
12. Select the **YUV4MPEG Stream** file format.
13. Specify the video output file name and path (example: `your-movie.m2v`).
14. Deselect **Render audio tracks** and select **Render video tracks**.
15. Click on the wrench next to "Video:". A new dialog window "Cinelerra: YUV4MPEG stream" pops up. The first textbox should already contain the output filename and path you had specified in the render dialog.
16. Select "Use Pipe:".
17. Fill the following command line into the second textbox:
    `ffmpeg -f yuv4mpegpipe -i - -y -target dvd -flags +ilme+ildct %`
18. Click OK in the yuv4mpeg dialog and in the render dialog to render video output.
19. The resulting .m2v can be further processed together with the .ac3 audio with the following shell command, producing a dvd-compatible mpeg stream:
    `ffmpeg -i your-movie.ac3 -i your-movie.m2v -target dvd -flags +ilme+ildct your-movie.mpg` (Yes, the stream is sent through ffmpeg a second time.)

Note on ffmpeg command line options:
`-i` tells ffmpeg to read from standard input (in our pipe, this means from Cinelerra's render stream).
The `-y` option allows to overwrite existing target files (of course, it is safer to omit this, but then you must make sure to rename or delete previous results each time you want to render a new version).
The `+ilme+ildct` flags are for proper interlacing, bottom fields first, tested with PAL footage. Some Cinelerra versions suggest a similar command line in the ffmpeg pipe presets for DVD, however with erroneous syntax of the interlacing flags or without the flags.

Before proceeding to put your rendered mpeg2 data on DVD, you might want to watch and check your-movie.mpg in mplayer or xine/kaffeine.

20.9.2 Making a DVD menu

A DVD menu is composed of:

- a background (still image or video)
- buttons
- sound/music

You can build a menu with a GUI such as qdvdauthor, dvdstyler, dvdwizard or tovid. However, using those GUI is not perfect for the moment, since they are bugged or limited for the moment.

If you prefer to use a GUI, we recommend you to try tovid:
`http://tovid.wikia.com/wiki/Main_Page`
QDVDAuthor contained a lot of bugs sometime ago, but its author fixed some of them recently, which makes QDVDAuthor more usable.

The method we explain below is more complicated than using a GUI, however it:

- produces DVD playable on all standalone players
- is not subject to bugs
- will save you a lot of time since all you have to do to author a new DVD is to modify text files

Here are the steps needed to create your DVD menu:

- create the menu background with cinelerra

- add the buttons by creating PNG images
- combine the menu and the buttons with spumux

We suppose that you want to create a menu with an animated background. Launch Cinelerra and create a project containing what you want to be the background of the menu. You can add a music if you wish to. Pay attention to the fact that this menu will play in loop.

To draw the buttons, you have two possibilities:

- display them in Cinelerra. That way, you will be able to make animated buttons, such as a video thumbnail for each part of your video.
- do not draw the buttons in Cinelerra. You will add them later on, from PNG images "added" to the mpeg2 menu file. This is the simpliest method, but you won't be able to display animated buttons.

Render that video into m2v and ac3 using the `cine_render.sh` method explain above. Combine the audio and video with mplex as you would do with any "normal" video.

You obtain a mpeg2 file containing the menu background, and some buttons displayed above it if you added them in Cinelerra.

We have to use spumux to define each button position in that mpeg2 file. If you did not draw the buttons in Cinelerra, you will be able to put them in with spumux.

Spumux is a command line utility which takes 2 arguments:

- an XML file explaining where the buttons are
- the mpeg2 file name (the one you rendered for the menu)

Here is a spumux example XML file:

```
<subpictures>
 <stream>
  <spu start="00:00:00.0" image="buttons_normal.png" highlight=
  "buttons_highlight.png" select="buttons_select.png">
   <button name="1" x0="94 " y0="234 " x1="253 " y1="278"
   down="2" right="4" />
   <button name="2" x0="63 " y0="287 " x1="379 " y1="331" up="1"
   down="3" right="5" />
  </spu>
 </stream>
</subpictures>
```

- **image="buttons_normal.png"** This png image contains the buttons as they should appear when they are not selected nor highlighted.
- **highlight="buttons_highlight.png"** This png image contains the buttons in their highlighted state.
- **select="buttons_select.png** This png image contains the buttons in their selected state.

If you already made the buttons in Cinelerra, you have to specify empty (100% transparent) PNG images here.

The PNG images used in spumux must:

- contain an **alpha channel** (ie support transparency)
- be in **4 indexed colors**. You can easily convert an image to 4 indexed colors using Gimp.

There is one line per button. Each line contains the button coordinates, a button having a rectangular shape:

- **x0, y0**: upper left corner
- **x1, y1**: bottom right corner

You also have to set which button to move to when using the up, down, left and right buttons of the DVD remote. Here is an example:

```
<button name="3" ...coordinates... up="1" down="5" left="2" right="4" />
```

When button 3 is selected, if the "Up" key is pressed on the remote then the button 1 will be highlighted. If the "Right" key is pressed on the remote, then button 4 will be highlighted.

When you have finished editing your spumux XML file, you have to type this command:

```
spumux menu.xml < menu.mpeg > menu_with_buttons.mpeg
```

That will make a 'menu_with_buttons.mpeg'. It is an mpeg2 files with buttons.

20.9.3 Authoring a DVD

After having rendered to mpeg2 your video files, and having prepared a menu with spumux, you need to "author" the DVD with dvdauthor, that is another command line application.

dvdauthor uses XML files to describe the DVD structure. You need to create an XML file in a text editor and save it as 'simple_example.xml' in the same folder of your '/the/mpeg/file.mpeg' mpeg2 video file. You should really pay a lot of attention to the .xml file syntax since it is very rigorous. The risk is the DVD to be readable on some standalone players, but not on all ofthem.

To help you start using dvdauthor, here are some example XML files you can copy and paste into your 'simple_example.xml' file. Replace example filenames and paths with the ones right for your project.

```
<dvdauthor dest="/path/to/the/folder/which/will/contain/the/dvd">
    <vmgm />
    <titleset>
        <titles>
            <pgc>
                <vob file="/the/mpeg/file.mpeg" />
                        <post>
                    jump chapter 1;
                </post>
            </pgc>
        </titles>
    </titleset>
</dvdauthor>
```

This is a very simple dvdauthor XML file. There are no menus, so the video file '/the/mpeg/file.mpeg' will be played as soon as you insert the DVD in the player.

The command in <post> tag means the video should be played in a loop. When the DVD player reaches the end of the video, it will jump to the first chapter of the video (which dvdautor assumes to be the beginning of the video since chapters haven't been defined). To make the video play only once without jumping from the end to the beginning, remove the following lines from your XML file.

```
                <post>
                    jump chapter 1;
                </post>
```

To author the DVD, go to the folder that contains the video and the XML file and type the following command:

```
dvdauthor -x simple_example.xml
```

Now, let's have a look at a more complex example. When the DVD is inserted, a menu is displayed and you can choose to play any of 4 videos.

```
<dvdauthor dest="/path/to/the/folder/which/will/contain/the/dvd" jumppad="yes" >
<vmgm>
 <fpc> jump menu 1; </fpc>
  <menus>
   <video format="pal" aspect="4:3" resolution="720x576" />
   <pgc entry="title" >
    <vob file="menu.mpeg" pause="0" />
    <button name="1" > { g3=1; jump titleset 1 menu entry root; } </button>
    <button name="2" > { g3=2; jump titleset 1 menu entry root; } </button>
    <button name="3" > { g3=3; jump titleset 1 menu entry root; } </button>
    <button name="4" > { g3=4; jump titleset 1 menu entry root; } </button>
     <post> { jump cell 1; } </post>
   </pgc>
  </menus>
 </vmgm>
 <titleset>
  <menus>
   <pgc entry="root" >
    <pre> { if ( g3 gt 0 )  {
                if ( g3 eq 1 ) { g3=0; jump title 1  chapter 1; }
                if ( g3 eq 2 ) { g3=0; jump title 1  chapter 3; }
                if ( g3 eq 3 ) { g3=0; jump title 1  chapter 5; }
                if ( g3 eq 4 ) { g3=0; jump title 1  chapter 7; }
                jump vmgm menu entry title;
                }
        } </pre>
    <post> { jump vmgm menu entry title; } </post>
   </pgc>
  </menus>
  <titles>
   <video format="pal" aspect="4:3" resolution="720x576" />
   <pgc pause="0" >
    <vob file="video_1.mpeg" pause="0" />
    <vob file="blackvideo.mpg" pause="0" />
    <vob file="video_2.mpeg" pause="0" />
    <vob file="blackvideo.mpg" pause="0" />
    <vob file="video_3.mpeg" pause="0" />
    <vob file="blackvideo.mpg" pause="0" />
    <vob file="video_4.mpeg" pause="0" />
    <post> { call vmgm menu entry title; } </post>
   </pgc>
  </titles>
 </titleset>
</dvdauthor>
```

The file ‘blackvideo.mpg’ is used to add a 2 second black screen between each video. Here is how to create it:

```
convert -size 720x576 xc:black -depth 8 blackframe.ppm
dd if=/dev/zero bs=4 count=960000 | toolame -b 128 -s 48 /dev/stdin emptyaudio.mpa
ppmtoy4m -S 420mpeg2 -n 50 -F 25:1 -r blackframe.ppm | mpeg2enc -a 2 -n p -f 8 -o
blackvideo.mpv
mplex -f 8 -o blackvideo.mpg blackvideo.mpv emptyaudio.mpa
```

20.9.4 Burning a DVD

When you have finished authoring the DVD, you will find in the destination folder the following directories: 'AUDIO_TS' and 'VIDEO_TS'. To test your DVD before burning it, cd into this folder, and type:

```
xine dvd:‘pwd‘
```

If your DVD plays fine on your computer, it is time to burn it. When you are in the folder containing 'AUDIO_TS' and 'VIDEO_TS', type this command (adjusting for your dvd burner device, eg /dev/dvdrw):

```
nice -n -20 growisofs -dvd-compat -speed=2 -Z /dev/dvd -dvd-video -V VIDEO ./ &&
eject /dev/dvd
```

If you have a lot of copies to do, you can first make an .iso master in the parent folder using this command:

```
nice -n -20 mkisofs -dvd-video -V VIDEO -o ../dvd.iso .
```

This '../dvd.iso' file can be burnt using this command:

```
nice -n -20 growisofs -dvd-compat -speed=2 -Z /dev/dvd=../dvd.iso && eject
/dev/cdrom
```

We recommend you do not burn at a speed higher than 4x. Use good quality DVD-R only.

To test your DVD on a standalone player without wasting several DVD-R, you can burn on DVD-RW. First, format your DVD-RW using this command:

```
dvd+rw-format -lead-out /dev/dvd
```

Then, burn the DVD-RW using the commands above.

20.10 Using background rendering

Background rendering allows impossibly slow effects to play back in real-time shortly after the effect is pasted in the timeline. It continuously renders temporary output. When renderfarm is enabled, background rendering uses the renderfarm continuously. This way, any size video can be seen in real-time merely by creating a fast enough network with enough nodes.

Background rendering is enabled in settings->preferences->performance. It has one interactive function: **settings->set background render**. This sets the point where background rendering begins to where the in point is. If any video exists, a red bar appears in the timeline showing what has been background rendered.

It is often useful to insert an effect or a transition and then select settings->set background render right before the effect to preview it at full framerates.

21 Tips

In this section, you will find ways to solve common problems using Cinelerra. This section is arranged in order of the problems and what tools are used to solve them. Following sections are arranged in order of the tools and their uses.

21.1 Encoding into Dolby Pro Logic

Dolby pro logic is an easy way to output 6 channel audio from a 2-channel soundcard with degraded but useful results. Rudimentary Dolby pro logic encoding can be achieved with clever usage of the effects.

First, create the front left and right channels. Create 2 audio tracks, each carrying either the left or right channel. Pan the left channel to the left and the right channel to the right with **pan**.

Next, create the rear left and right channels. Create another 2 audio tracks as above: the left channel panned left and the right channel panned right. Then apply **invert audio** to both new channels and the signals will come out of the rear speakers.

Next, create the center channel by creating a single audio track with monaural audio from a different source. Center it with the **pan** control and the signal will come out of the center speaker.

If a copy of the signal in the back speakers is desired in any single front speaker, the signal in the back speakers must be delayed by at least 0.05 seconds and a single new track should be created. Pan the new track to orient the signal in the front speakers.

If the same signal is desired in all the speakers except the center speaker, delay the back speakers by 0.5 seconds and delay either the front left or front right by 0.2 seconds.

If you want to hear something from the subwoofer, create a new track, select a range, drop a synthesizer effect, and set the frequency below 60 Hz. The subwoofer merely plays anything below 60Hz or so.

Other tricks you can perform to separate the speakers are parametric equalization to play only selected ranges of frequencies through different speakers and lowpass filtering to play signals through the subwoofer.

21.2 Cleaning analog TV

Unless you live in a rich nation like China or are a terrorist, you probably record analog TV more than you record digital TV. The picture quality on analog TV is horrible but you can do things in Cinelerra to make it look more like it did in the studio.

First, when capturing the video, capture it in the highest resolution possible. For Europeans it is 720x576 and for North Americans it is 720x480. Do not bother adjusting the brightness or contrast in the recording monitor, although maxing out the color is useful. Capture it using MJPEG or uncompressed Component Video if possible. If those are too demanding, then capture it using JPEG. RGB should be a last resort.

Now on the timeline use **Settings->Format** to set a YUV colorspace. Drop a **Downsample** effect on the footage. Set it for

```
Horizontal:        2
Horizontal offset: 0
Vertical:          2
Vertical offset:   0
      red
  x   green
```

```
x   blue
    alpha
```

Use the camera tool to shift the picture up or down a line to remove the most color interference from the image. This is the difference we are looking for:

If you have vertical blanking information or crawls which constantly change in each frame, block them out with the **Mask** tool. This improves compression ratios.

This is about all you can do without destroying more data than you would naturally lose in compression. The more invasive cleaning techniques involve deinterlacing.

21.3 Defeating interlacing

Interlacing is done on most video sources because it costs too much to build progressive scanning cameras and progressive scanning CRT's. Many a consumer has been disappointed to spend 5 paychecks on a camcorder and discover what horrible jagged images it produces on a computer monitor.

As for progressive scanning camcorders, forget it. Cost factors are probably going to keep progressive scanning cameras from ever equaling the spatial resolution of interlaced cameras. Interlacing is here to stay. That is why they made deinterlacing effects in Cinelerra.

We do not believe there has ever been a perfect deinterlacing effect. They are either irreversible or do not work. Cinelerra cuts down the middle by providing deinterlacing tools that are irreversible sometimes and do not work sometimes but are neither one or the other.

- **Line Doubling** This one is done by the **Deinterlace** effect when set to **Odd lines** or **Even lines**. When applied to a track it reduces the vertical resolution by 1/2 and gives you progressive frames with stairstepping. This is only useful when followed by a scale effect which reduces the image to half its size.
- **Line averaging** The **Deinterlace** effect when set to **Average even lines** or **Average odd lines** does exactly what line doubling does except instead of making straight copies of the lines it makes averages of the lines. This is actually useful for all scaling.
  There is an option for adaptive line averaging which selects which lines to line average and which lines to leave interlaced based on the difference between the lines. It does not work.
- **Inverse Telecine** This is the most effective deinterlacing tool when the footage is an NTSC TV broadcast of a film. See Section 14.4.28 [Inverse telecine], page 102.
- **Time base correction** The first three tools either destroy footage irreversibly or do not work at times. **Time base correction** is last because it is the perfect deinterlacing tool. It leaves the footage intact. It does not reduce resolution, perceptually at least. It does not cause jittery timing.
- The **Frames to Fields** effect converts each frame to two frames, so it must be used on a timeline whose project frame rate is twice the footage's frame rate. In the first frame it puts a line-averaged copy of the even lines. In the second frame it puts a line-averaged copy of the odd lines. When played back at full framerates it gives the illusion of progressive

video with no loss of detail.
Best of all, this effect can be reversed with the **Fields to frames** effect. That one combines two frames of footage back into the one original interlaced frame of half the framerate.
Be aware that frames to fields inputs frames at half the framerate as the project. Effects before frames to fields process at the reduced framerate.
Unfortunately, the output of **Frames to Fields** can not be compressed as efficiently as the original because it introduces vertical twitter and a super high framerate.
Interlaced 29.97 fps footage can be made to look like film by applying **Frames to Fields** and then reducing the project frame rate of the resulting 59.94 fps footage to 23.97 fps. This produces no timing jitter and the occasional odd field gives the illusion of more detail than there would be if you just line averaged the original.

HDTV exceptions

1920x1080 HDTV is encoded a special way. If it is a broadcast of original HDTV film, an inverse telecine works fine. If it is a rebroadcast of a 720x480 source, you need to use a time base and line doubling algorithm to deinterlace it, See Section 14.4.1 [1080 to 480], page 94.

21.4 Making video look like film

Video sweetening is constantly getting better. Lately the best thing you can do for dirt cheap consumer camcorder video is to turn it into progressive 24 fps output. While you can not really do that, you can get pretty close for the money. Mind you, since this procedure can degrade high quality video just as easily as it improves low quality video, it should only be used for low quality video.

1. Set project framerate to twice the video framerate.
2. Apply a **Sharpen** effect. Set it to sharpness: 25, no interlacing, and horizontal only.
3. Drop a **Frame to Fields** effect on the same track. Set Average Empty Rows to on and play through the video a few times to figure out which field is first. If the wrong field is first, the motion is shaky. Secondly, any editing in the doubled frame rate may now screw up the field order. We are still figuring out the easiest way to support warnings for field glitches but for now you need to go back to the normal framerate to do editing or play test to make sure the fields are right.
4. Render just the video to the highest quality file possible.
5. Import the video back to a new track. Set the project framerate to 24. The new track should now display more filmish and sharper images than the original footage.

This entire procedure could be implemented in one non-realtime effect, but the biggest problem with that is you will most often want to keep the field based output and the 24 fps output for posterity. A non-realtime effect would require all that processing just for the 24 fps copy. Still debating that one.

21.5 Clearing out haze

You probably photograph a lot of haze and never see blue sky. Even if you can afford to briefly go somewhere where there is blue sky, horizon shots usually can stand for more depth. This is what the **gradient effect** is for.

Drop the gradient effect on hazy tracks. Set the following parameters:

- Angle: 0
- Inner radius: 0
- Outer radius: 40
- Inner color: blue 100% alpha

- Outer color: blue 0% alpha

It is important to set the 0% alpha color to blue even though it is 0% alpha. The color of the outer alpha is still interpolated with the inner color. This is a generally applicable setting for the gradient. Some scenes may work better with orange or brown for an evening feel.

21.6 Making a ringtone

This is how we made ringtones for the low end Motorola V180's and it will probably work with any new phone. Go to **File->Load files...** and load a sound file with Insertion strategy: **Replace current project**. Go to **Settings->Format** change **Channels** to 1 and **Samplerate** to 16000 or 22050.

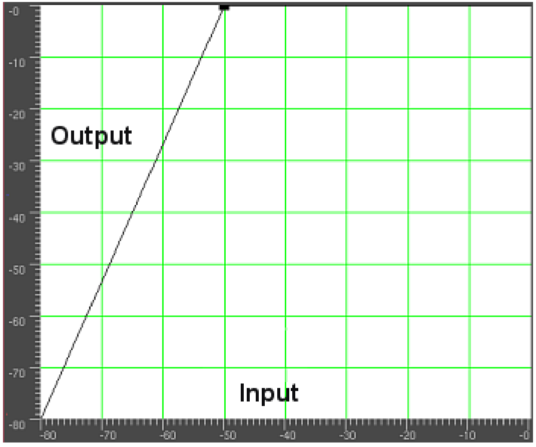
Either highlight a region of the timeline or set in/out points to use for the ringtone. To improve sound quality on the cell phone, you need the maximum amplitude in as many parts of the sound as possible. Right click on track Audio 1 and select **Attach effect...**. Highlight the **Compressor** effect and hit **Attach** in the attachment popup.

Make sure the insertion point or highlighted area is in the region with the Compressor effect. Right click on track Audio 2 and select **Attach effect...**. Highlight **Audio 1: Compressor** and hit **Attach**. Click the Audio1 Compressor's magnifying glass 🔍 to bring up the compressor GUI.

Set the following parameters:

- Reaction secs: **-0.1**
- Decay secs: **0.1**
- Trigger Type: **Total**
- Trigger: **0**
- Smooth only: **No**

Click **Clear** to clear the graph. Click anywhere in the grid area and drag a new point to 0 Output and -50 Input. The graph should look like this.



Go to **File->Render**. Specify the name of an mp3 file to output to. Set the file format to **MPEG Audio**. Click the wrench 🔧 for Audio and set **Layer** to **III** and **Kbits per second** to **24** or **32**. Check **Render audio tracks** and uncheck **Render video tracks**. Hit OK to render the file.

The resulting '`.mp3`' file must be uploaded to a web server. Then, the phone's web browser must download the '`.mp3`' file directly from the URL. There also may be a size limit on the file.

21.7 Time stretching audio

It may appear that time stretching audio is a matter of selecting a region of the audio tracks, enabling recording for the desired tracks, going to **Audio->Render Effect**, and applying **Time**

Stretch. In actuality there are 3 audio effects for time stretching: **Time Stretch**, **Resample**, and **Asset info dialog**.

Time Stretch applies a fast Fourier transform to try to change the duration without changing the pitch, but this introduces windowing artifacts to the audio. It is only useful for large changes in time because obvious changes in duration make windowing artifacts less obtrusive.

For smaller changes in duration, in the range of 5%, **Resample** should be used. This changes the pitch of the audio but small enough changes are not noticeable. Resample does not introduce any windowing artifacts, so this is most useful for slight duration changes where the listener is not supposed to know what is going on.

Another way to change duration slightly is to go to the **Resources** window, highlight the **media** folder, right click on an audio file, click on **Info**. Adjust the sample rate in the **Info** dialog to adjust the duration. This method also requires left clicking on the right boundary of the audio tracks and dragging left or right to correspond to the length changes.

21.8 Video screen captures

We explain here how to record video screen captures and edit them in Cinelerra.

First, you have to record the video with xvidcap. You can find that utility in most distributions' repositories, or download it here:
http://xvidcap.sourceforge.net

First, capture the screen:

```
xvidcap --fps 10 --cap_geometry 1280x1024+0+0 --file "file1.mpeg" --gui no --audio
no
```

Do not forget to change the geometry option according to your screen size. Then, convert the '`file1.mpeg`' file you obtained into an mpeg file suitable for Cinelerra:

```
ffmpeg -r 10 -i file1.mpeg -s 1280x1024 -b 3000 -aspect 1.33 -r 25 file2.mpeg
```

You can now load that file into Cinelerra. Make sure you properly set the video format of your project (size, frame-rate, aspect-ratio)

When you have finished editing your video, you have to render it. Render it as a jpeg-sequence. It is recommended to write the jpeg files in a new folder, since there probably will have a lot of files created.

Then, open a shell window, and cd into that folder. Encode the jpeg files using those commands:

First pass:

```
mencoder "mf://*.jpg" -mf fps=25 -oac pcm -sws 2 -vf scale=\
1280:1024,hqdn3d=2:1:2 -ovc lavc -lavcopts vcodec=mpeg4:\
vbitrate=800:aspect=4/3:vpass=1 -ofps 10 -of avi -o /dev/null \
-ffourcc DIVX
```

Second pass:

```
mencoder "mf://*.jpg" -mf fps=25 -oac pcm -sws 2 -vf \
scale=1280:1024,hqdn3d=2:1:2 -ovc lavc -lavcopts \
vcodec=mpeg4:vbitrate=800:aspect=4/3:vpass=2 -ofps 10 -of avi \
-o ../rendered_file.avi -ffourcc DIVX
```

You can also render the video to mpeg4 directly from Cinelerra if you wish to.

21.9 Improving performance

For the moment GNU/Linux is not an excellent desktop. It is more of a server. Most of what you will find on modern GNU/Linux distributions are faceless, network-only programs strategically designed to counteract one Microsoft server feature or another and not to perform very well at user interaction. There are a number of parameters on GNU/Linux, which ordinary people can adjust to make it behave more like a thoroughbred in desktop usage.

21.9.1 Disabling swap space

On systems with lots of memory, Cinelerra sometimes runs better without a swap space. If you have 4 GB of RAM, you are probably better off without a swap space. If you have 512MB of RAM, you should keep the swap. If you want to do recording, you should probably disable swap space in any case. There is a reason for this. GNU/Linux only allows half the available memory to be used. Beyond that, it starts searching for free pages to swap, in order to cache more disk access. In a 4 GB system, you start waiting for page swaps after using only 2 GB.

The question then is how to make GNU/Linux run without a swap space. Theoretically it should be a matter of running

```
swapoff -a
```

Unfortunately, without a swap space the kswapd tasklet normally spins at 100%. To eliminate this problem, edit '`linux/mm/vmscan.c`'. In this file, put a line saying `return 0;` before it says

```
/*
 * Kswapd main loop.
 */
```

Then recompile the kernel.

21.9.2 Enlarging sound buffers

In order to improve realtime performance, the audio buffers for all the GNU/Linux sound drivers were limited from 128k to 64k. For recording audio and video simultaneously and for most audio recording this causes dropouts. Application of low latency and preemptible kernel patches make it possible to record more audio recordings but it does not improve recording video with audio. This is where you need to hack the kernel.

To see if your sound buffers are suitable, run the included soundtest program with nothing playing or recording. This allocates the largest possible buffers and displays them. If the **Total bytes available** is under 131072, you need to see about getting the buffers enlarged in the driver. While many drivers differ, we have a hack for at least one driver.

This only applies to the OSS version of the Soundblaster Live driver. Since every sound card and every sound driver derivative has a different implementation you will need to do some searching for other sound cards. Edit '`linux/drivers/sound/emu10k1/audio.c`'

Where it says

```
if (bufsize >= 0x10000)
```

change it to:

```
if (bufsize > 0x40000)
```

Where it says

```
for (i = 0; i < 8; i++)
    for (j = 0; j < 4; j++)
```

change it to:

```
for (i = 0; i < 16; i++)
    for (j = 0; j < 4; j++)
```

In '`linux/drivers/sound/emu10k1/hwaccess.h`', change

```
#define MAXBUFSIZE 65536
```

to

```
#define MAXBUFSIZE 262144
```

Finally, in '`linux/drivers/sound/emu10k1/cardwi.h`', change

```
#define WAVEIN_MAXBUFSIZE         65536
```

to

```
#define WAVEIN_MAXBUFSIZE         262144
```

Then recompile the kernel modules.

21.9.3 Freeing more shared memory

The GNU/Linux kernel only allows 32MB of shared memory to be allocated by default. This needs to be increased to do anything useful. When launched, Cinelerra may remind you that with the following error message:

```
The following errors occurred:
void MWindow::init_shm0: WARNING:/proc/sys/kernel/shmmax is 0x2000000, which is too low.
Before running Cinelerra do the following as root:
echo "0x7ffffff">/proc/sys/kernel/shmmax
```

For a permanent change, add to the '/etc/sysctl.conf' file the following line:

```
kernel/shmmax=0x7fffffff
```

or if you prefer:

```
kernel.shmmax = 2147483647
```

For the first time, to avoid restarting your computer, use the following command as root:

```
sysctl -p
```

21.9.4 Speeding up the hard drive

This is a very popular command sequence among GNU/Linux gurus, which is not done by default on GNU/Linux distributions.

```
hdparm -c3 -d1 -u1 -k1 /dev/hda
```

- '-c3' puts the hard drive into 32 bit I/O with sync. This normally does not work due to inept kernel support for most IDE controllers. If you get lost interrupt or SeekComplete errors, quickly use '-c0' instead of '-c3' in your command.
- '-d1' enables DMA of course. This frees up the CPU partially during data transfers.
- '-u1' allows multiple interrupts to be handled during hard drive transactions. This frees up even more CPU time.
- '-k1' prevents GNU/Linux from resetting your settings in case of a glitch.

21.9.5 Disabling cron

GNU/Linux runs some daily operations like compressing man pages. These may be acceptable background tasks while compiling or word processing but not while playing video. Disable these operations by editing '/etc/rc.d/init.d/anacron'.

Put exit before the first line not beginning in #.

In '/etc/rc.d/init.d/crond' put exit before the first line not beginning in #. Then reboot.

You can not use the at command anymore, but who uses that command anyways?

21.9.6 Reducing USB mouse sensitivity

Gamers like high resolution mice, but this can be painful for precisely positioning the mouse on a timeline or video screen. XFree86 once allowed you to reduce PS/2 mouse sensitivity using commands like xset m 1 1 but you are out of luck with USB mice or KVM's.

We have a way to reduce USB mouse sensitivity but it requires editing the kernel source code. Even though USB mice have been supported for years, the kernel source code for

USB mice is constantly being rewritten. These instructions were relevant for 2.6.12.3. Edit '/usr/src/linux/drivers/input/mousedev.c'.

After the line saying

```
struct mousedev_hw_data {
```

put

```
#define DOWNSAMPLE_N 100
#define DOWNSAMPLE_D 350
int x_accum, y_accum;}
```

Next, the section which says something like:

```
switch (code) {
    case REL_X: mousedev->packet.dx += value; break;
    case REL_Y: mousedev->packet.dy -= value; break;
    case REL_WHEEL:     mousedev->packet.dz -= value; break;
}
```

must be replaced by

```
switch (code) {
    case REL_X:
    mousedev->packet.x_accum += value * DOWNSAMPLE_N;
    mousedev->packet.dx += (int)mousedev->packet.x_accum
    / (int)DOWNSAMPLE_D;
    mousedev->packet.x_accum -=
    ((int)mousedev->packet.x_accum / (int)DOWNSAMPLE_D)
    * (int)DOWNSAMPLE_D;
    break;
    case REL_Y:
    mousedev->packet.y_accum += value * DOWNSAMPLE_N;
    mousedev->packet.dy -= (int)mousedev->packet.y_accum
    / (int)DOWNSAMPLE_D;
    mousedev->packet.y_accum -=
    ((int)mousedev->packet.y_accum
    / (int)DOWNSAMPLE_D) * (int)DOWNSAMPLE_D;
    break;
    case REL_WHEEL: mousedev->packet.dz -= value; break;
}
```

Change the value of **DOWNSAMPLE_N** to change the mouse sensitivity.

21.9.7 Assorted X tweeks

XFree86 by default can not display Cinelerra's advanced pixmap rendering very fast. The X server stalls during list box drawing. Fix this by adding a line to your XF86Config* files.

In the **Section "Device"** area, add a line saying:

```
Option "XaaNoOffscreenPixmaps"
```

and restart the X server.

Screen blanking is really annoying, unless you are fabulously rich and can afford to leave your monitor on 24 hours a day without power saving mode. In '/etc/X11/xinit/xinitrc' put

```
xset s off
xset s noblank
```

before the first `if` statement.

How about those windows keys which no GNU/Linux distribution even thinks to use. You can make the window keys provide ALT functionality by editing '/etc/X11/Xmodmap'. Append the following to it.

```
keycode 115 = Hyper_L
keycode 116 = Hyper_R
add mod4 = Hyper_L
add mod5 = Hyper_R
```

The actual changes to a window manager to make it recognize window keys for ALT are complex. In **FVWM** at least, you can edit '/etc/X11/fvwm/system.fvwm2rc' and put

```
Mouse 0 T A move-and-raise-or-raiselower
#Mouse 0 W M move
Mouse 0 W 4 move
Mouse 0 W 5 move
Mouse 0 F A resize-or-raiselower
Mouse 0 S A resize-or-raiselower
```

in place of the default section for moving and resizing. Your best performance is going to be on FVWM. Other window managers seem to slow down video with extra event trapping and are not as efficient in layout.

21.9.8 Speeding up the file system

You will often store video on an expensive, gigantic disk array separate from your boot disk. You will thus have to manually install an EXT filesystem on this disk array, using the `mke2fs` command. By far the fastest file system is

```
mke2fs -i 65536 -b 4096 my_device
tune2fs -r0 -c10000 my_device
```

This has no journaling, reserves as few blocks as possible for filenames, and accesses the largest amount of data per block possible. A slightly slower file system, which is easier to recover after power failures is

```
mke2fs -j -i 65536 -b 4096 my_device
tune2fs -r0 -c10000 my_device
```

This adds a journal which slows down the writes but makes filesystem checks faster.

21.9.9 Improving Zoran video

Video recorded from the ZORAN inputs is normally unaligned or not completely encoded on the right. This can be slightly compensated by adjusting parameters in the driver sourcecode.

In '/usr/src/linux/drivers/media/video/zr36067.c' the structures defined near line 623 affect alignment. At least for NTSC, the 2.4.20 version of the driver could be improved by changing

```
    static struct tvnorm f60ccir601 = { 858, 720, 57, 788, 525, 480, 16 };
to
    static struct tvnorm f60ccir601 = { 858, 720, 57, 788, 525, 480, 17 };
```

In '/usr/src/linux/drivers/media/video/bt819.c' more structures near line 76 affect alignment and encoding.

For NTSC

```
    {858 - 24, 2, 523, 1, 0x00f8, 0x0000},
could be changed to
    {868 - 24, 2, 523, 1, 0x00f8, 0x0000},
```

Adjusting these parameters may or may not move your picture closer to the center. More of the time, they will cause the driver to lock up before capturing the first frame.

New in 2.6.5:
In the 2.6 kernels, the video subsystem was rewritten again from scratch. To adjust the Zoran parameters go to 'drivers/media/video/zoran_card.c' and look for a group of lines like

```
static struct tvnorm f50sqpixel = { 944, 768, 83, 880, 625, 576, 16 };
static struct tvnorm f60sqpixel = { 780, 640, 51, 716, 525, 480, 12 };
static struct tvnorm f50ccir601 = { 864, 720, 75, 804, 625, 576, 18 };
static struct tvnorm f60ccir601 = { 858, 720, 57, 788, 525, 480, 16 };

static struct tvnorm f50ccir601_lml33 = { 864, 720, 75+34, 804, 625, 576, 18 };
static struct tvnorm f60ccir601_lml33 = { 858, 720, 57+34, 788, 525, 480, 16 };

/* The DC10 (57/16/50) uses VActive as HSync, so HStart must be 0 */
static struct tvnorm f50sqpixel_dc10 = { 944, 768, 0, 880, 625, 576, 0 };
static struct tvnorm f60sqpixel_dc10 = { 780, 640, 0, 716, 525, 480, 12 };

/* FIXME: I cannot swap U and V in saa7114, so i do one
 * pixel left shift in zoran (75 -> 74)
 * (Maxim Yevtyushkin <max@linuxmedialabs.com>) */
static struct tvnorm f50ccir601_lm33r10 = { 864, 720, 74+54, 804, 625, 576, 18 };
static struct tvnorm f60ccir601_lm33r10 = { 858, 720, 56+54, 788, 525, 480, 16 };
```

These seem to control the image position. At least for the LML33 the following definition for **f60ccir601_lml33** does the trick.

```
static struct tvnorm f60ccir601_lml33 = { 858, 720, 67+34, 788, 525, 480, 13 };
```

21.10 Translating Cinelerra

This information is needed if you wish to partipate in translating Cinelerra. See Section 3.1 [Environment variables], page 19, for running Cinelerra in your own language.

21.10.1 Available localizations

There are some existing localizations for cinelerra:

- **DE** - German
- **ES** - Spanish
- **EU** - Basque
- **FR** - French
- **IT** - Italian
- **PT_BR** - Brazilian Portuguese
- **SL** - Slovenian

If your distribution has only UTF-8 support (like Ubuntu), you must create the language charset first. See Section 3.1 [Environment variables], page 19.

21.10.2 Updating an existing translation

To generate an updated '*.po' file with the newer strings of Cinelerra source code not yet present in the '.po' file, run after ./configure:

```
cd po && make
```

Then, edit the '.po' file located in 'po/' directory of your target language and submit the diff file to the Cinelerra-CV team.

21.10.3 Creating a new translation

To create a new translation, run after `./configure`:

```
cd po && make
```

Then, edit the '`cinelerra.pot`' file located in '`po/`' and add the appropriate translated strings. Rename the file to '`(lang_prefix).po`' and add the language prefix to '`po/LINGUAS`'. Finally, submit the diff file to the cinelerra-CV team.

21.11 Panning and zooming still images

Cinelerra's powerful keyframe features allow you to use pan and zoom effects on still pictures.

1. Load and create a clip from a still image as described above. Make the clip 10 seconds long.
2. Activate the **automatic generation of keyframes**
3. Using the **transport controls**, go to the beginning of the clip
4. Using the **compositing camera control** set the clip's initial position
5. Using the **transport controls**, move forward a couple of seconds on the clip
6. Dragging on the **compositing camera** move the camera center to a new position further
7. Now, rewind to the beginning of the clip and play it.

You can see that the camera smoothly flows from keyframe point to next keyframe point, as Cinelerra automatically adjusts the camera movement in straight lines from point to point.

21.12 HDV 1080i editing using proxy files

Working with high definition video, which typically comes from HDV camcorders, requires a lot of processing power. Even if the system is able to play a single track at full framerate, it is usually not able to play several tracks simultaneously. Thus simple dissolve transition is slowed down to unacceptable level. Moreover, HDV is in GOP based format, and simple cut requires decoding the whole GOP in less then 1/25s. Thus, one of the possibilities is to perform all edits on low resolution files, and use HDV material only for the final rendering. The workflow presented below was first proposed by Hermann Vosseler.

21.12.1 Overview

- For each HDV file a proxy is created with a scale of 0.5.
- The project is created with HDV resolution e.g. 1440x1080 and 16/9 aspect.
- New resources are created with both proxies as well as HDV files.
- Each video track must have Camera Automation set to 2.0.
- Editing is performed with the proxy files.
- For HDV rendering, exit Cinelerra and convert the project file with proxychange.py and reopen the project.
- After rendering, if further editing is required, the project file can be back-transformed into a proxy version.

21.12.2 Grabbing HDV from camcorder

There is no perfect solution so far. One possibility is to run the `test-mpeg2` command available with the sources of **libiec61883**. Use this syntax:

```
test-mpeg2 > hdv_tape.mpeg
```

and press **Play** on the camcorder. You should not run any heavy ressources consuming task on your computer since the lack of caching in test-mpeg2 causes framedrops.

New version of dvgrab seems to support HDV. Minimal example:
Syntax:

```
dvgrab -format mpeg2 myclip
```

21.12.3 Using TOC and WAV files

Try using WAV files for sound, and load HDV MPEG-2 files via their generated toc. To create toc files, use the following command:

```
for i in *.mpeg; do mpeg3toc $i ‘basename $i mpeg‘toc; done
```

21.12.4 Making the proxy files

Proxy files can be converted in many ways and can use any format. However, Cinelerra works better when editing non-GOP based formats. To convert your HDV files into I-frame based mjpeg files with 50% scaling, use the following command:

```
for i in *.mpeg;do mencoder -mc 0 -noskip $i -ovc lavc -lavcopts vcodec=mjpeg -vf
scale=720:540 -oac pcm -o ‘basename $i mpeg‘avi; done
```

21.12.5 Converting HDV and proxy files

The **proxychange.py** python script converts HDV to/from proxies. You can download that script here:
`http://cvs.cinelerra.org/docs/proxychange.py`

It overwrites the existing project files, and creates copy of the original in ‘`projectfile.xml.bak`’.

- Proxy -> HDV (e.g. for rendering):
  ```
  ./proxychange.py projectfile.xml -from ‘proxyfiles/(\w+)\.avi‘ -to
  ‘hdv/\1.toc‘ -scale 0.5
  ```
- HDV -> Proxy (e.g. after rendering if you want go back to editing):
  ```
  ./proxychange.py projectfile.xml -from ‘hdv/(\w+)\.toc‘ -to
  ‘proxyfiles/\1.avi‘ -scale 2.0
  ```

The project XML file is not a perfectly valid XML file. Thus after each Cinelerra "Save", some problem can occur. Sometimes the tags are not closed, <TAG> is not followed by </TAG>. This must be corrected manually.

ACODEC contains some \001 characters. Edit the file manually or use the following command:

```
cat temp001.xml| tr -d ‘\001‘ > /tmp/1 ; mv /tmp/1 temp001.xml
```

Update: Recent version of Cinelerra seems to produce valid XML.

21.12.6 Rendering the HDV project

HDV files can be rendered to an YUV4MPEG stream and then encoded to MPEG2 using a modified Mjpegtools binary. `mpeg2enc -verbose 0 -aspect 3 -format 3 -frame-rate 3 -video-bitrate 25000 -nonvideo-bitrate 384 -force-b-b-p -video-buffer 448 -video-norm n -keep-hf -no-constraints -sequence-header-every-gop -min-gop-size 6 -max-gop-size 6 -o %`

Render the sound as an AC3 file, and multiplex both the video and the audio with mplex.

21.12.7 Other issues

When playing MJPEG files, the dissolve transistion does not work properly in RGBA or YUVA modes but it works fine in RGB or YUV.

21.13 Adding subtitles

There are two methods available for adding subtitles in a video:

- Use Cinelerra’s Titler effect. That task is long and fastidious. Moreover, the subtitles are actually incrusted into the image. It is not be possible to display the rendered video without subtitles. If you want your video to be available with subtitles in several languages, you have to render it several times. See Section 14.4.54 [Title], page 117, for information about Cinelerra's titler.

- Add the subtitles with a subtitles editor after having rendered the video.

The second method is the one to use if you want your video to be available with subtitles in multiple languages. If you want to produce a DVD, that method is also the only one which is compatible with dvdauthor subtitles feature. If you plan to distribute your video over the internet, one video file and several subtitles files is smaller than several video files, one for each language.

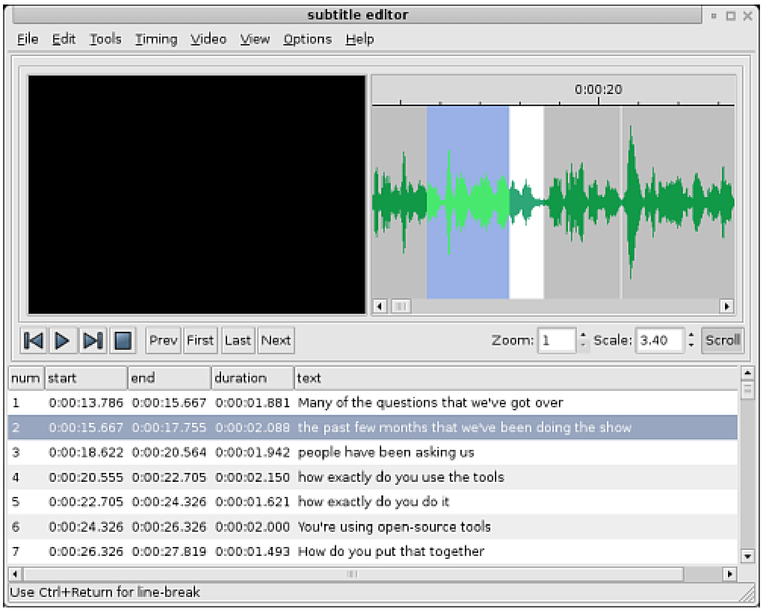
Subtitles text files can be displayed by any decent video player. With mplayer one can use the following syntax:

```
mplayer -sub <the_subtitles_text_file> <the_video_file>
```

A subtitle file is a simple plain text file, which contains the text and the time or frame number where each subtitle should be displayed on the screen.

There are a lot of subtitles editor available on Linux. However, most of them are fine for easing **translation** of subtitles, but are not appropriate to actually **add** and **synchronize** new subtitles on a video. Since video creation is what most of us focus on, the task we are mostly interested in is **creating** subtitles for a video.

We highly recommend you **Subtitleeditor**, which is available here:
http://kitone.free.fr/subtitleeditor


subtitle editor
File Edit Tools Timing Video View Options Help
0:00:20
Prev First Last Next
Zoom: 1 Scale: 3.40 Scroll

num	start	end	duration	text
1	0:00:13.786	0:00:15.667	0:00:01.881	Many of the questions that we've got over
2	0:00:15.667	0:00:17.755	0:00:02.088	the past few months that we've been doing the show
3	0:00:18.622	0:00:20.564	0:00:01.942	people have been asking us
4	0:00:20.555	0:00:22.705	0:00:02.150	how exactly do you use the tools
5	0:00:22.705	0:00:24.326	0:00:01.621	how exactly do you do it
6	0:00:24.326	0:00:26.326	0:00:02.000	You're using open-source tools
7	0:00:26.326	0:00:27.819	0:00:01.493	How do you put that together

Use Ctrl+Return for line-break

Subtitleeditor

Subtitleeditor has the huge advantage of displaying the audio waveform. This feature is really important to precisely synchronize subtitles and talks. Keep in mind the synchronization would be lost if you edit your video after having added the subtitles. Adding subtitles should be done after the video edition is finished.

Once the subtitle text file is created, you can:

- Distribute it with your video. People will have to load the appropriate subtitle file in their video player to actually see the subtitles.
- Use it with dvdauthor, to add the subtitles in a DVD. Read dvdauthor's documentation for more information.
- Incrust the subtitles into the video using mencoder. This command line is an example. Adapt the options to your needs:

```
mencoder -sub <your_subtitle_file> <video_file_without_subtitles> -ovc lavc
-lavcopts vcodec=mpeg4:vhq:vbitrate=1000 -oac mp3lame -lameopts br=256:vol=1
-ffourcc DIVX -o <converted_video.avi>
```

21.14 Creating DVD video from Lower Quality Footage

This section is for those who want to create PAL or NTSC DVD-format videos, using lower quality source footage such as that sourced on the net, or from cheap cameras such as SD-cams.

Typically, SD cameras produce progressive footage at framerates of 10-30fps at frame sizes like 640x480. Footage sourced online can have framerates as slow as 8fps and frame sizes as small as 320x240.

This section outlines a recipe for making the most of this limited quality footage, and minimising any further quality losses.
The steps we will follow are:

1. Up-sample the frame size
2. Convert to yuv4mpeg format
3. Up-sample the framerate with motion interpolation
4. Import into Cinelerra without loss
5. Interlace appropriately before DVD export

This technique requires that you have ffmpeg, mjpegtools and yuvmotionfps installed. You will likely already have ffmpeg and mjpegtools installed on your system. If not, you can get them from your distro feeds. But will need to get yourself a copy of yuvmotionfps from: `http://jcornet.free.fr/linux/yuvmotionfps.html`. yuvmotionfps is a great "poor man's" free/opensource equivalent of the 'Twixtor' plugin on Adobe Premiere.

We will perform steps 1-3 with 2 shell commands, and create temporary .yuv and .wav files ready to import into Cinelerra. Note too that we're assuming you want to create a PAL-DVD project, which is 25fps interlaced, 720x576 framesize. Convert these figures below to the NTSC framerate and framesize if you are creating an NTSC-DVD project.

Assume you have your source footage in the file '`myfootage.avi`'

The shell command to separate out the audio is:

```
ffmpeg -i myfootage.avi -f wav myfootage.wav
```

The shell command to separate out the video, upsample the framesize and framerate is:

```
ffmpeg -i myfootage.avi -s 720x576 -f yuv4mpegpipe -vcodec pgmyuv - | yuvmotionfps
-r 50:1 > myfootage.yuv
```

After executing both these commands, you should have separated audio and video files ready for Cinelerra.

Now, make sure that in your Cinelerra project options, you have set the framerate to 50fps. This is crucial, otherwise you will get a quality loss and jerky motion after rendering. (The sad thing is that this quality loss may not even show until you have mastered your DVD and are playing it to others - embarrassing). But with your project framerate at 50fps, you should be able to avoid this.

Now, import your new separated and converted video and audio files into Cinelerra. Apply effects as needed, such as colour corrections, zooms etc. Step through the frames, and verify that you see motion change with every frame. If you've got this, then you're on track.

Now, when you're ready to render, add one last effect to your video, and make sure this effect sits at the bottom of your effect stack. Select the entire duration of your video, and add the **Fields to frames** effect. Your footage is sitting within Cinelerra as 50fps progressive, and this effect will correctly convert it to 25fps interlaced. I'd suggest setting **Bottom fields first** initially, and changing this later if it doesn't play properly on your DVD player.

To render, I'd suggest you use the recipe on the Crazed Mule Productions website: `http://crazedmuleproductions.blogspot.com/2007/06/beginners-guide-to-exporting-video-from.ht` But, contrary to this recipe, leave in the `-ilme -ildct` options. Depending on your ffmpeg version, you may need to change this to `-flags +ilme+ildct`

After this, you should end up with video that plays on a wide variety of consumer DVD players with good, flicker-free motion.

Tweaking

Here are some ideas for tweaks, in case you're getting less than perfect results:

- When initially separating audio/video with the ffmpeg command, cut out the frame size upsampling - remove the `-s 720x576` option - perform the size upsampling within Cinelerra using the camera/projector settings.
- In the final **Fields to frames** effect, switch between **Top fields first** and **Bottom fields first**
- Disable the **Fields to frames** effect in Cinelerra, and delay the reinterlacing to the render stage. Get the alternative version of yuvdeinterlace from `http://silicontrip.net/~mark/lavtools/`, and when rendering, put: `yuvdeinterlace -i -t |` before the `ffmpeg...` part of the yuv4mpegpipe shell command
- If the motion looks weird, try different settings in the yuvmotionfps command - do `yuvmotionfps -h` and look at the various options.

Warning

Before you release your DVD to anyone important, make sure to try it on as many consumer DVD appliances and TVs as possible. You don't want to release a DVD into the wild - for sale etc - and have it look like crap on your customer's TV. Even if it looks good on your DVD player and TV, and those of your friends, there could be some appliances out there that handle it badly.

Conclusion

With a small amount of experimentation, you should be able to import lower-quality video into Cinelerra, process it and render out to DVD-quality video and end up with the best overall quality that will look as good as possible on the greatest possible range of DVD players and TVs. Good luck!

22 Troubleshooting

22.1 Reporting bugs

When you notice a bug, the first thing to do is to go to http://bugs.cinelerra.org and check if it has not been already reported. If there is no bug report for the bug you noticed, you can file a bug report. Open an account on http://bugs.cinelerra.org if you do not have one. Then, file the bug report, including the following information:

- Revision number of Cinelerra CV. Example: r959
- Distribution name and version. Example: Debian SID
- Steps to replicate the bug. That is very important since it really helps people trying to fix bugs. Example:
  1. launch cinelerra
  2. open the recording window
  3. click on OK
  4. Cinelerra crashes
- When Cinelerra CV crashes, a debugger output is welcome. Run:
  `gdb cinelerra`
  `run`
  (You trigger the bug and Cinelerra CV crashes)
  `thread apply all bt`
  Then copy all of the information displayed into your bug report.

Do not hesitate to attach any file which you think could be useful, such as a screenshot for example. The gdb output is more useful when Cinelerra is compiled with debugging symbols. See Section 2.3.2 [Compiling with debugging symbols], page 8, for compilation instructions.

Moreover, if the bug you noticed concerns a problem loading a specific file into Cinelerra-CV, uploading a small sample of such a file on the internet is appreciated. That would allow people fixing bugs to load that file themselves in Cinelerra and look at what happens.

22.2 Playback does not stop

If playback of audio tracks doesn't stop on the timeline and keeps going after the end of the video, go to **Settings -> Preferences -> Playback** and click on the **Stop playback locks up** checkbox. This checkbox is shown only if you set ALSA as audio driver.

22.3 Buz driver crashes

First, Zoran capture boards must be accessed using the **Buz** video driver in **Preferences->Recording** and **Preferences->Playback**. Some performance tweeks are available in another section. See Section 21.9 [Improving performance], page 159.

Once tweeked, the Buz driver seems to crash if the number of recording buffers is too high. Make sure **Preferences->Recording->Frames to buffer in device** is below 10.

22.4 Dragging edit boundaries does not work

Sometimes there will be two edits really close together. The edit boundary selected for dragging may be next to the indended edit if those edits are too small to see at the current zoom level. Zoom in horizontally.

If you think you can't drag all the edits starting at the same point on armed tracks, zoom in horizontally to check if they really start at the same point. Sometime vertical sychronization of edits can be lost just because you did not set properly project attributes (e.g. PAL/NTSC). Check **Settings -> Format**.

22.5 Locking up when loading files

The most common reason loading files locks up Cinelerra is because the codec is not supported. Another reason is because Cinelerra is building picons for the Resources window. If you load a large number of images, it needs to decompress every single image to build a picon. Go into **settings->preferences->interface** and disable **Use thumbnails in resource window** to skip this process.

22.6 Synchronization lost while recording

If the rate at which frames are captured during recording is much lower than the framerate of the source, the video will accumulate in the recording buffers over time and the audio and video will become well out of sync. Decrease the **number of frames to buffer in the device** in **preferences->recording** so the excess frames are dropped instead of buffered.

22.7 Applying gamma followed by blur does not work

The gamma effect uses the pow function while the blur effect uses a number of exp functions in the math library. For some reason, using the pow function breaks later calls to the exp functions in the math library. You need to apply gamma after blur to get it to work.

22.8 Copy/Paste of track selections does not work in the timeline

If you are running the KDE Klipper application, either disable it, or right-click its taskbar icon, select **Configure Klipper** and ensure **Prevent empty clipboard** is not selected.

22.9 Cinelerra often crashes

Do a clean install. Be sure that you do not have libraries from previous installations. Delete your '`$HOME/.bcast/`' directory too.

```
rm -f /usr/local/lib/libguicast*
rm -f /usr/lib/libguicast*
rm -f /usr/local/lib/libquicktimehv*
rm -f /usr/lib/libquicktimehv*
rm -f /usr/local/lib/libmpeg3hv*
rm -f /usr/lib/libmpeg3hv*
```

22.10 Theme Blond not found error

If the following error message appears: `Aborted, MWindow::init_theme: Theme Blond not found`, then:

- You should check for the file '`defaulttheme.*`' in '`/usr/lib/cinelerra`' or '`/usr/local/lib/cinelerra`'. If it does not exist, you need to install the plugins again.
- Try to delete the '`$HOME/.bcast/`' directory
- Look into '`$HOME/.bcast/Cinelerra_rc`' and find THEME, it should be => THEME Blond

23 Plugin authoring

The plugin API in Cinelerra dates back to 1997, before the LADSPA and before VST became popular. It is fundamentally the same as it was in 1997, with minor modifications to handle keyframes and GUI feedback. The GUI is not abstracted from the programmer. This allows the programmer to use whatever toolkit they want and allows more flexibility in appearance but it costs more.

There are several types of plugins, each with a common procedure of implementation and specific changes for that particular type. The easiest way to implement a plugin is to take the simplest existing one out of the group and rename the symbols.

23.1 Introducing the pull method

Originally plugins were designed with the push method. The push method is intuitive and simple. A source pushes data to a plugin, the plugin does math operations on it, and the plugin pushes it to a destination. For 6 years this was the way all realtime plugins were driven internally but it did not allow you to reduce the rate of playback in realtime. While plugins can still be designed as if they are pushing data, this is not the way they are processed internally anymore.

The latest evolution in Cinelerra's plugin design is the pull method. The rendering pipeline starts at the final output and the final steps in the rendering pipeline are reading the data from disk. Every step in the rendering chain involves requesting data from the previous step. When the rendering pipleline eventually requests data from a plugin chain, each plugin requests data from the plugin before it.

This is less intuitive than the push method but is much more powerful. Realtime plugins written using the pull method can not only change the rate data is presented to the viewer but also the direction of playback. The pull method also allows plugins to take in data at a higher rate than they send it out.

To get the power of rate independence, the pull method requires plugins to know more about the data than they needed to under the push method. Plugins need to know what rate the project is at, what rate their output is supposed to be at and what rate their input is supposed to be at. These different data rates have to be correlated for a plugin to configure itself properly.

Keyframes for a plugin are stored relative to the project frame rate. Queries from a plugin for the current playback position are given relative to the project frame rate. If the plugin's output was requested to be at twice the project frame rate, the positions need to be converted to the project rate for keyframes to match up. Two classes of data rates were created to handle this problem.

Rate conversions are done in terms of the **project rate** and the **requested rate**. The project rate is identical for all plugins. It is determined by the **settings->format** window. The requested rate is determined by the downstream plugin requesting data from the current plugin. The requested rate is arbitrary. Exactly how to use these rates is described below.

23.2 Common plugin functions

All plugins inherit from a derivative of PluginClient. This PluginClient derivative implements most of the required methods in PluginClient, but users must still define methods for PluginClient. The most commonly used methods are predefined in macros to reduce the typing yet still allow flexibility.

The files they include depend on the plugin type. Audio plugins include '`pluginaclient.h`' and video plugins include '`pluginvclient.h`'. They inherit **PluginAClient** and **PluginVClient** respectively.

Cinelerra instantiates all plugins at least twice when they are used in a movie. One instance is the GUI. The other instance is the signal processor. User input, through a complicated sequence, is propogated from the GUI instance to the signal processor instance. If the signal processor wants to alter the GUI, it propogates data back to the GUI instance. There are utility functions for doing all this.

All plugins define at least three objects:

- **Processing object**
  Contains pointers to all the other objects and performs the signal processing. This object contains a number of queries to identify itself and is the object you register to register the plugin.
- **User interface object**
  This is defined according to the programmer's discretion. It can either use Cinelerra's toolkit or another toolkit. It shows data on the screen and collects parameters from the user.
  Using Cinelerra's toolkit, the only user interface object a developer needs to worry about is the Window. The window has pointers to a number of widgets, a few initialization methods, and a back pointer to the plugin's processing object. The documentation refers to the usage of Cinelerra's toolkit.
  Depending on the user interface toolkit, a user interface thread may be created to run the user interface asynchronous of everything else. Synchronizing the user interface to changes in the plugin's configuration is the most complicated aspect of the plugin, so the user interface thread and object are heavily supported by macros if you use Cinelerra's toolkit.
- **Configuration object**
  This stores the user parameters and always needs interpolation, copying, and comparison functions. Macros for the plugin client automatically call configuration methods to interpolate keyframes.

23.2.1 The processing object

Load up a simple plugin like gain to see what this object looks like. The processing object should inherit from the intended PluginClient derivative. Its constructor should take a PluginServer argument.

```
MyPlugin(PluginServer *server);
```

In the implementation, the plugin must contain a registration line with the name of the processing object like

```
REGISTER_PLUGIN(MyPlugin)
```

The constructor should contain

```
PLUGIN_CONSTRUCTOR_MACRO
```

to initialize the most common variables.

The processing object should have a destructor containing

```
PLUGIN_DESTRUCTOR_MACRO
```

to delete the most common variables.

Another function which is useful but not mandatory is

```
int is_multichannel();
```

It should return 1 if one instance of the plugin handles multiple tracks simultaneously or 0 if one instance of the plugin only handles one track. The default is 0 if it is omitted.

Multichannel plugins in their processing function should refer to a function called **PluginClient::get_total_buffers()** to determine the number of channels.

To simplify the implementation of realtime plugins, a macro for commonly used members has been created for the class header, taking the configuration object and user interface thread object as arguments. The macro definitions apply mainly to realtime plugins and are not useful in nonrealtime plugins. Fortunately, nonrealtime plugins are simpler.

```
PLUGIN_CLASS_MEMBERS(config_name, thread_name)
```

The commonly used members in PLUGIN_CLASS_MEMBERS are described below.

int load_configuration();
Loads the configuration based on surrounding keyframes and current position.
The class definition for load_configuration should contain

```
LOAD_CONFIGURATION_MACRO(plugin_class, config_class)
```

to implement the default behavior for load_configuration. This stores whatever the current configuration is inside the plugin's configuration object and returns 1 if the new configuration differs from the previous configuration. The return value of load_configuration is used by another commonly used function, update_gui to determine if the GUI really needs to be updated.
The plugin's configuration object is always called **config** inside PLUGIN_CLASS_MEMBERS.

VFrame* new_picon();
Creates a picon for display in the resource window. Use

```
#include "picon_png.h"
NEW_PICON_MACRO(plugin_class)
```

to implement new_picon. In addition, the user should create a '`picon_png.h`' header file from a PNG image using `pngtoh`. `pngtoh` is compiled in the '`guicast/ARCH`' directory.
The source PNG image should be called '`picon.png`' and can be any format supported by PNG.

char* plugin_title();
Returns a text string identifying the plugin in the resource window. The string has to be unique.

void update_gui();
Should first load the configuration, test for a return of 1, and then redraw the GUI with the new parameters. All the plugins using GuiCast have a format like

```
void MyPlugin::update_gui()
{
    if(thread)
    {
    if(load_configuration())
    {
        thread->window->lock_window();
        // update widgets here
        thread->window->unlock_window();
    }
    }
}
```

to handle concurrency and conditions of no GUI.

int show_gui();
Instantiate the GUI and switch the plugin to GUI mode. This is implemented with

```
SHOW_GUI_MACRO(plugin_class, thread_class)
```

int set_string();
Changes the title of the GUI window to a certain string. This is implemented with

```
SET_STRING_MACRO(plugin_class)
```

void raise_window();
Raises the GUI window to the top of the stack. This is implemented with

```
RAISE_WINDOW_MACRO(plugin_class)
```

Important functions that the processing object must define are the functions which load and save configuration data from keyframes. These functions are called by the macros so all you need to worry about is accessing the keyframe data.

```
void save_data(KeyFrame *keyframe);
void read_data(KeyFrame *keyframe);
```

The read data functions are only used in realtime plugins. The read data functions translate the plugin configuration between the KeyFrame argument and the configuration object for the plugin. The keyframes are stored on the timeline and can change for every project.

Use an object called **FileXML** to do the translation and some specific commands to get the data out of the KeyFrame argument. See any existing plugin to see the usage of KeyFrame and FileXML.

```
int load_defaults();
int save_defaults();
```

The load defaults functions are used in realtime and non-realtime plugins. The load defaults functions translate the plugin configuration between a BC_Hash object and the plugin's configuration. The BC_Hash object stores configurations in a discrete file on disk for each plugin but does not isolate different configurations for different projects.

The function overriding **load_defaults** also needs to create the BC_Hash object. See any existing plugin to see the usage of BC_Hash.

Other standard members may be defined in the processing object, depending on the plugin type.

23.2.2 The configuration object

The configuration object is critical for GUI updates, signal processing, and default settings in realtime plugins. Be aware it is not used in nonrealtime plugins. The configuration object inherits from nothing and has no dependancies. It is merely a class containing three functions and variables specific to the plugin's parameters.

Usually the configuration object starts with the name of the plugin followed by Config.

```
class MyPluginConfig
{
public:
    MyPluginConfig();
```

Following the name of the configuration class, we put in three required functions and the configuration variables.

```
    int equivalent(MyPluginConfig &that);
    void copy_from(MyPluginConfig &that);
    void interpolate(MyPluginConfig &prev,
    MyPluginConfig &next,
    int64_t prev_position,
    int64_t next_position,
    int64_t current_position);
    float parameter1;
    float parameter2;
    int parameter3;
};
```

Now you must define the three functions. **Equivalent** is called by LOAD_CONFIGURATION_MACRO to determine if the local configuration parameters are identical to the configuration parameters in the arguement. If equivalent returns 0, the

LOAD_CONFIGURATION_MACRO causes the GUI to redraw. If equivalent returns 1, the LOAD_CONFIGURATION_MACRO does not redraw the GUI.

Then there is **copy_from** which transfers the configuration values from the argument to the local variables. This is once again used in LOAD_CONFIGURATION_MACRO to store configurations in temporaries. Once LOAD_CONFIGURATION_MACRO has replicated the configuration, it loads a second configuration. Then it interpolates the two configurations to get the current configuration. The interpolation function performs the interpolation and stores the result in the local variables.

Normally the interpolate function calculates a previous and next fraction, using the arguments.

```
void MyPluginConfig::interpolate(MyPluginConfig &prev,
    MyPluginConfig &next,
    int64_t prev_position,
    int64_t next_position,
    int64_t current_position
{
    double next_scale =
    (double)(current_position - prev_position)
    / (next_position - prev_position);
    double prev_scale =
    (double)(next_position - current_position) /
    (next_position - prev_position);
```

Then the fractions are applied to the previous and next configuration variables to yield the current values.

```
    this->parameter1 =
    (float)(prev.parameter1 * prev_scale
    + next.parameter1 * next_scale);
    this->parameter2 =
    (float)(prev.parameter2 * prev_scale
    + next.parameter2 * next_scale);
    this->parameter3 =
    (int)(prev.parameter3 * prev_scale
    + next.parameter3 * next_scale);
}
```

Alternatively you can copy the values from the previous configuration argument if no interpolation is desired.

This usage of the configuration object is the same in audio and video plugins. In video playback, the interpolation function is called for every frame, yielding smooth interpolation. In audio playback, the interpolation function is called only once for every console fragment and once every time the insertion point moves. This is good enough for updating the GUI while selecting regions on the timeline but it may not be accurate enough for really smooth rendering of the effect.

For really smooth rendering of audio, you can still use load_configuration when updating the GUI. For process_buffer; however, ignore load_configuration and write your own interpolation routine which loads all the keyframes in a console fragment and interpolates every sample. This would be really slow and hard to debug, yielding improvement which may not be audible. Then of course, every country has its own wierdos.

An easier way to get smoother interpolation is to reduce the console fragment to 1 sample. This would have to be rendered and played back with the console fragment back over 2048 of course. The GNU/Linux sound drivers can not play fragments of 1 sample.

23.2.3 The user interface object

The user interface object at the very least consists of a pointer to a window and pointers to all the widgets in the window. Using Cinelerra's toolkit, it consists of a **BCWindow** derivative and a **Thread** derivative. The Thread derivative is declared in the plugin header using

```
PLUGIN_THREAD_HEADER(plugin_class, thread_class, window_class)
```

Then it is defined using

```
PLUGIN_THREAD_OBJECT(plugin_class, thread_class, window_class)
```

This, in combination with the SHOW_GUI macro does all the work in instantiating the Window. This two-class system is used in realtime plugins but not in nonrealtime plugins. Nonrealtime plugins create and destroy their GUI in their **get_parameters** function and there is no need for a Thread.

Now the window class must be declared in the plugin header. It is easiest to implement the window by copying an existing plugin and renaming the symbols. The following is an outline of what happens. The plugin header must declare the window's constructor using the appropriate arguments.

```
#include "guicast.h"
class MyPluginWindow : public BC_Window
{
public:
    MyPluginWindow(MyPluginMain *plugin, int x, int y);
```

This becomes a window on the screen, positioned at x and y.

It needs two methods

```
int create_objects();
int close_event();
```

and a back pointer to the plugin

```
MyPlugin *plugin;
```

The constructor's definition should contain extents and flags causing the window to be hidden when first created. The create_objects member puts widgets in the window according to GuiCast's syntax. A pointer to each widget which you want to synchronize to a configuration parameter is stored in the window class. These are updated in the **update_gui** function you earlier defined for the plugin. The widgets are usually derivatives of a GuiCast widget and they override functions in GuiCast to handle events. Finally create_objects calls

```
show_window();
flush();
```

to make the window appear all at once.

The close_event member should be implemented using

```
WINDOW_CLOSE_EVENT(window_class)
```

Every widget in the GUI needs to detect when its value changes. In GuiCast the **handle_event** method is called whenever the value changes. In **handle_event**, the widget then needs to call **plugin->send_configure_change()** to propogate the change to any copies of the plugin which are processing data.

23.3 Realtime plugins

Realtime plugins should use PLUGIN_CLASS_MEMBERS to define the basic set of members in their headers. All realtime plugins must define an **int is_realtime()**

member returning 1. This causes a number of methods to be called during live playback and the plugin to be usable on the timeline.

Realtime plugins must override a member called **process_buffer**

This function takes different arguments depending on if the plugin handles video or audio. See an existing plugin to find out which usage applies.

The main features of the process_buffer function are a buffer to store the output, the starting position of the output, and the requested output rate. For audio, there is also a size argument for the number of samples.

The starting position of the output buffer is the lowest numbered sample on the timeline if playback is forward and the highest numbered sample on the timeline if playback is reverse. The direction of playback is determined by one of the plugin queries described below.

The position and size arguments are all relative to the frame rate and sample rate passed to process_buffer. This is the requested data rate and may not be the same as the project data rate.

The process_realtime function should start by calling **load_configuration**. The LOAD_CONFIGURATION_MACRO returns 1 if the configuration changed.

After determining the plugin's configuration, input media has to be loaded for processing. Call:

```
    read_frame(VFrame *buffer,
        int channel,
        int64_t start_position,
        double frame_rate)
or
    read_samples(double *buffer,
        int channel,
        int sample_rate,
        int64_t start_position,
        int64_t len)
```

to request input data from the object which comes before this plugin. The read function needs a buffer to store the input data in. This can either be a temporary you create in the plugin or the output buffer supplied to process_buffer if you do not need a temporary.

It also needs a set of position arguments to determine when you want to read the data from. The start position, rate, and len passed to a read function need not be the same as the values recieved by the process_buffer function. This way plugins can read data at a different rate than they output data.

The channel argument is only meaningful if this is a multichannel plugin. They need to read data for each track in the get_total_buffers() value and process all the tracks. Single channel plugins should pass 0 for channel.

Additional members are implemented to maintain configuration in realtime plugins. Some of these are also needed in nonrealtime plugins.

- **void read_data(KeyFrame *keyframe);**
  Loads data from a keyframe into the plugin's configuration. Inside the keyframe is an XML string. It is most easily parsed by creating a **FileXML** object. See an existing plugin to see how the read_data function is implemented.
  Read data loads data out of the XML object and stores values in the plugin's configuration object. Since configuration objects vary from plugin to plugin, these functions can not be automated.
- **void save_data(KeyFrame *keyframe);**
  Saves data from the plugin's configuration to a keyframe. Inside the keyframe you will put an XML string which is normally created by a FileXML object. See an existing plugin to

see how the save_data function is implemented.
Save data saves data from the plugin's configuration object into the XML object.

- **int load_defaults();**
Another way the plugin gets parameters is from a defaults file. The load and save defaults routines use a BC_Hash object to parse the defaults file. The defaults object is created in **load_defaults** and destroyed in the plugin's destructor. See an existing plugin to see how the BC_Hash object is used.
- **int save_defaults();**
Saves the configuration in the defaults object.

23.4 Nonrealtime plugins

Some references for non-realtime plugins are **Normalize** for audio and **Reframe** for video.

Like realtime plugins, **load_defaults** and **save_defaults** must be implemented. In nonrealtime plugins, these are not just used for default parameters but to transfer values from the user interface to the signal processor. There does not need to be a configuration class in nonrealtime plugins.

Unlike realtime plugins, the LOAD_CONFIGURATION_MACRO can not be used in the plugin header. Instead, the following methods must be defined.

The nonrealtime plugin should contain a pointer to a defaults object.

```
BC_Hash *defaults;
```

It should also have a pointer to a MainProgressBar.

```
MainProgressBar *progress;
```

The progress pointer allows nonrealtime plugins to display their progress in Cinelerra's main window.

The constructor for a nonrealtime plugin cannot use PLUGIN_CONSTRUCTOR_MACRO but must call **load_defaults** directly.

The destructor, likewise, must call **save_defaults** and **delete defaults** directly instead of PLUGIN_DESTRUCTOR_MACRO.

- **VFrame* new_picon();**
char* plugin_title();
The usage of these is the same as realtime plugins.
- **int is_realtime();**
This function must return 0 to indicate a nonrealtime plugin.
- **int get_parameters();**
Here, the user should create a GUI, wait for the user to hit an OK button or a cancel button, and store the parameters in plugin variables. This routine must return 0 for success and 1 for failure. This way the user can cancel the effect from the GUI.
Unlike the realtime plugin, this GUI need not run asynchronously of the plugin. It should block the get_parameters function until the user selects OK or Cancel.
- **int load_defaults();**
This should create a defaults object and load parameters from the defaults object into plugin variables.
- **int save_defaults();**
This should save plugin variables to the defaults object.
- **int start_loop();**
If **get_parameters** returned 0 for success, this is called once to give the plugin a chance to initialize processing. The plugin should instantiate the progress object with a line like

```
progress = start_progress("MyPlugin progress...",
PluginClient::get_total_len());
```

The usage of **start_progress** depends on whether the plugin is multichannel or single channel. If it is multichannel you always call start_progress. If it is single channel, you first need to know whether the progress bar has already started in another instance of the plugin.
If **PluginClient::interactive** is 1, you need to start the progress bar. If it is 0, the progress bar has already been started.
The PluginClient defines **get_total_len()** and **get_source_start()** to describe the timeline range to be processed. The units are either samples or frames and in the project rate.

- **int process_loop**
  This is called repeatedly until the timeline range is processed. It has either a samples or frames buffer for output and a reference to write_length to store the number of samples processed. If this is an audio plugin, the user needs to call **get_buffer_size()** to know how many samples the output buffer can hold.
  The plugin must use **read_samples** or **read_frame** to read the input. These functions are a bit different for a non realtime plugin than they are for a realtime plugin.
  They take a buffer and a position relative to the start of the timeline, in the timeline's rate. Then you must process it and put the output in the buffer argument to process_loop. write_length should contain the number of samples generated if it is audio.
  Finally, process_loop must test **PluginClient::interactive** and update the progress bar if it is 1.
  `progress->update(total_written);`
  returns 1 or 0 if the progress bar was cancelled. If it is 1, process_loop should return 1 to indicate a cancellation. In addition to progress bar cancellation, **process_loop** should return 1 when the entire timeline range is processed.
- **int stop_loop();**
  This is called after process_loop processes its last buffer.
  If PluginClient::is_interactive is 1, this should call **stop_progress** in the progress bar pointer and delete the pointer. Then it should delete any objects it created for processing in **start_loop**.

23.5 Audio plugins

The simplest audio plugin is Gain. The processing object should include '`pluginaclient.h`' and inherit from **PluginAClient**. Realtime audio plugins need to define

```
    int process_buffer(int64_t size,
        double **buffer,
        int64_t start_position,
        int sample_rate);
if it is multichannel or
    int process_buffer(int64_t size,
        double *buffer,
        int64_t start_position,
        int sample_rate);
```

if it is single channel. These should return 0 on success and 1 on failure. In the future, the return value may abort failed rendering.

The processing function needs to request input samples with

```
    int read_samples(double *buffer,
        int channel,
        int sample_rate,
        int64_t start_position,
        int64_t len);
```

It always returns 0. The user may specify any desired sample rate and start position.

Nonrealtime audio plugins need to define

```
int process_loop(double *buffer, int64_t &write_length);
for single channel or
int process_loop(double **buffers, int64_t &write_length);
```

for multi channel. Non realtime plugins use a different set of read_samples functions to request input data. These are fixed to the project sample rate.

23.6 Video plugins

The simplest video plugin is Flip. The processing object should include '`pluginvclient.h`' and inherit from **PluginVClient**. Realtime video plugins need to define

```
    int process_buffer(VFrame **frame,
        int64_t start_position,
        double frame_rate);
```

if it is multichannel or

```
    int process_buffer(VFrame *frame,
        int64_t start_position,
        double frame_rate);
```

if it is single channel.

The nonrealtime video plugins need to define

```
int process_loop(VFrame *buffer);
for single channel or
int process_loop(VFrame **buffers);
```

for multi channel. The amount of frames generated in a single process_loop is always assumed to be 1, hence the lack of a write_length argument. Returning 0 causes the rendering to continue. Returning 1 causes the rendering to abort.

A set of read_frame functions exist for requesting input frames in non-realtime video plugins. These are fixed to the project frame rate.

23.7 Transition plugins

The simplest video transition is **wipe** and the simplest audio transition is **crossfade**. These use a subset of the default class members of realtime plugins, but so far no analogue to PLUGIN_CLASS_MEMBERS has been done for transitions.

The processing object for audio transitions still inherits from PluginAClient and for video transitions it still inherits from PluginVClient.

Transitions may or may not have a GUI. If they have a GUI, they must also manage a thread like realtime plugins. Do this with the same PLUGIN_THREAD_OBJECT and PLUGIN_THREAD_HEADER macros as realtime plugins. Since there is only one keyframe in a transition, you do not need to worry about updating the GUI from the processing object like you do in a realtime plugin.

If the transition has a GUI, you can use PLUGIN_CONSTRUCTOR_MACRO and PLUGIN_DESTRUCTOR_MACRO to initialize the processing object. You will also need a BC_Hash object and a Thread object for these macros.

Since the GUI is optional, overwrite a function called **uses_gui()** to signifiy whether or not the transition has a GUI. Return 1 if it does and 0 if it does not.

Transitions need a **load_defaults** and **save_defaults** function so the first time they are dropped on the timeline they will have useful settings.

A **read_data** and **save_data** function takes over after insertion to access data specific to each instance of the transition.

The most important difference between transitions and realtime plugins is the addition of an **is_transition** method to the processing object. **is_transition** should return 1 to signify the plugin is a transition.

Transitions process data in a **process_realtime** function.

```
int process_realtime(VFrame *input,
    VFrame *output);
int process_realtime(int64_t size,
    double *input_ptr,
    double *output_ptr);
```

The input argument to process_realtime is the data for the next edit. The output argument to process_realtime is the data for the previous edit.

Routines exist for determining where you are relative to the transition's start and end.

- **PluginClient::get_source_position()** - returns the current position since the start of the transition of the lowest sample in the buffers.
- **PluginClient::get_total_len()** - returns the integer length of the transition. The units are either samples or frames, in the data rate requested by the first plugin.

Users should divide the source position by total length to get the fraction of the transition the current **process_realtime** function is at.

Transitions run in the data rate requested by the first plugin in the track. This may be different than the project data rate. Since process_realtime lacks a rate argument, use **get_framerate()** or **get_samplerate** to get the requested rate.

23.8 Plugin GUI's which update during playback

Effects like **Histogram** and **VideoScope** need to update the GUI during playback to display information about the signal. This is achieved with the **send_render_gui** and **render_gui** methods. Normally in process_buffer, when the processing object wants to update the GUI it should call **send_render_gui**. This should only be called in process_buffer. Send_render_gui goes through a search and eventually calls **render_gui** in the GUI instance of the plugin.

Render_gui should have a sequence like

```
void MyPlugin::render_gui(void *data)
{
    if(thread)
    {
    thread->window->lock_window();
    // update GUI here
    thread->window->unlock_window();
    }
}
```

Send_render_gui and render_gui use one argument, a void pointer to transfer information from the processing object to the GUI. The user should typecast this pointer into something useful.

23.9 Plugin queries

There are several useful queries in PluginClient which can be accessed from the processing object. Some of them have different meaning in realtime and non-realtime mode. They all give information about the operating system or the project which can be used to improve the quality of the processing.

23.9.1 System queries

- **get_interpolation_type()**
  Returns the type of interpolation the user wants for all scaling operations. This is a macro from overlayframe.inc. It can be applied to any call to the **OverlayFrame** object.
- **get_project_smp()**
  Gives the number of CPU's on the system minus 1. If it is a uniprocessor it is 0. If it is a dual processor, it is 1. This number should be used to gain parallelism.
- **get_total_buffers()**
  Gives the number of tracks a multichannel plugin needs to process.

23.9.2 Timing queries

There are two rates for media a realtime plugin has to be aware of: the project rate and the requested rate. Functions are provided for getting the project and requested rate. In addition, doing time dependant effects requires using several functions which tell where you are in the effect.

- **get_project_framerate()**
  Gives the frames per second of the video as defined by the project settings.
- **get_project_samplerate()**
  Gives the samples per second of the audio as defined by the project settings.
- **get_framerate()**
  Gives the frames per second requested by the plugin after this one. This is the requested frame rate and is the same as the frame_rate argument to process_buffer.
- **get_samplerate()**
  Gives the samples per second requested by the plugin after this one. This is the requested sample rate and is the same as the sample_rate argument to process_buffer.
- **get_total_len()**
  Gives the number of samples or frames in the range covered by the effect, relative to the requested data rate.
- **get_source_start()**
  For realtime plugins it gives the lowest sample or frame in the effect range in the requested data rate. For nonrealtime plugins it is the start of the range of the timeline to process.
- **get_source_position()**
  For realtime plugins it is the lowest numbered sample in the requested region to process if playing forward and the highest numbered sample in the region if playing backward. For video it is the start of the frame if playing forward and the end of the frame if playing in reverse. The position is relative to the start of the EDL and in the requested data rate.
  For transitions this is always the lowest numbered sample of the region to process relative to the start of the transition.
- **get_direction()**
  Gives the direction of the current playback operation. This is a macro defined in transportque.inc. This is useful for calling read functions since the read functions position themselves at the start or end of the region to read, depending on the playback operation.

- **local_to_edl()**
  edl_to_local()
  These convert between the requested data rate and the project data rate. They are used to convert keyframe positions into numbers which can be interpolated at the requested data rate. The conversion is automatically based on frame rate or sample rate depending on the type of plugin.
- **get_prev_keyframe(int64_t position, int is_local)**
  get_next_keyframe(int64_t position, int is_local)
  These give the nearest keyframe before or after the position given. The macro defined version of load_configuration automatically retrieves the right keyframes but you may want to do this on your own.
  The position argument can be either in the project rate or the requested rate. Set is_local to 1 if it is in the requested rate and 0 if it is in the project rate.
  In each keyframe, another position value tells the keyframe's position relative to the start of the timeline and in the project rate.
  The only way to get smooth interpolation between keyframes is to convert the positions in the keyframe objects to the requested rate. Do this by using edl_to_local on the keyframe positions.

23.10 Using OpenGL

Realtime video plugins support OpenGL. Using OpenGL to do plugin routines can speed up playback greatly since it does most of the work in hardware. Unfortunately, every OpenGL routine needs a software counterpart for rendering, doubling the amount of software to maintain. Fortunately, having an OpenGL routine means the software version does not need to be as optimized as it did when software was the only way.

As always, the best way to design a first OpenGL plugin is to copy an existing one and alter it. The **Brightness** plugin is a simple OpenGL plugin to copy. There are 3 main points in OpenGL rendering and 1 point for optimizing OpenGL rendering.

23.10.1 Getting OpenGL data

The first problem is getting OpenGL-enabled plugins to interact with software-only plugins. To solve this, all the information required to do OpenGL playback is stored in the VFrame object which is passed to **process_buffer**. To support 3D, the VFrame contains a PBuffer and a texture, in addition to VFrame's original rows.

In OpenGL mode, VFrame has 3 states corresponding to the location of its video data. The opengl state is recovered by calling **get_opengl_state** and is set by calling **set_opengl_state**. The states are:

- **VFrame::RAM**
  This means the video data is stored in the traditional row pointers. It must be loaded into a texture before being drawn using OpenGL routines.
- **VFrame::TEXTURE**
  The video data is stored in texture memory. It is ready to be drawn using OpenGL routines.
- **VFrame::SCREEN**
  The video data is stored in a frame buffer in the graphics card. For plugins, the frame buffer is always a PBuffer. The image on the frame buffer can not be replicated again unless it is read back into the texture and the opengl state is reset to TEXTURE. The frame buffer is limited to 8 bits per channel. If an OpenGL effect is used in a floating point project, it only retains 8 bits.

In the plugin's **process_buffer** routine, there is normally a call to **read_frame** to get data from the previous plugin in the chain. **read_frame** takes a new parameter called **use_opengl**.

The plugin passes 1 to **use_opengl** if it intends to handle the data using OpenGL. It passes 0 to **use_opengl** if it can only handle the data using software. The value of **use_opengl** is passed up the chain to ensure a plugin which only does software only gets the data in the row pointers. If **use_opengl** is 0, the opengl state in VFrame is RAM.

The plugin must not only know if it is software-only but if its output must be software only. Call **get_use_opengl** to determine if the output can be handled by OpenGL. If **get_use_opengl** returns 0, the plugin must pass 0 for **use_opengl** in **read_frame** and do its processing in software. If **get_use_opengl** is 1, the plugin can decide based on its implementation whether to use OpenGL.

The main problem with OpenGL is that all the gl... calls need to be run from the same thread. To work around this, the plugin interface has routines for running OpenGL in a common thread.

run_opengl transfers control to the common OpenGL thread. This is normally called by the plugin in **process_buffer** after it calls **read_frame** and only if **get_use_opengl** is 1.

Through a series of indirections, **run_opengl** eventually transfers control to a virtual function called **handle_opengl**. **handle_opengl** must be overridden with a function to perform all the OpenGL routines. The contents of **handle_opengl** must be enclosed in **#ifdef HAVE_GL** ... **#endif** to allow it to be compiled on systems with no graphics support, like render nodes. The return value of **handle_opengl** is passed back from **run_opengl**.

read_frame can not be called from inside **handle_opengl**. This would create a recursive lockup because it would cause other objects to call **run_opengl**.

Once inside **handle_opengl**, the plugin has full usage of all the OpenGL features. VFrame provides some functions to automate common OpenGL sequences.

The VFrame argument to **process_buffer** is always available through the **get_output(int layer)** function. If the plugin is multichannel, the layer argument retrieves a specific layer of the output buffers. The PBuffer of the output buffer is where the OpenGL output must go if any processing is done.

23.10.2 Drawing using OpenGL

The sequence of commands to draw on the output PBuffer stars with getting the video in a memory area where it can be recalled for drawing:

```
get_output()->to_texture();
get_output()->enable_opengl();
```

- **to_texture** transfers the OpenGL data from wherever it is to the output's texture memory and sets the output state to TEXTURE.
- **enable_opengl** makes the OpenGL context relative to the output's PBuffer.

The next step is to draw the texture with some processing on the PBuffer. The normal sequence of commands to draw a texture is:

```
get_output()->init_screen();
get_output()->bind_texture(0);
get_output()->draw_texture();
```

- **VFrame::init_screen** sets the OpenGL frustum and parameters to known values.
- **VFrame::bind_texture(int texture_unit)** binds the texture to the given texture unit and enables it.
- **VFrame::draw_texture()** calls the vertex functions to draw the texture normalized to the size of the PBuffer. Copy this if you want custom vertices.

The last step in the handle_opengl routine, after the texture has been drawn on the PBuffer, is to set the output's opengl state to SCREEN with a call to **VFrame::set_opengl_state**. The plugin should not read back the frame buffer into a texture or row pointers if it has no further processing. Plugins should only leave the output in the texture or RAM if its location results from normal processing. They should set the opengl state to RAM or TEXTURE if they do.

Colormodels in OpenGL:
The colormodel exposed to OpenGL routines is always floating point since that is what OpenGL uses, but it may be YUV or RGB depending on the project settings. If it is YUV, it is offset by 0.5 just like in software. Passing YUV colormodels to plugins was necessary for speed. The other option was to convert YUV to RGB in the first step that needed OpenGL. Every effect and rendering step would have needed a YUV to RGB routine. With the YUV retained, only the final compositing step needs a YUV to RGB routine.

23.10.3 Using shaders

Very few effects can do anything useful with just a straight drawing of the texture on the PBuffer. They normally define a shader. The shader is a C program which runs on the graphics card. Since the graphics card is optimized for graphics, it can be much faster than running it on the CPU.

Shaders are written in OpenGL Shading Language. The shader source code is contained in a string. The normal sequence for using a shader comes after a call to **enable_opengl**.

```
char *shader_source = "...";
unsigned char shader_id = VFrame::make_shader(0, shader_source, 0);
glUseProgram(shader_id);
// Set uniform variables using glUniform commands
```

The compilation and linking step for shaders is encapsulated by the VFrame::make_shader command. It returns a shader_id which can be passed to OpenGL functions. The first and last arguments must always by 0. And arbitrary number of source strings may be put between the 0's. The source strings are concatenated by make_shader into one huge shader source. If multiple main functions are in the sources, the main functions are renamed and run in order.

There are a number of useful macros for shaders in '`playback3d.h`'. All the shaders so far have been fragment shaders. After the shader is initialized, draw the texture starting from **init_screen**. The shader program must be disabled with another call to **glUseProgram(0)** and 0 as the argument.

The shader_id and source code is stored in memory as long as Cinelerra runs. Future calls to make_shader with the same source code run much faster.

23.10.4 Aggregating plugins

Further speed improvements may be obtained by combining OpenGL routines from two plugins into a single handle_opengl function. This is done when **Frame to Fields** and **RGB to 601** are attached in order. Aggregations of more than two plugins are possible but very hard to get working. Aggregation is useful for OpenGL because each plugin must copy the video from a texture to a PBuffer. In software there was no copy operation.

In aggregation, one plugin processes everything from the other plugins and the other plugins fall through. The fall through plugins must copy their parameters to the output buffer so they can be detected by the processing plugin.

The VFrame used as the output buffer contains a parameter table for parameter passing between plugins and it is accessed with **get_output()->get_params()**. Parameters are set and retrieved in the table with calls to **update** and **get** just like with defaults.

The fall through plugins must determine if the processor plugin is attached with calls to **next_effect_is** and **prev_effect_is**. These take the name of the processor plugin as a string argument and return 1 if the next or previous plugin is the processor plugin. If either returns 1, the fall through plugin must still call **read_frame** to propogate the data but return after that.

The processor plugin must call **next_effect_is** and **prev_effect_is** to determine if it is aggregated with a fall through plugin. If it is, it must perform the operations of the fall through plugin in its OpenGL routine. The parameters for the the fall through plugin should be available by **get_output()->get_params()** if the fall through plugin set them.

24 Keyboard shortcuts

Alex Ferrer started summarizing most of the keyboard shortcuts. Most of the keys work without any modifier like SHIFT or CTRL. Most windows can be closed with a *CTRL-w*. Most operations can be cancelled with ESC and accepted with RET.

24.1 Program window shortcuts

24.1.1 Editing Media shortcuts

z	Undo
SHIFT Z	Re-Do
x	Cut
c	Copy
v	Paste
Del	Clear
SHIFT Space	Paste Silence
m	Mute region
a	Select all
SHIFT + click	When done over an edit causes the highlighted selection to extend to the cursor position. When done over the boundary of an effect causes the trim operation to apply to one effect.
e	Toggle between Drag-and-Drop and Cut-and-Paste editing modes

24.1.2 Editing Labels and In/Out Points shortcuts

[	Toggle In point
]	Toggle Out point
l	Toggle label at current position
CTRL <-	Go to Previous Label
CTRL ->	Go to Next Label

24.1.3 Navigation shortcuts

Right arrow	Move the timeline right (not the insertion point) *
Left arrow	Move the timeline left (not the insertion point) *
Up arrow	Zoom time out *
Down arrow	Zoom time in *
CTRL Up	Expand current curve amplitude
CTRL Dn	Shrink current curve amplitude
CTRL Alt Up	Expand all curve amplitude
Ctrl Alt Dn	Shrink all curve amplitude
Alt Up	Expand curve amplitude
Alt Dn	Shrink curve amplitude
f	Fit time displayed to selection
Alt f	Make the range of all the automation types. Fit the maximum and minimum range of the current highlighted selection
Ctrl Alt f	Make the range of the currently selected automation type fit the maximum and minimum range of the current highlighted selection
Alt Left	Move the insertion point left one edit
Alt Right	Move the insertion point right one edit
Page Up	Move the timeline up *
Page Dn	Move the timeline down *
Ctrl Page Up	Expand track height

Ctrl Page Dn	Shrink track height
Home	Move insertion point to beginning of timeline *
End	Move insertion point to end of timeline *

* You may have to click on the timeline to deactivate any text boxes or tumblers before these work.

24.1.4 File operations shortcuts

n	New project
o	Load Files
s	Save Project
r	Record
SHIFT R	Render
q	Quit
SHIFT P	Preferences
SHIFT B	Batch Render
SHIFT F	Set Format

24.1.5 Key frame editing shortcuts

SHIFT X	Cut keyframes
SHIFT C	Copy keyframes
SHIFT V	Paste keyframes
SHIFT Del	Clear keyframes
Alt c	Copy default keyframe
Alt v	Paste default keyframe

24.1.6 Track Manipulation shortcuts

t	Add Audio Track
u	Insert default Audio Transition
SHIFT T	Add Video Track
SHIFT U	Insert Default Video Transition
d	Delete last Track
SHIFT L	Loop playback
TAB	Toggle single track arming status
SHIFT-TAB	Toggle every other track's arming status

24.1.7 What is drawn on the timeline shortcuts

1	Show titles
2	Show transitions
3	Fade keyframes
4	Mute keyframes
5	Mode keyframes
6	Pan keyframes
7	Camera keyframes
8	Projector keyframes
9	Plugin keyframes
0	Mask keyframes
-	Camera Zoom
=	Projector Zoom

24.2 Viewer and compositor windows shortcuts

`x`	Cut
`c`	Copy
`v`	Paste
`v`	Splice
`b`	Overwrite
`[`	Toggle In point
`]`	Toggle Out point
`l`	Toggle label at current position
`Ctrl <-`	Go to Previous Label
`Ctrl ->`	Go to Next Label
`Home`	Go to beginning
`End`	Go to end
`z`	Undo
`SHIFT Z`	Re-Do
`+`	Zoom in
`-`	Zoom out

24.3 Playback transport shortcuts

Transport controls work in any window which has a playback transport. They are accessed through the number pad with num lock disabled.

`4`	Frame back	`5`	Reverse Slow	`6`	Reverse	`+`	Reverse Fast
`1`	Frame Forward	`2`	Forward Slow	`3`	Play	**`Enter`**	Fast Forward
`0`	Stop						

SPACE is normal Play, Hitting any key twice is Pause.

Hitting any transport control with CTRL down causes only the region between the in/out points to be played, if in/out points are defined.

24.4 Record window shortcuts

`Space`	Start and pause recording of the current batch
`l`	Toggle label at current position

GNU General Public License

Version 2, June 1991

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software—to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Lesser General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software.

Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you".

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

1. You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program.

   You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

   a. You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.

   b. You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

   c. If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

   These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

   Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

   In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

   a. Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

   b. Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

c. Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4. You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

5. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

6. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.
9. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

   Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.
10. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

11. BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

Appendix: How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
one line to give the program's name and a brief idea of what it does.
Copyright (C) yyyy  name of author

This program is free software; you can redistribute it and/or modify
it under the terms of the GNU General Public License as published by
the Free Software Foundation; either version 2 of the License, or
(at your option) any later version.

This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
GNU General Public License for more details.

You should have received a copy of the GNU General Public License
along with this program; if not, write to the Free Software
Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA  02110-1301, USA.
```

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
Gnomovision version 69, Copyright (C) year name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type 'show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type 'show c' for details.
```

The hypothetical commands '`show w`' and '`show c`' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than '`show w`' and '`show c`'; they could even be mouse-clicks or menu items—whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the program
'Gnomovision' (which makes passes at compilers) written by James Hacker.

signature of Ty Coon, 1 April 1989
Ty Coon, President of Vice
```

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License instead of this License.

Index