

Part I

Jaleo 2.1 Introduction

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1. Introduction

Jaleo is an open digital video postproduction environment. It contains a flexible and complete suite of tools to facilitate digital media production.

Modern production typically encompasses elements of media creation (like special effects production, compositing, 2D- and 3D animation) as well as editing and arrangement of media material.

Jaleo is designed to integrate special effects production and compositing with story telling and editing. For the first time, the simplicity and elegance of a timeline based non linear editing system is combined with the flexibility and power offered by advanced process tree-based systems. Not only can fancy effects for a single shot be produced efficiently – Jaleo is also capable of handling complex and lengthy multi-shot arrangements of media material and advanced special effect and compositing processes.

Jaleo also allows you to increase production efficiency by employing hierarchical structures, as production templates that can be reused and modified at any time quickly and easily. Work can be prepared with low quality “dummy” material, and can then be replaced whenever the final material is available. Most important, edit decisions are never irreversible, not even at the very bottom of a 200-layer composite.

With Jaleo, material creation and modification using advanced multilayer compositing tools is a natural part of the story telling process, i.e. the arrangement of media material over time. Jaleo thus helps to keep the most important part of any production in mind: the story.

In the remainder of this manual section, the most important operational principles of the Jaleo Environment are presented.

1.1 Jaleo An Overview

1.1.1 Jaleo And Image Material

Jaleo has been designed to provide highly interactive editing and compositing functionality with any digital image material, including full resolution uncompressed digital video images. Furthermore, Jaleo's goal is to maintain the principles of non-destructive editing with complex multilayer settings and process trees. Therefore, every arrangement the user makes is reversible at any time, as no rendering is required unless the production is committed explicitly for rendering. During the work process, the system provides previews in as close as possible to real time.

To maintain its responsiveness even in complex editing situations, Jaleo operates during interactive sessions primarily on preview images of reduced size and, optionally, reduced quality (by applying compression; the amount of reduction necessary depends on the available hardware). Jaleo can be scaled from small workstations to large multiprocessor machines, allowing real time playback and recording of full size uncompressed video with close-to-realtime processing.

Image material needs to be prepared for use in Jaleo. During this process, the preview files and a single reference file, called the clip file, are created. The clip file is a level of abstraction between the source material and its use, enabling the user to use any number of segments of the source material in a very fast and easy way.

The clip file and further details regarding Jaleo's handling of image data (among others, the storage of data on Raw Devices) are described in a later section of this chapter (see section on Digital Media Usage, page 35); the use of the IO subsystem is explained in chapter 16 (page 139).

1.1.2 The Reel

Jaleo offers a large collection of tools to the user. The heart of the system, Jaleo's story-telling playground so to speak, is the Reel Window. The Reel Window is an almost unlimited two dimensional workspace in timeline-style – representing the progress of time in the horizontal direction, while providing space for an unlimited number of layers of video and audio material or effects in the vertical direction. If there is not enough space for all of the reels content in the visible window portion, the Reel can be scrolled and zoomed in both

directions. The timeline displays timecode tick marks and, if activated, various sets of markers to denote locations and area limits for edit operations, playback and rendering.

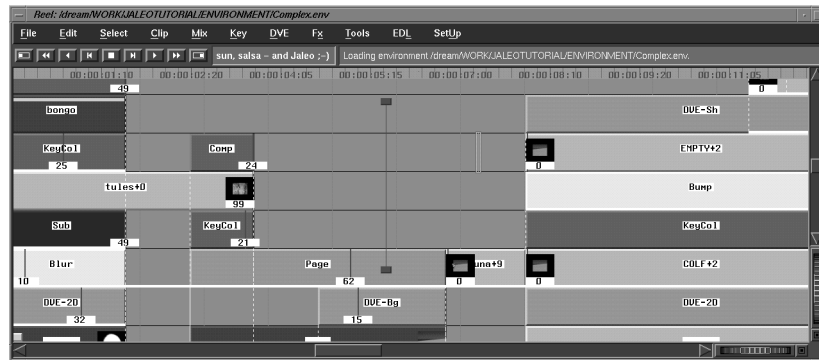


FIGURE 1. The Jaleo Workspace, the Reel Window

Desktop Integration

The Reel Window, like all Jaleo tools, is tightly integrated into the Silicon Graphics graphical desktop environment. Drag&Drop operations can not only be used between applications of the Jaleo environment, but also between Jaleo and desktop directory browsers of Silicon Graphics Indigo Magic™. For more information on the Magic™ desktop tools, see the Silicon Graphics documentation that came with your system.

See “Drag&Drop Integration” on page 46 for more information.

Clips

Media clips, prepared using the Jaleo IO system (see the section on page 29, as well as chapter 16, page 139), can be brought into the reel using either the extended file selector boxes of Jaleo, or by just dragging file icons from the desktop views. Using the mouse and a set of powerful keyboard editing functions, clips can be arranged interactively in any desired way.

When rendered or previewed, the content of the reel will be processed from left to right, bottom to top. That is, Jaleo starts at the left end to process the clips it finds in the reel. For each frame, all layers are processed top down.

If there are only image clips, only the uppermost layer is visible, as each image clip effectively blocks the view on anything below it, just like a photo placed over another photo. The view to underlying layers is blocked even in case the image clips have a transparency mask (or alpha channel). If the transparency masks are to be used to make parts of underlying images visible, compositing operations needs to be applied. This is done using effect clips, Jaleo's universal method of applying image processing and special effects of any kind (see below). Operation of composition functions is similar to a stack of images painted on cellophane or glass plates – wherever something is painted on the glass (that is, wherever the transparency mask is not set to zero percent), the underlying layers are visible.

Note that Jaleo layers are always counted relatively – there is no such thing as an absolute bottom or top layer. The layer at which processing starts is simply the lowest layer in use, and processing continues until the uppermost layer of the process tree is reached (this is not always exactly true – when the monitor, as described below in section 1.2.1 on page 23, is used for previewing, processing can be limited to any desired layer range).



1. Here, “Palmera” is visible. There is nothing above it to hide it
2. “Duna” is visible; it hides “Bongo” below it.
3. “Bongo” is visible
4. “Yate” is visible

FIGURE 2. Visibility of Image Layers

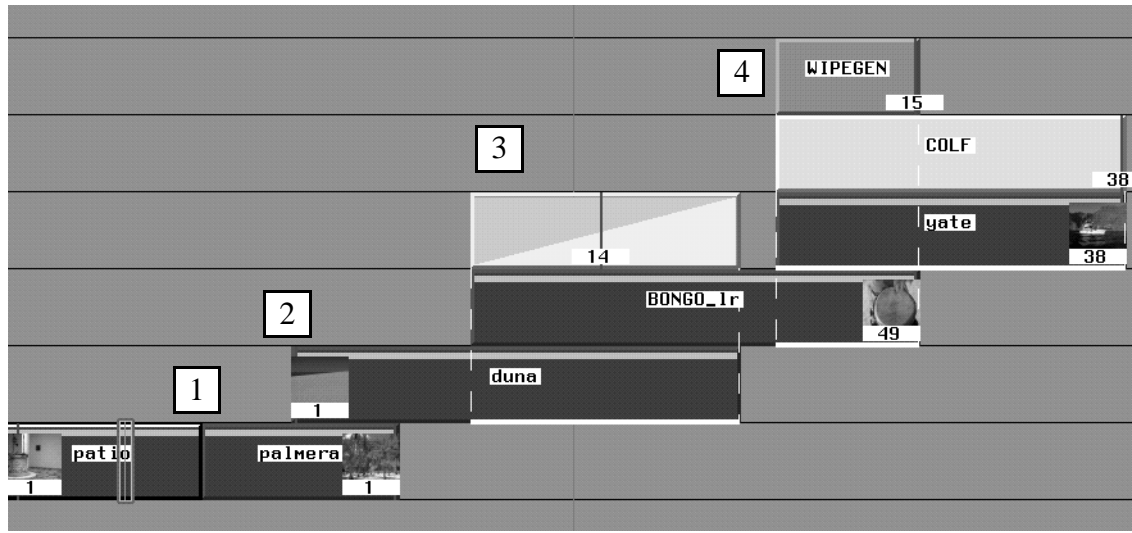
Sound clips are processed slightly differently: as sound does not have any sensible notion of “blocking something layered below it”, all sound clips are always mixed, regardless of their layer position.

Effects

The practically unlimited number of layers in Jaleo would not be very spectacular if only image clips could be arranged. Therefore, a large collection of effect clips are available, including mask generators (used for advanced chroma keying), compositing operators, DVE, image processors, and many more. Using the effect clip mechanism, the user can create dynamic processing trees manipulating image layers in numerous ways. The process trees created by Jaleo are, in contrast to most available compositing systems, dynamic, as they can, if necessary, change completely from one frame to the next. This capability enables Jaleo not only to perform advanced special effects, but also to provide a comfortable editing environment for any combination of full-resolution uncompressed or compressed material.

Effect clips works like this: Effect clips are normally created using a menu bar command. The clip is then placed in the reel just like any image clip, and can be resized or copied like an image clip. In contrast to normal clips, effect clips have the capability to accept underlying image or effect clips as inputs. Some effects, like a color filter, have a single input, most have more, or even an unlimited number of inputs (for example, the multiple mix or 3D DVE effect can handle any number of inputs). Of course, effect clips do not unconditionally process all underlying clips. Every effect clip has an attached effect extend rectangle

that is used to determine how many underlying clips will be used as inputs. For details on the operation of the reel, see chapter 2 (page 41).



1. Hard Cut, achieved by placing two clips on the same layer, with one following immediately after the other
2. Hard Cut, by “hiding” the underlying material with the clip in the upper layer
3. A Mix between two layers. The Mix takes “Bongo” and “Duna” as inputs
4. A Wipe between two layers, one of them (Yate) piped first through a color filter.

FIGURE 3. Simple Effects

As seen in the previous illustration, effect clips also accept the output of another effect clip as input. As this can be repeated infinitely, any desired process tree can be built. In fact, the layering scheme is equivalent to a process tree – its layout in the time line allows it to change over time much more easily than it would be possible with a static tree. In fact, a simple setup like the one shown in the following illustration would need many passes in a

typical static tree compositing system. Refer to paragraph 1.2.4 for more information regarding viewing the process trees using Jaleo's Process Flow Monitor.

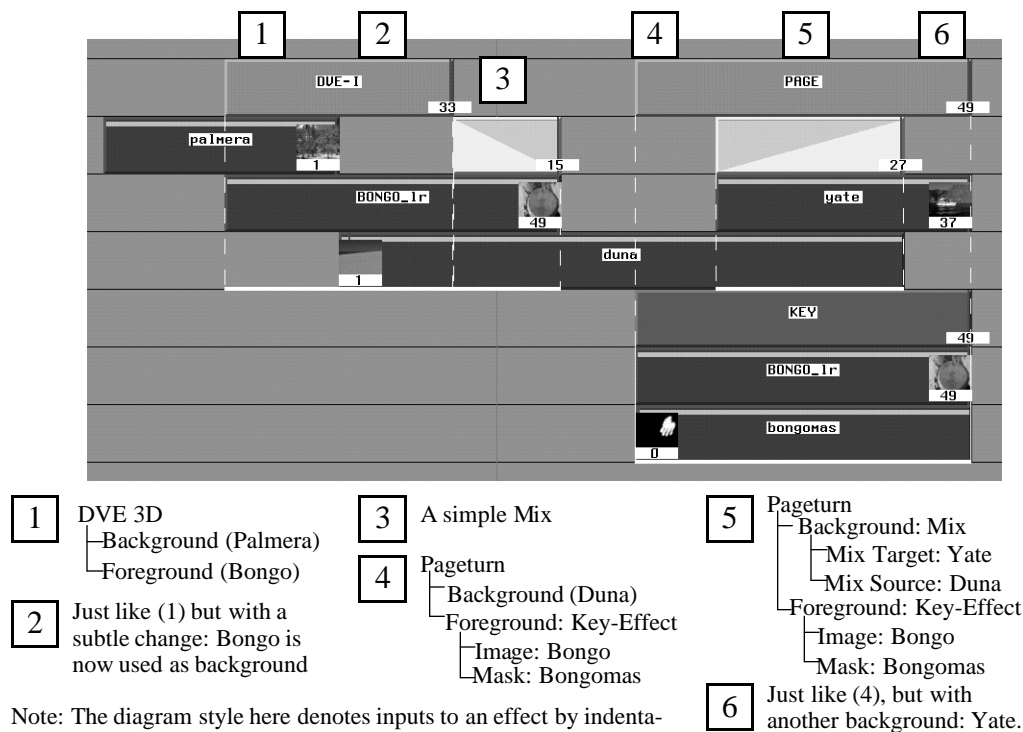


FIGURE 4. Multilayer Setups and Process Trees

Also note in the illustration that the absolute position of an input layer is not important – important is the relative position. If, for example, for a pageturn effect the first input is the background and the second is the first foreground (it does not matter how many empty layers are in between – Jaleo counts only “populated” layers as inputs.)

Effect setups can be saved, to be used as templates in other productions. With Jaleo, the effect is never committed with the image, unless the render process is begun,

Effect Processing

Processing of multilayer composites containing effects is handled as follows:

If the uppermost layer is an effect, all its inputs are evaluated. If the inputs are image layers, they are directly used to compute the effect. If the inputs are effects, their inputs are evaluated in turn, until the process tree is parsed to the very bottom. This structure of effects piped into other effects can be visualized using the Flow Monitor.

Clips, Effects, and Alpha Information

Clips may or may not command their own alpha channel information. If clips have been captured from video, there normally is no alpha (or mask) information available. Computer graphics material usually has an alpha channel. Note that a clip without alpha channel is exactly equivalent to a clip with an alpha channel set to “opaque”. Thus, there is no differ-

ences in handling required for clips with or without an alpha channel. Alpha information, is, however, quite important for the operation of some effects, and it is important to know where and how alpha information is generated/used.

Jaleo includes a large variety of effects to generate alpha information from images. This class of effects is typically referred to as “Keying”. The most important keying function is the chroma key, generating a mask for areas in an image that have a particular color.

There are also some Jaleo effects that require alpha information: a composite effect, for example, does not make sense without it, because the alpha mask defines the transparent areas of a foreground pasted on a background.

Generally speaking, a Jaleo effect receives one or more inputs that may or may not have alpha information associated with it. Depending on the effect, this information is either used to calculate the effect or discarded. Again depending on the effect, the output of the effect may or may not include alpha information.

Some effects transpose image information to mask information and vice versa. The “Show Alpha” effect transforms mask information to image information, discarding the original image channel of the input. The “Key color” effect, on the other hand, can place transformed image channel information in the alpha channel of its output. Other effects may use image information “as if” it was alpha. The reference pages for each effect give a description on alpha usage on the input side and on the output of the effect.

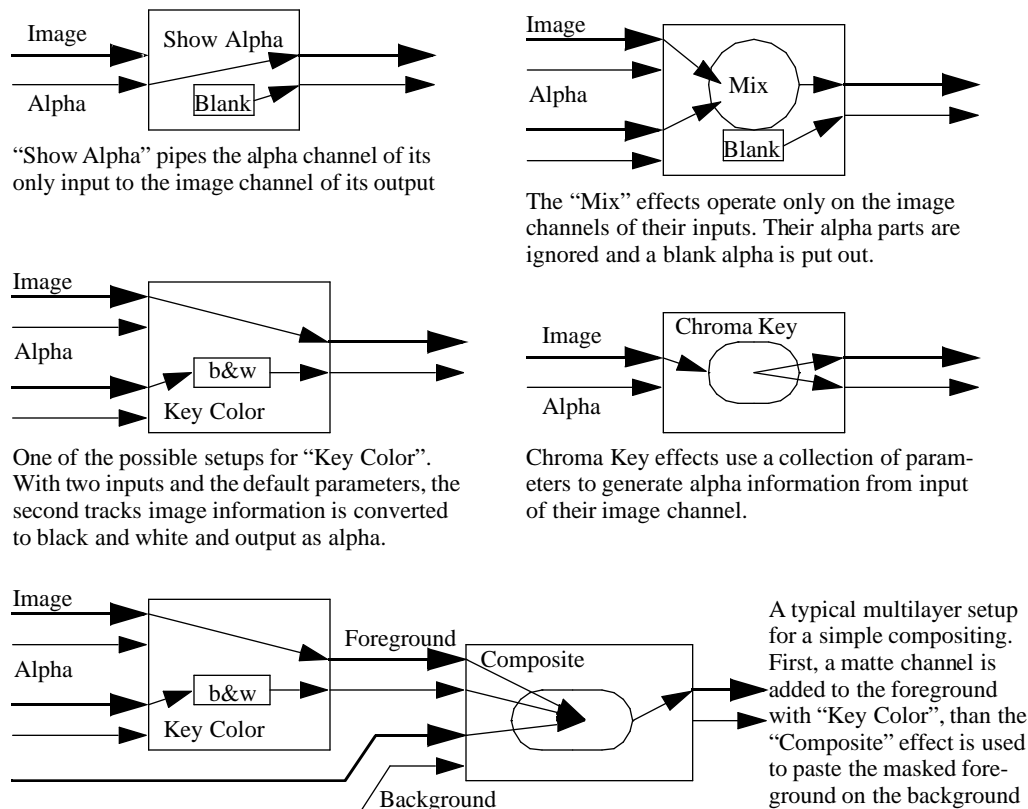


FIGURE 5. Clips, Effects and Alpha Channels

Groups and Timewarping (Dynamic Tracking)

Finally, the reel offers the possibility to replace any number of selected clips by a single group clip. This makes arrangements much more transparent, as Jaleo provides the ability to “navigate” inside of a group to make changes to it, or to re-expand the group whenever this is desired. Furthermore, groups provide timestretching (Dynamic Tracking) of the underlying material. Therefore, if a simple image clip is to be stretched or squeezed in time, it should be placed into a group, containing just this clip. The only effect parameter for a group is a dynamic tracking curve, that can be edited like all other effect parameters in the Time Editor (see section 1.2.3 on page 24 or the chapter “The Time Editor” on page 85).

Groups can be saved as building blocks for other productions.

1.2 Reel And Timeline Tools

The reel uses a number of important tools. These include monitors for previewing, reel overview, editors for effect clip parameters and a variety of other useful utilities. The most important tools will be described in separate sections below, including explanations of the underlying operational concepts of Jaleo.

1.2.1 Previewing: The Monitors

Jaleo has a very flexible concept of previewing: any number of monitors can be open at any time, each being attached to any desired range of layers. This is very similar to the preview monitors in a traditional post production studio that can be inserted at any point of the signal flow, showing for example source material on monitor 1, the output of the DVE on monitor 2 and the final result of the mix on monitor 3. As monitors can be positioned on the reel freely in both dimensions, (and can even show different timecode locations simultaneously) multiple monitors are often very helpful when comparing effects or cuts.

When a new monitor is opened, a line with two handle boxes appears on the reel. The horizontal position of this line denotes the point in time the monitor is showing. By default, the line fits to the vertical extent of the Reel Window. This line extent can be modified using the handle boxes on top and bottom of the line to view any layer or layer range as desired. Of course, the processing priority rules apply to the monitor lines as well: if two image clips are layered, only the uppermost will be visible in the monitor.

To view the arrangement in motion, Jaleo offers three basic possibilities: first, the monitor line can simply be dragged with the mouse over the reel. The monitor display will follow the movements. This is like “scrubbing” through the material, allowing you to alternate freely between layers. As there is only a single mouse available, by dragging the monitor line only a single monitor can be moved.

To playback a layout using all monitors, the monitor shuttle can be used. The shuttle is a standard transport control providing the standard functions to playback from a machine. Using the play button, the reel will be played back using all monitors. Actually, this is moving the reel, not the monitors – just like the central remote control in a studio starts all tape transports when the play button is pressed. Playback is, depending on hardware configuration and reel content, as close as realtime as possible for the given complexity and number of monitors – if for each monitor a different effect needs to be calculated, playback speed may drop. This can be prevented using effect caching (see below). If the frame rate can still not be matched, you may activate skip frame playback mode (see “Monitor Playback Speed” on page 78); in this mode, the target frame rate will be matched, but frames may be dropped where necessary.

Also, by holding the Shift key while dragging a Monitor Cursor, display update can be suppressed, allowing for fast positioning of the Monitor Cursor in complex arrangements.

Scrolling through the reel has the same effect as a jog/shuttle control: while scrolling, the monitor locations on screen remain constant; and the reel is moved under the monitor lines. This provides a quick way to search through large arrangements.

Finally, it is always possible to render part of a reel using the render tool or render group option. Precalculated clips can then be viewed using the Flipbook or the Gallery.

1.2.2 Preview Caching And Group Render

If, for complex layerings, the response time of a preview rendering is too long, clip results can be cached, giving the same access speed as for simple image clips. Caching can be activated for each effect clip separately. Caching does not require a special rendering pass – instead, each preview image is cached whenever it is displayed for the first time. A bar on top of the clip icon in the reel shows which frames are already in the cache. Caching occurs by any type of preview rendering, be it by moving the monitor line using the mouse, or by using playback. Whenever the monitor line moves over a frame not yet cached, its preview is rendered and placed in the cache, giving much faster access the next time the frame is passed.

The cache process always uses the reference clip image, or low-resolution 1/8, 1/4, or 1/2 scale image. A cache is a preview render of this reference image.

Note that the cache is not invalidated automatically if you change any underlying information.

If not only a preview rendering is desired, but the state of affairs is advanced enough to pre-render a part of a sequence, the Render Group function can be used. A group can be pre-rendered in the background, effectively replacing the group in the reel with a pseudo image clip. While this rendering takes place, work in the reel is not interrupted. As soon as a frame of the background rendering is completed, it is available as an image without further processing. The group can still be modified, but this of course invalidates the pre-render. See section 3.4.11 on page 71 for more details.

1.2.3 Effect Clip Parameters: The Time Editor

Effect clips typically have a number of parameters. A color correction clip, for example, has a number of parameters allowing control of individual color parameters. Using the time editor, all effect parameters can not only be modified statically, but their values can also be animated over time.

The time editor is a separate window, which always shows the effect parameters of the currently selected clip. If this clip does not have any parameters, or if it is an image clip, the window remains empty.

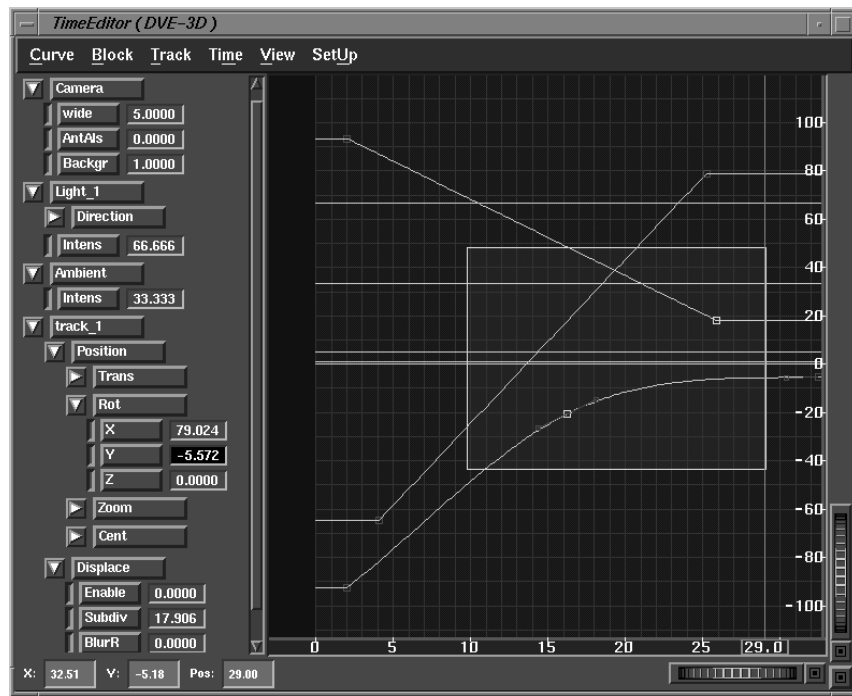


FIGURE 6. The Time Editor Window

Time curves are interpolations between values specified at certain points in time. For example, if a motion effect is specified, it is convenient to define a start and end position and to have the system interpolate between these positions. The interpolation curves can be manipulated graphically; they may be linear or spline motion paths, providing hard or smooth interpolation as desired.

As some parameter groups are not quite intuitively understood as time curves (in particular motion curves and colors), the time editor provides specialized views for these parameters.

The color view provides a color selector window with a color cone and color sliders – color changes using either the timecurves or the color view will automatically be reflected in the other view. Because the color selector is a static view, it always displays the value at the current time.

The 3D view is used for the 3D DVE effect, providing interactive manipulation of objects in 3D. This view displays on-screen manipulators when an object is selected, that operate like 3D extensions of the familiar tools found in 2D drawing packages. The 3D editor provides the ability to intuitively edit position, scale and rotation of an image in 3D for any given point of time; the time editor then interpolates smoothly between the specified key positions.

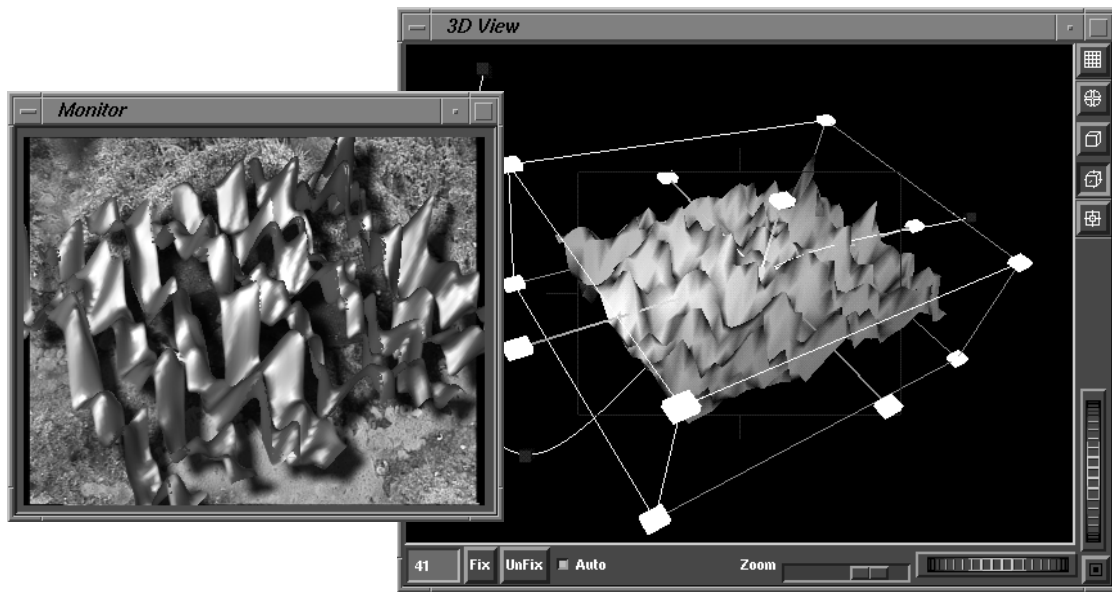


FIGURE 7. 3D View and Monitor Result

1.2.4 Another View on Layerings: The Process Flow Monitor

A complex multilayer arrangement can be difficult to understand at first sight. To solve this problem, Jaleo offers an additional view on these arrangement structure, called the Process Flow Monitor. The Flow Monitor can be attached to the clips in the reel. It shows a structured view of the effect layering placed over the reel display. Although process layering can change in Jaleo on a frame-by-frame basis, the static structure at any frame can be captured with the Flow Monitor, while the output is viewed in the associated monitor windows.

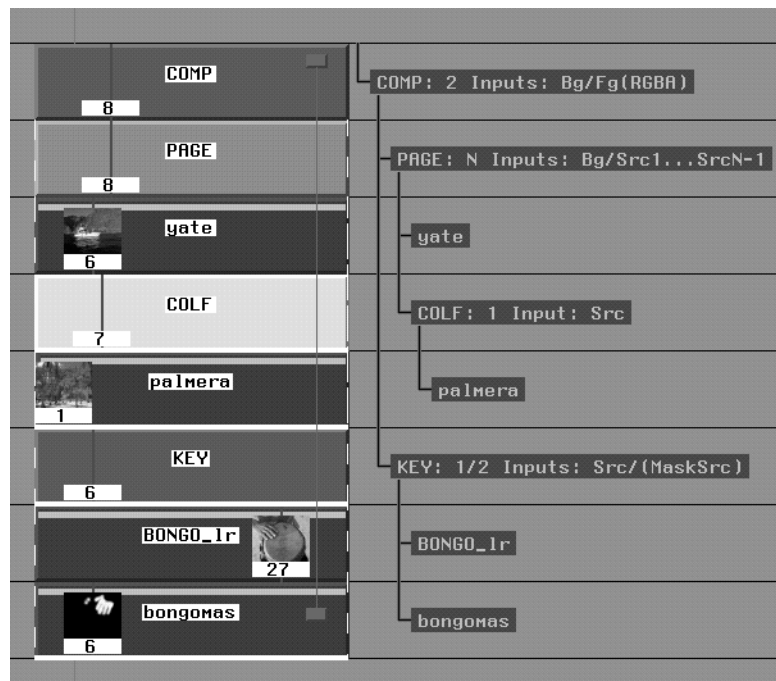


FIGURE 8. FlowMonitor

1.2.5 Attributes

The attributes window is used to display and modify the attributes of an image clip. Recall that an image clip is an instance of an image clip file, actually referring to source material on hard disk. The attributes window shows the file the instance is made of, and a set of parameters **particular** to each instance. These parameters include a name, an independent set of head and tail trimming parameters, and various option flags.

Additionally, a clip can have a number of marker positions assigned to it. The marker positions are displayed directly in the clip representation in the reel, not in the Attributes window (see “Clip > Mark” on page 66 for more information on markers).

See also chapter 7, page 105.

1.2.6 Overview

The overview tool provides a window with a zoomable overview of the whole reel content, and makes navigation in a large production considerable easier.

See also chapter 8, page 110.

1.2.7 Render

The render tool is used create render files once a production is satisfactory. It displays a set of markers on screen that can be moved to mark the part of the reel that is to be rendered. Also, a dialogue is displayed into which a name for a render file may be specified.

Note that creating a render file does not initiate the render process immediately. The render file only collects all the information on the desired render job that then can be run from the IO subsystem. Integrating the rendering with the IO subsystem has the advantage that it enables Jaleo to render to any supported IO device directly, i.e. to files, DDRs or any other supported hardware.

An almost identical tool is available to create EDL files from the reel arrangement. As EDL formats are far more limited than the reel arrangement capabilities, some restrictions apply as to which arrangements can be successfully converted into EDL.

See also chapter 10, page 114 and chapter 11, page 116.

1.2.8 RotoPaint

RotoPaint is the Jaleo paint application. RotoPaint operates on an image clip, but changes are normally written into temporary files on disk.

Only when the user explicitly selects the save command, the frames retouched so far are overwritten with the temporary files. Also, if the user terminates a paint session or if the temporary disk does not have enough space, the user has the option to save her or his work or to discard it (i.e. copy the temporary files to the working clip or delete them). Jaleo RotoPaint thus provides fast and secure rotoscoping capabilities.

RotoPaint includes a set of paint tools as well as vector drawing capabilities. To facilitate complex retouching tasks, all paint operations can be done in “Stroke” mode. Here, the system actually handles the interactive painting movements as vector shapes that can be modified later on. They can be moved, scaled or deformed, and even the paint operation type can be changed (paint, drag, blur, etc.). Undo capabilities allow the user to undo every single brush movement, or to remove complete strokes.

Closed vector shapes may also be saved as vector shape files. The files can be dropped in the reel and be animated using a special DVE Shape effect. This feature is useful when creating title animations using text shapes.

RotoPaint is a separate option that is described in Part 2 of this manual.

1.3 Utility Programs

1.3.1 Loader

The Loader application is an extended file selector box, specifically adapted to operate in the context of the Jaleo environment. It can be used to load all Jaleo-specific file types. Among other things, the Loader includes a preview monitor that can be used to view clips before loading. See also chapter 12, page 119.

1.3.2 Flipbook

The flipbook tool, available from the system toolchest, is a constant frame rate display utility for image clips. The desired display frame rate can be adjusted in a wide range. Clips can be loaded into the Flipbook by Drag & Drop.

See also chapter 13, page 125.

1.3.3 Gallery

The Gallery, also available from the system toolchest, is a collection of simple flipbooks. Any number of clips can be dropped here, to be arranged and viewed in a grid. Clips can be played back alone or in sequence, and any selection can be dragged from here to the reel. The Gallery can be used to quickly sort material, pre-arranging it in a highly visual manner, before placing the material in the reel.

See also chapter 14, page 131.

1.3.4 Project Manager

The project manager is, as the user probably suspected, used to manage Jaleo projects. A Jaleo project is a specific directory structure located below the Jaleo work directory, including directories for source images, clips, effects, reel arrangements (environments), sound etc. The project manager allows to create, maintain and delete these projects. Refer to Part 3, Installation and Setup, for more details on Jaleo project structures.

See also chapter 15, page 137.

1.3.5 The Jaleo Device Interface: IO And Real-Time Tools

The IO subsystem of Jaleo integrates all IO related tasks. It allows to specify a batch of conversions jobs to be executed together, or to run a single job manually. Its primary applications are to create clip files, to copy clips including their source material, to load from and save to DDRs and to initiate render processes.

The IO module displays two columns, representing source and destination for the operation. Sources and destinations can be actual hardware devices, like DDRs or other peripherals, or “pseudo” devices, like clips or render files (source only). (Clips are called pseudo devices because they do not represent a hardware interface, but an interface to Jaleo. They do act like a device, though: the user can copy to or from a clip just like to a real device. A render file is very similar, but just read only. (One can copy from a render file, effectively rendering part of an arrangement, but not into it.)

Depending on the device selected, a number of parameters are available to control the read or write process. For a DDR, these parameters typically include in and out points, clip information such as file formats preview format, compression etc. can be controlled. See chapter 16 (page 139) for more information.

The RealTime tools for the SIRIUS Video and the Galileo/Cosmo allow the user to grab video in real time, using machine control to accurately control connected VTRs. Of course, real time output is also supported.

1.4 Editing Strategies with Jaleo

Jaleo provides support for nonlinear editing. Traditional editing concepts, like trimming or shifting of material are implemented in a very elegant fashion. However, some of the vocabulary of the editing world is not very applicable to a system that does not deal with a limited number of continuous tracks, but with an unlimited number of compositing layers and processing effects. Jaleo's processing paradigm generally offers very simple and fast solutions to typical editing problems.

Note: This manual section is complementary to other parts of this manual. It is intended to present some topics in a general way, but for details on operation of certain functions it will certainly be fruitful to consult the chapter on the Reel Window and on the Reels menu bar, as well as the introduction above.

1.4.1 Arrangement Pane

Jaleo's Reel Window provides a generic arrangement pane for digital media material. Material to be arranged in Jaleo is called a Clip; clips may be basic material like video and/or audio data or material processors (effects), or ordering elements (groups). A media composition is an arrangement of clips in sequence and layering. The arrangement capabilities of Jaleo encompass horizontal arrangement tools, traditionally called editing, as well as vertical arrangement tools, often called compositing or multilayer processing. Jaleo is designed to put as few limits as possible to the expressivity of an arrangement and to provide at the same time as much support as possible for quick and easy arrangements.

1.4.2 Managing Material Clips: Moving, Trimming, Timestretching, Shifting, Extending

The relationships between source material and clips have been discussed earlier in this document. Just to repeat the most important information: The digitized source material is available to the computer in two qualities, high-resolution and preview. Description of format and location of the source material are stored in clip files. When a clipfile is loaded into a reel, a clip instance is created. A clip instance predominantly needs to know two things: Where it is located in the arrangement, i.e. the position of the clip instance in the reel, and, which section of the source material the clip instance references.

A clip in the reel is like a window in a wall: It allows you to look at something behind the wall, but you can only see a portion of what is behind. When you position a clip in the reel, you move the window in the wall, but you also move the material you can look at by moving a clip you do not change the portion of the source material you see.

1.4.3 Moving

Positioning of clips in the reel is very easy: Just drag one or more selected clips to any desired position while holding down the left mouse button. For precise editing, or quick processing using a prepared plan, fast keyboard-based positioning is also provided.

- If you press <CTRL> while dragging, only horizontal movements are allowed.
- If you press <ALT>, while dragging, only vertical movements are accepted.

1.4.4 Trimming

It is as easy to define a section of source material used by an image clip instance. To do so, drag the preview cursor on the clip icon using the right mouse button. Attached to this preview cursor, you see a preview image (unless the scaling of the reel makes this impossible). Drag the cursor to either end of the clip and then press the left mouse button. You can now drag the length of the clip, either making it longer or shorter. However, this does not “scale” the material of the clip by stretching or squeezing it (there is another mechanism to do so), but it repositions the In/Out (head and tail) points of the source material, as described below (see “Clips and Image Data” on page 37). Again, there are quick and precise keyboard modes for these operations. See the section on the reel’s Edit menu for more information on trimming options (“Edit > Force Size” on page 58, “Edit > Trim” on page 59).

Again using the “window” analogy, trimming is like resizing the window, without moving the material you look at.

1.4.5 Timestretching

Timestretching, where desired, can be achieved by placing the clip (or any collection of clips) into a group (see the menu items on groups on page 67 for more information). A simple linear timestretch can be produced by dragging the group size just as described above; for non linear timestretches, you can edit a time curve using the Time Editor. More information about this feature can be found in “The Time Editor” on page 85.

1.4.6 Shifting

In many cases, you want a clip to remain exactly where it is, but it should show a different part of the material. Typically, only small shifts of the material are required, a few frames for example. To do a material shift, you could trim head and tail and then move the window back to its original position. However, there is a more direct approach to shifting, that is, a quick menu command allowing you to shift quickly in both directions, using any amount of frames. Shifting is analog to move the material you look at without moving the window. Shifting is further explained in the section on the reels Edit menu (“Edit > Shift” on page 58).

1.4.7 Extending

The Extend function, using the window analogy, works like the Trim, in that the window itself is resized. However, the material we look at does not remain motionless but follows the window resize. The frame that was originally visible at the window’s left edge will still

be visible in the same location after the resize; additional frames are added to be visible at the window's right edge.

This analogy is reversed if you are Extending the tail of the clip; the frame visible at the window's right edge is still visible in that location, while additional frames are added from the left.

Remember: An extend operation is equivalent to a trim followed by a shift.

See “Edit > Extend” on page 62 for more information.

1.4.8 Multiple Selections

Practically all editing options can be applied to multiple selections. Typically, you will want to do this in a multilayer setup: for instance, if you have ten layers and need to trim the effect, you may select all layers and apply the trim, using either the mouse or the keyboard method. As always, if you want a timestretch of the multilayer effect instead of a trim, just place the whole multilayer shot into a group.

There is a special case of trimming with a selection of two sequential clips in the same layer. Using the mouse drag trim function, it is possible to trim the end of the first clip and the beginning of the second clip at the same time. To do so, drag the preview cursor of the second clip to the start of the clip. Then select both clips and drag the preview cursor of the first clip to the very right of the clip, like shown in the illustration below. If you press the left mouse button now, with both preview cursors very close, you can trim the tail of the first clip and the head of the second at the same time. This is a very quick method of trimming a cut edit on the same layer.

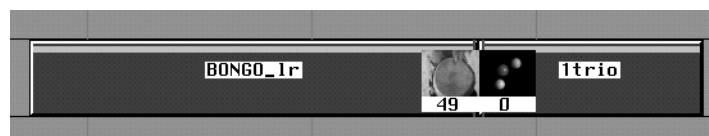


FIGURE 9. Trimming of two adjoining clips

As we will see later, in a multilayer environment there are other methods of achieving the results of traditional editing very quickly and easily, with superior overview and control of the material in the reel.

1.4.9 Multiple Selections: Insert, Alignment, and Packing

Jaleo also supports arrangement of any number of selected clips by providing insert, alignment and packing functions.

To insert material in a layer, one places the new material in the layer above the target layer. The left end of the new material should be aligned to the desired insert position in time. Now, all clips on the target layer can be selected using a selection function, and the layer to be inserted needs to be selected as well. Insert now splits the target layer at the insert

position, moving everything right of the insert position far enough to the right to be able to accommodate the new material. The new material is then moved into the resulting space.

Insert also works with more than two layers: in this case the stack is processed top down. First the uppermost layer is inserted in the layer below it. The result of this is then inserted in the layer below, and so forth. Finally, it is possible to place multiple inserts at multiple insert positions. Any number of inserts, be they stacked vertically or distributed over time, can be processed using one insert command. See “Edit > Insert” on page 56 for more information.

Alignment allows you to position head or tail of a number of clips to a pick position, to other clips or to a set of edit markers. See “Edit > Align” on page 61 for more information.

Packing is used to put clips in a layer in precise sequence by removing any space between them. See “Edit > Pack” on page 61 for more information.

1.4.10 Editing in a Multilayer Environment

As mentioned above, in a multilayer environment many traditional edit functions have equivalents that are more flexible and allow you to maintain easy editing for the lifetime of a project.

The following illustration shows a multilayer composition. As you can see, an edit point is not easily identified in the setup. Something equivalent to an edit can happen in many ways:

- If two clips (or multilayer sets) follow each other sequentially on the same layer, there will be the equivalent of a cut where the two clips come together.
- If a clip (or multilayer set) is placed above another clip (in another layer) with an offset in time, the equivalent of a cut will occur because from the point on where the upper clip begins the lower clip is hidden.
- Effect clips layered over any conceivable arrangement of clips will produce a result that may be equivalent to a wipe, a fade or a number of other effects.

- The layers beneath an effect may have very complex arrangements by themselves, adding a whole dimension of recursion to editing.

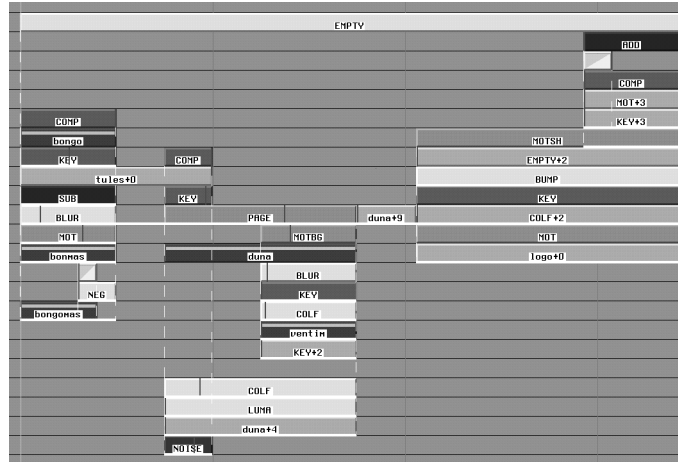


FIGURE 10. A More Complex Editing Example

Due to the complex dependencies in a multilayer environment, it is difficult to define which clips or effects will be affected by an edit operation on a given level without any manual specification. On the other hand, many editing tasks become much easier because it is not necessary to place everything in a single layer. The following image shows a simple edit using traditional NLE-style arrangement.

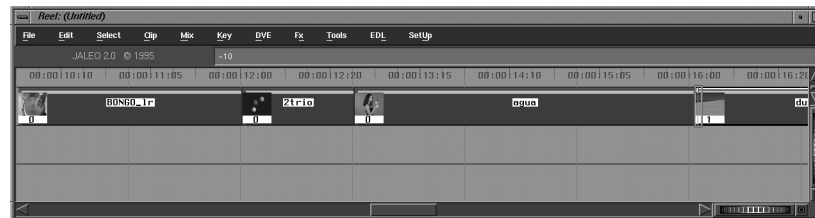


FIGURE 11. Traditional NLE-Style Edit

Clips are placed one after the other. To do for example a replace edit, the system has to cut out material from the track and insert new material instead. Undoing operations of this type may be cumbersome after a few more steps have been done, as even an unlimited undo is not selective in the sense that any past operation cannot be undone without also undoing all steps done since then. In this sense, although traditional NLE editing is not destructive to the material, many edit decisions are in fact destructive to the arrangement. In contrast, in a multilayering environment as provided by Jaleo, to do a replacement edit, you can simply place the new image material in a layer above the original. Due to the top down processing of the material (see “Material and Processing” on page 36 for more information), the clip placed on top will effectively hide the part below, but as its application does not modify the original in any way, the replacement can be moved, replaced, modified or deleted at any time.

Also, a cut edit can look quite different in a multilayering environment. Instead of putting all clips in a sequence in a single layer, it is often much more convenient to place them separately:

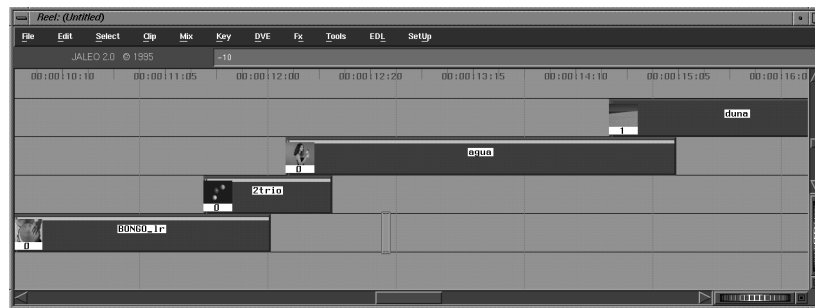


FIGURE 12. Edit, Multilayer Style

By placing each clip of the edit sequence in a separate layer, many edit operations become much more transparent and easier to maintain: It is always possible to add effects, replace clips with multilayer composition sets of any complexity, shift and trim selectively and so forth. By providing an efficient collection of selection commands, one can select all to the right, all to the left, all above or all below a pick position with a single keystroke, in effect transforming a multilayer edit into a simple move operation involving any number of clips.

For example, to trim an edit (in opposition to trimming a clip) it is often sufficient to simply move a clip (or complex clip selection) with the mouse or the keyboard. There is no need to switch to special edit modes. Very complex edits involving not only many cuts but also many layers of special effects can be handled by applying one or two edit commands in sequence to the same selection set. A typical case is for example a move followed by a trim. This is accomplished with very few keystrokes, yet it is more flexible than the editing and trimming modes found in typical NLE editors. Quick keyboard commands guarantee fast operation of simple editing, while complex composites follow the same concepts naturally.

In the multilayer environment, editing typically involves a selection of an edit position and the affected material, being just a keystroke for the vast majority of typical operations. Then, a sequence of simple editing commands can be applied to the selections, allowing you to move, trim and shift (or whatever operations you desire) even very complex edits with great ease. By using the opportunities provided by multiple layers and the truly nondestructive editing of the Jaleo environment, nonlinear editing can be accomplished in an efficient and intuitive manner.

1.5 Digital Media Usage

Jaleo has been designed to facilitate interactive editing, special effects production and compositing. As the accent is on *interactive*, it was an important goal to reduce waiting time for excessive processing during the work session as much as possible, and to enable the user to change the editing decisions at any time. No parameter setting or effects setup in Jaleo ever needs to be applied permanently to the material unless the user explicitly decides to do so. Layout work can be done with dummy material, easily replaced at a later stage by the final

production footage. Effect templates can be preproduced and applied to new productions at any time.

1.5.1 Hardware Requirement

Jaleo will operate on a wide range of hardware configurations. Instead of imposing architectural constraints, Jaleo scales well from small platforms with limited resources up to the most powerful multiprocessor systems. Availability of features in Jaleo is not dependent on available hardware resources, and in most cases not even the preview performance is affected seriously: If not enough performance is available to operate with a satisfying level of interactivity, the system can be configured with a lower level of preview quality. Also, Jaleo can use either normal disks setup for standard UNIX filesystem operation, or special raw device setups that increase performance significantly. See the section on raw devices below (“Raw Device Storage” on page 38).

1.5.2 Material and Processing

Jaleo can operate on any kind of digitized imagery. Uncompressed CCIR601-quality material can be used together with JPEG compressed imagery in various grades of quality. Dependent on the available hardware, users can thus optimally utilize their available hardware. For example:

- Layout production can be done with compressed material, and final production with full-resolution CCIR 601 material.
- Large stretches of a industrial documentation movie may not need advanced compositing: here, compressed quality is sufficient. However, there are some shots that require application of a quality chroma key, not possible using JPEG compressed material. In the same production project, both compressed and uncompressed material may be freely mixed and rendered to a common end product.

While working on a project, a highly responsive system is desired. To maintain this responsiveness, Jaleo uses reduced quality preview versions of the media material. While scrolling through the arrangement in production, for previewing or for effect adjustments, by default the preview material is used. This allows for real time response typically without any or with very small waiting times for previews – as effects can be layered to any desired degree of complexity, it is impossible to eliminate all rendering, given a limited amount of processing power. A caching mechanism can be used though to further minimize wait times.

As the quality of the preview can be adjusted to match the capabilities of the available hardware setup, optimal balance between quality and interactivity can be reached. At all times a snapshot of the original materials can be viewed in full quality, using exactly the same processing as the final render process. Once the arrangement is completed, the Jaleo renderer is called to process all effects and to create the final production.

On small machines, preview resolution is typically a quarter of the original material. On multiprocessor machines, half-size and full size preview are possible.

If high capacity hard disk recorders are used, the preview imagery mechanism has another advantage – the original images can remain on the hard disk recorder and need not to be downloaded on local disk drives. Only the preview material needs to be readily available. Whenever a full size snapshot or a render process is initiated, the material will be fetched automatically from the external device.

The preview material is created automatically by the Jaleo IO driver system. Here, material can be captured using either hard disk recorders or real time IO hardware (like SIRIUS Video with appropriate disks, or Galileo and Cosmo Compress) built directly into the computer. Also, material can be converted from a variety of file formats. The IO subsystem, capable of processing a series of jobs in a batch mode, is also used to execute render processes and to store the results either on disk or directly on any other supported IO device.

1.5.3 Clips and Image Data

Jaleo distinguishes clearly between the captured raw material and its instances actually used in reels. An instance, called a “clip”, contains references to the original media material and the generated preview material, and associated information like original timecode data, comments, markers etc. A clip does not contain any actual media material; clip files therefore are very small. (It is also possible that the same physical source material is referenced by a number of clips. In fact, every copy operation of a clip in Jaleo’s arrangement window creates a new instance referring the same source material.)

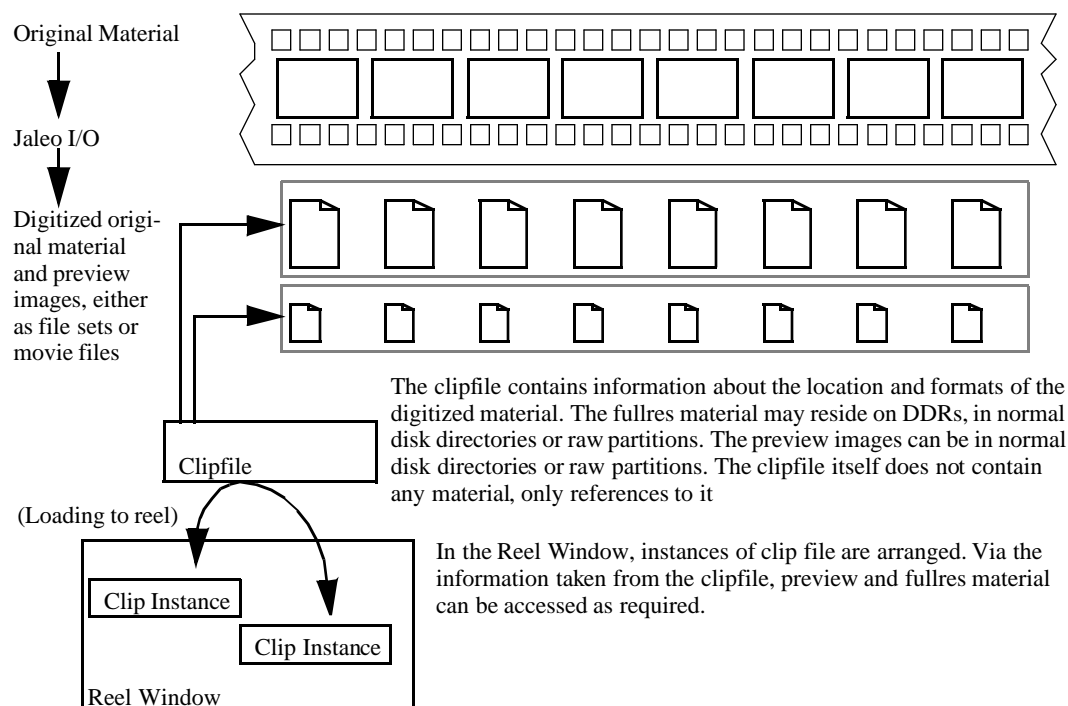


FIGURE 13. The Relationship between material and the clip file

By default, a clip uses the full extent of the captured material. However, when the clip is placed in an arrangement, head and tail of the clip can be readjusted. For every new instance (or copy) of the clip, these in- and out-positions can of be set independently. Based on this mechanism, Jaleo provides powerful editing functions, like trimming, shifting, alignment and extension.

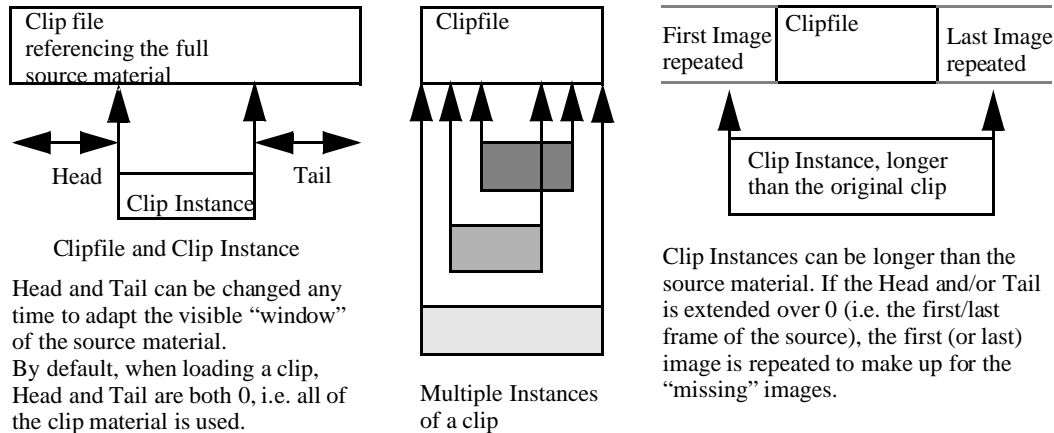


FIGURE 14. Heads and Tails

The clip definition puts a degree of indirection between the image material and its appearance in the reel. From a captured sequence of material, any portion can be used, and different portions can be used without the need to duplicate material. Also, the original material can be replaced, and there will be no need to change any "users" of the clips referring this material. In fact, the only time the user needs to be concerned with the original material is when it is originally captured in the IO subsystem. Here, the associated preview files are generated and the clip description is prepared and stored in a clip file. Further on, only the clip file is used.

Whenever a clip file is loaded into a Reel Window, a new and independent instance of the clip is generated. This instance has its own in- and out point, instance name, text comments and so on (these can be set and modified in the Attribute Window). All copy operations in the reel, and some edit operations like Split, produce new clip instances that refer to the same image source material. When an arrangement is saved to a Jaleo environment file, all the clip instances actually present in the reel are saved to this file as well. It is also possible to save any clip instance from the reel into a separate clip file.

As loading a clip file into the reel produces a new instance, the original clip file could be deleted without negative effects on the project. However, the image source files, should be maintained as long as there are clip copies that reference them.

1.5.4 Raw Device Storage

Jaleo supports raw device storage of source data and preview images. Raw devices do not have the considerable overhead of the UNIX filesystem, and thus offer considerable performance benefits. This section explains raw devices – refer to the installation and setup manual for a description how to create and maintain them.

Imagine a disk drive as a large empty warehouse. Empty means empty, without walls, or shelves. Before you can store anything with this warehouse, you will at least need some walls inside. For a disk drive, these walls are the disk partitions, normally created with the low level tools like SGI's `fx`. At least one wall, shielding the infrastructure (furnace, etc.) from the actual usable space, will always be needed, and so even the most basic disk partitioning always will have to create a volume header (the furnace) and at least a single partition (the walls).

Then, with the walls installed, one will need storage shelves. And this is where the difference between UNIX file systems and raw devices comes in. A UNIX file system needs shelves to support all kinds of goods coming in, in any size, mixed in any way, accessible by anyone who happens to pass by. The shelves are an ingenious construction in their flexibility, but they happen to have a lot of overhead if only a single type of goods, with a fixed size is to be stored or retrieved quickly. The shelves used by SGI's IRIS are called efs, for extended file system. After partitioning a disk, the `mkfs` operating system command is used to create the efs shelves.

Raw devices, in contrast, by default have no shelves at all. An application using the raw devices is, so to speak, renting the warehouse without shelves. It has to see itself how to organize the space. To deal with images with the highest possible speed, they will be stored in the raw device in a plain format, one after the other, all the same size, in the manner of stacked standard boxes on special shelves, built for fastest delivery.

Jaleo supports raw devices for both source images and preview data. Of course, it is also possible to store the preview data on normal disks, or to have the source images on an external DDR to save space. The configuration can be adapted to the available hardware and to the requirements of the current project, to fine tune performance and to deliver speed where it is required.

On multiprocessor systems, the raw device capabilities are of special importance. If the raw device is created from multiple disk drives, performance can be increased to a rate where real time IO of full size uncompressed video images is possible. These drive collections are called logical volumes. In the warehouse analogy, this means distributing the goods over multiple warehouses, allowing multiple boxes to be retrieved concurrently. For realtime performance, at least 12 fast disk drives connected to 4 controllers are required. A collection of disks controlled as one large single device is called a "logical volume", because it creates a logical entity from a number of discreet physical ones. The distribution of data between the disks is called "striping". Logical volumes for efs or raw device usage can be created using SGI tools (`mklv`, `lvinit` etc.).

Alternatively, an external disk array (for example RAID systems) can be used, which manages the disk collection and appears to the host machine like a single large drive. RAID arrays offer various levels of redundancy and downtime prevention, i.e. increased security. Although the video data on single devices normally can be reconstructed easily from the source tapes, downtime due to drive failure can be critical in a production. In these cases, the considerable price for RAID arrays may be a sensible investment.

