# ARRILASER

# Instruction Manual

As of: May 2005

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## 2.1 Disclaimer

Before using the products described in this manual be sure to read and understand all respective instructions. The ARRILASER is only available for commercial customers. The customer grants by utilization, that the ARRILASER or other components of the system are only deployed for commercial use. Otherwise the customer has the obligation to contact ARRI preceding the utilization.

While ARRI endeavors to enhance the quality, reliability and safety of their products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in the products, customers must incorporate sufficient safety measures in their work with the system and have to heed the statuted canonic use.

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In the case one or all of the forgoing clauses are not allowed by applicable law, the fullest extent permissible clauses by applicable law are validated.

ARRI is a registered trademark of Arnold & Richter Cine Technik GmbH & Co Betriebs KG.

# 2.2 General Safety Instructions

*Please always follow these instructions to help ensure against injury to yourself and damage to the system or other objects.*

*This safety information is additional to the product-specific operating instructions in general and must be strictly observed for safety reasons. They are no substitute to settled down your own safety measures.*

## Warning Signs

*Possible risk of injury or damage to equipment.*

*This symbol indicates the risk of electric shock or fire danger that could result in injury or equipment damage.*

## Safety Instructions

*Read and understand all safety and operating instructions before you operate or install the system.*

*Retain all safety and operating instructions for future reference.*

*Heed all warnings on the system and in the safety and operating instructions before you operate or install the system.Follow all installation and operating instructions.*

*Do not use accessories or attachments not recommended by ARRI, as they may cause hazards and void the warranty.*

*Do not repair any part of the system. Repairs must only be carried out by authorized ARRI repair shops.*

*Do not remove any safety measure of the system.*

*Do not operate the system in high humidity areas or expose it to water or moisture.*

*Do not place the system on an unstable cart. The system may fall, causing serious personal injury and damage to the system or other objects.*

*Operate the system using only the type of power source indicated in the manual. Unplug the power cord by gripping the power plug, not the cord.*

*Never insert objects of any kind into any part of the system through openings, as the objects may touch dangerous voltage points or short out parts. This could cause fire or electrical shock.*

*Unplug the system from the power outlet before opening any part of the system or before making any changes on the system, especially the attaching or removing of cables.*

*Do not use solvents to clean.*

*Clean optical surfaces only with a lens brush or a clean lens cloth! In case of solid dirt moisten a lens cloth with pure alcohol.*

*Do not loosen any screws which are painted over!*

## 2.3 Laser Safety

*Caution:*
*Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure.*

*Service may only be carried out by trained ARRI service personnel.*

*Caution:*
*Do not remove any screws or any part of the housing as laser radiation may be emitted. The protective housing is to be opened by trained ARRI service personnel only. Protective glasses have to be worn for protection against the laser light by service personnel and all other persons present.*

*Check unit in regular intervals for any damage, wear or changes to the housing which could result in exposure to laser light. In this case, immediately contact the ARRI service personnel and do not operate the unit.*

The housing contains visible and invisible laser light of the following wavelength and power:

- 25 mW or less at between 630nm and 670nm;
- 20 mW or less at between 520 and 550 nm;
- 10 mW or less at between 430 and 480 nm;
- 2 mW at 780 nm.

*Avoid exposure to the laser light at all times.*

# 2.4 General Safety

*Do not cover the fan outlets on the back of the ARRILASER and make sure that there is a distance of at least 10cm (=4 inches) between the fan outlets and the wall.*

*Caution:*
*Do not open the rear doors without the power cord unplugged, even when the power switch is turned off. The rear doors are to be opened by trained service personnel only.*

For cleaning the camera push the 'cleaning' button and wait until the sliding carriage moves to the cleaning position [*see chapter 4.2.6*].

*Caution: Be careful while cleaning the camera and keep fingers clear of moving parts as injury might occur. The maximum force of the sliding carriage is limited to 60N.*

*Caution: Camera can be damaged by electro-statical discharge (ESD). Take adequate measures when inner cover is opened for cleaning! (Wear ESD wristlet)*

*To avoid edge flare in the middle of an exposure sequence, there must not be standby times within this sequence (e. g. through recording errors etc.) longer than 5 hours.*

**Mains voltage range:**
The ARRILASER can be operated at two different mains voltage ranges:
200-240V, 50/60Hz, Fuse: 6.3AT, or
100-120V, 50/60Hz, Fuse: 10AT

The ARRILASER will be configured to the local mains voltage at installation. Any changes are to be performed by trained personnel only.

**Changing Fuses:**
- Unplug the mains connector before opening the fuse holder. Replace only with a fuse of the required rated current, voltage and specified type (slow blow).

# 2.5 Compliance with Regulations

This product conforms to 21 CFR 1040.10 & 1040.11, to IEC825-1:1993 and to EN60825-1:1994 at the date of manufacture.

The ARRILASER contains Class II and Class IIIb Lasers according to 21 CFR 1040.10, Class 2 and Class 3 Lasers according to IEC825-1 and EN60825-1.

The ARRILASER is a Class I Laser product according to 21 CFR 1040.10, a Class 1 Laser product according to IEC825-1 and EN60825-1.

**US, Japan:**
This equipment has been tested and found to comply with the limits for a Class A digital device according to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference with radio communication. Operation of this equipment in residential areas is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

**Europe:**
This product has been tested and found to comply with the limits for a class A ITE device according to EN55022:1994.

*Warning:*
*This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.*

This product and the accessories recommended by the manufacturer fulfill the specifications of the EU-Guideline 73/23/EEC, 93/68/EEC, and 89/336/EEC, 92/31/EEC, 93/68/EEC.

# 2.6 Labels

ARNOLD & RICHTER CINE TECHNIK
GMBH & BETRIEBS KG
TÜRKENSTR. 89 D-80799 MÜNCHEN
Model: ARRILASER 35
Ident.Nr.: D0.11350.C Ser.Nr.: 011
Manufactured: September 1999
100-120Vac/200-240Vac 50/60 Hz
6/3A Fuse 6,3/10AT CE

ARRI

*ARNOLD & RICHTER CINE TECHNIK*
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Model: ARRILASER 35
Ident.Nr.: D0.11350.C Ser.Nr.: 011
Manufactured: September 1999
*Made in Germany* 100-120Vac/200-240Vac 50/60 Hz
6/3A Fuse 6,3/10AT
CE

Product conforms to 21
CFR 1040.10 & 1040.11 and
to IEC 825-1 at the date
of manufacture

**ID/Certification Labels**
Placed on the bottom left corner of the rear frame, next to the main power switch.

**Camera: ESD-Warning and injury warning**

*Warning! Injury may be caused by moving parts!*

Placed inside camera housing.
Visible when camera lid is open.

Warning! Injury may be
caused by moving parts!

**Non-Interlocked Protective Housing Label - Visible Energy**

Placed on each of the lids, which are mounted by screws on the main optical compartment.

DANGER
Laser light when open
AVOID DIRECT EXPOSURE
TO BEAM

Placed on the rear of the protective housing, which covers the scanner, behind the camera; inside the scanner housing, close to the beam path.

**DANGER**
Laser light when open
AVOID DIRECT EXPOSURE TO BEAM

**DANGER**
Invisible laser radiation when open
AVOID DIRECT EXPOSURE TO BEAM

**Non-Interlocked Protective Housing Label - IR Energy**

Placed inside the scanner housing, on the optical element in which the scanner is mounted.

DANGER
Laser light when open
and interlock defeated
AVOID DIRECT EXPOSURE TO
BEAM

**Defeatably-Interlocked Protective Housing Label - Visible Energy**

Placed in the center of the camera door on the outside.

**DANGER**
Laser light when open and interlock defeated
AVOID DIRECT EXPOSURE TO BEAM

Placed in the center of the camera door on the inside.

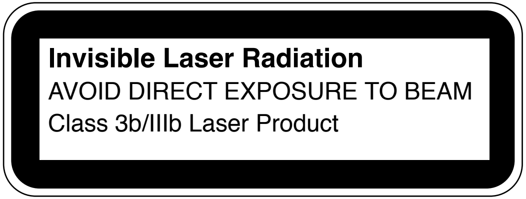
**Internal Laser Protective Housing Label - Visible Energy**

Placed inside the optics cabinet, on or close to the red and green laser.


Placed inside the optics cabinet, on or close to the blue laser.

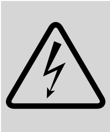

**Internal Laser Protective Housing Label - Invisible Energy**

Placed inside the scanner housing, on the optical element in which the scanner is mounted.




**Warning Sign Electrical Danger**

Placed on the outside of the left rear door.



# 2.7 About this Manual

Text that should be typed in the computer is in the `Courier` font.

When the instruction manual advices you to type a command, it is implied that you should press the return key afterwards.

Note: Basic functions are described first in each chapter, followed by the description for the experienced users. Make sure, not to make changes or settings in a mode that you do not completely understand.

➪ **photo** indicates objects shown in graphics or pictures.

# 3 Introduction

## 3.1 Key Features

The ARRILASER system is a laser film recorder designed to record digital image files onto 35 mm motion picture film with an optional resolution of 4K or 2K. It's proprietary optical, electronic and digital design and its state-of-the-art solid state lasers ensure that high quality images are recorded on film rapidly and reliably. Its revolutionary Auto Calibration System and service friendly design result in greatly improved productivity.

The ARRILASER System in its standard version has the following key features:

- Fast recording speeds of 1.7 seconds per frame at 2K resolution.
- High precision film movement to ensure perfect image registration.
- 1000´ or 2000′ Magazines
- Low power consumption due to the solid state lasers.
- Auto Calibration System monitors optical parameters and adjusts these automatically.
- Job control through a Graphical User Interface (GUI) and a Command Line Interface (CLIF);
- Visible control of recorded images with the ALICE-software (ARRILASER Interactive Configuration Editor)
- Support of various image file formats [*see chapter 10.1*];
- Image processing – a software implementation of basic image processing algorithms like cropping, flipping, scaling, sharpening. Image processing is designed to run on the fly during a normal recording sequence;
- Support of an Application Programming Interface (API);

# 3.2 Models

### 3.2.1 ARRILASER Speed Performance
High end model for recording of 2K and 4K files.

**Recording time:**

< 1.7 seconds per 2K frame (1:1.85)
< 2.2 seconds per 2K frame (full ap)
< 2.9 seconds per 4K frame (1:1.85)
< 3.8 seconds per 4K frame (full ap)

### 3.2.2 ARRILASER Speed twoK
Recording of 2K files only.

**Recording time:**

< 1.7 seconds per 2K frame (1:1.85)
< 2.2 seconds per 2K frame (full ap)

### 3.2.3 ARRILASER HD
ARRILASER model customized for video to film applications.
Recording on camera negative filmstock only.

**Recording time:**

< 1.7 seconds per 2K frame (1:1.85)
< 1.9 seconds per HD frame
< 2.2 seconds per 2K frame (full ap)

# 3.3 Options

**ALICE**:
The ARRILASER Interactive Configuration Editor gives a visual control over the whole image processing and offers the fastest, easiest and safest way to generate an image processing configuration [*see chapter 5.3*].

**CMS**:
The ARRI Color Management for videolook offers the possibility to match the colors of the film projection perfectly with the colors of a video monitor as part of the ARRILASER image processing [*see chapter 6.4*].

**Camera Negative**:
The camera negative option enables the ARRILASER to shoot also on camera negative film stock [*see chapter 6.2.4*].

**HD Module**:
software plug-in that allows recording of native 1920 pixel per line (HD files) for full aperture and academy formats without rescaling.

**Native Academy Module**:
software plug-in that allows recording of 2048 or 4096 pixel across the academy area without rescaling.

**3Perforation option**:
recording of 3 Perforation hight images


ARRILASER film recorder

# 3.4 System Components

### Host Computer

The host computer ➪ **photo** receives image data files from a digital storage medium, prepares them for recording and sends them to the film recorder. On the host computer the operator controls which files are to be recorded and when recording starts and stops.

### Film Recorder

Inside the film recorder ➪ **photo**, three laser beams (red, green and blue) are being varied in their intensity by the image data. The three beams are then combined into one beam, which is focused on the film to expose the image pixel by pixel.

The electronics module ➪ **photo** contains the power supplies and control electronics for the lasers, the AOMs (accousto-optical-modulators) and drive electronics of the film recorder. Accessible through a pull-out tray in the electronics module is the internal control computer (ICC) used for set-up and maintenance.

The optics module ➪ **photo** contains the lasers, as well as shutters, attenuators, accousto-optic modulators, mirrors, sensors and other optical and electronic elements.

The laser light travels from the optics module up into the scanner module ➪ **photo**, where it is focused and scanned onto the film. The scanner writes the image onto film, one line at a time.

Unexposed film travels from the feed magazine ➪ **photo** through the camera ➪ **photo**, where the film is slowly moved past the line drawn by the scanner. The exposed film is wound up inside the take-up magazine.

# 3.5 ARRILASER HD System Components

On the ARRILASER HD the host computer is integrated in the housing of the film recorder ➪ **photo** and combined with the internal control computer. Access to the connections of the host computer is possible via the back plane of the film recorder ➪ **photo**.

# 3.6 Status on Delivery

During the delivery the ARRILASER is initially set up, calibrated and then ready to be operated.

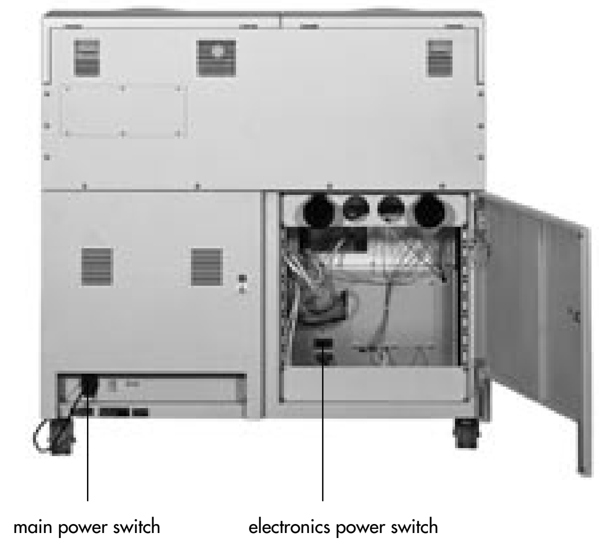
# 4 Hardware Operation

## 4.1 Start-up, Stand-by and Power-Down

### 4.1.1 Start-Up

Turn main power switch ➪ **photo** on.

- Check that the film recorder electronics power switch ➪ **photo** is on. This switch can be left in the 'on' position at all times. The main power switch also turns the green and the blue laser on.




laptop
(internal control computer)
ARRI
blue laser
key switch
red laser

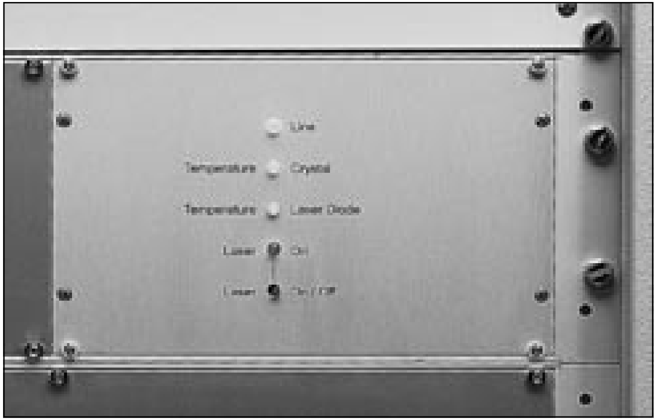
- To turn the red laser on, open the right front door ➪ **photo**. Turn the key clockwise to the 12:00 o'clock position. The 'LASER ON' LED   photo should turn green. This indicates that the red laser is now operational.

- Pull the laptop tray out and open the laptop ➪ **photo**. Push the laptop power switch on the left side of the laptop. When you see the login dialog press <control> + <alt> + <delete>.

- In the next dialog enter the username 'admin'. The password is 'laserservice', then click the OK button. To start the 'CARMILLE ARRILASER (OP)' program (carmille from here on) doubleclick on the carmille icon. This will initialize the film recorder electronics and set-up parameters. Close the laptop, push it back into the housing and close the front doors, locking them with the key provided.

- Turn the ARRILASER host computer on.
  Login as 'Administrator'.
  There is no password, so click the OK button.

- Follow the advices of chapter 5 to set up a recording job.



Note: The start-up takes about 5 minutes in total. After a longer pause, the system should only be used for production after a warm-up time of about 30 minutes.

## 4.1.2 Start-Up on ARRILASER HD

Turn main power switch ➪ **photo** on.

- Check that the film recorder electronics power switch ➪ **photo** is on. This switch can be left in the 'on' position at all times.
  The main power switch also turns all lasers on.

- Open the right door of the electronics module and switch on the computer ➪ **photo**. Switch on the monitor. When you see the login dialog press <control> + <alt> + <delete>.

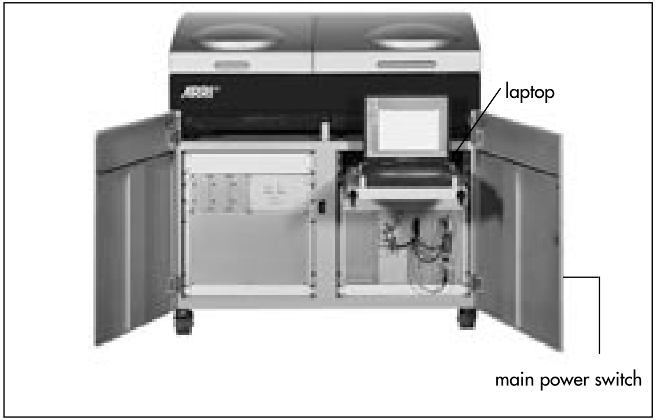
- In the next dialog enter the username 'admin'. The password is 'laserservice', then click the OK button. To start the 'CARMILLE ARRILASER (OP)' program (carmille from here on) doubleclick on the carmille icon. This will initialize the film recorder electronics and set-up parameters.

- Follow the advices of chapter 5 to set up a recording job

Note: The start-up takes about 5 minutes in total. After a longer pause, the system should only be used for production after a warm-up time of about 30 minutes.

## 4.1.3 Standby

When powered up and in standby, the ARRILASER film recorder will continuously monitor the laser beam strength. A clicking noise (the opening and closing of the shutters) is heard which is normal when the recorder is in standby. It is recommended to keep the ARRILASER in standby mode at all times. A 1kHz sound is heard caused by the fast rotating scanner motor.



## 4.1.4 Power-Down

Note: In general, the ARRILASER system should stay powered up all the time.

If it is necessary to shut the whole system down for service, follow these steps:

- Open the front doors ➪ **photo**, unlocking them with the key provided. Open the laptop ➪ **photo**.
- If the screen is dark, hit any key to restart the display. Close all current applications ('File' - 'Quit'; or button in top right corner).
- In the 'Start' menu select 'Shut Down'. Confirm the shut down procedure by pressing the 'Yes' button. The laptop will turn itself off automatically.
- Turn off the main power switch on the bottom rear panel of the machine ➪ **photo**.

## 4.1.5 Power-Down on ARRILASER HD

Note: In general, the ARRILASER system should stay powered up all the time.

If it is necessary to shut the whole system down for service, follow these steps:

- Close all current applications on the computer. ('File' - 'Quit'; or button in top right corner).
- In the 'Start' menu select 'Shut Down'. Confirm the shut down procedure by pressing the 'Yes' button. The computer will turn itself off automatically.
- Turn off the main power switch on the bottom rear panel of the machine ➪ **photo**.

# 4.2 Camera Operation

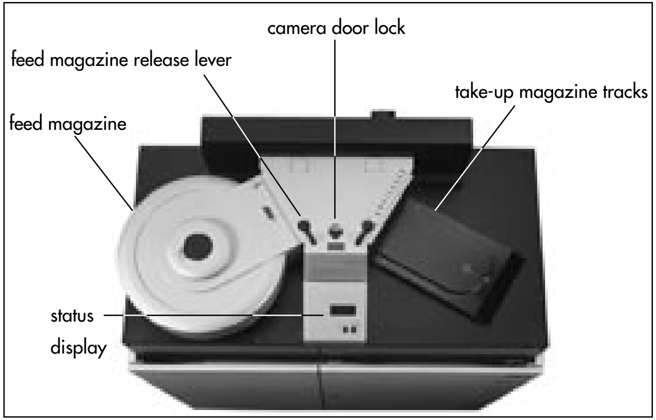
For supported filmstocks see *chapter 10.2.*

**Notes about the magazines:**

⚠ *Caution:*
*keep clear of all moving parts while the film recorder is in operation. These are: the film gate, sprocket wheels and magazines.*

The ARRILASER magazines can be used on the feed side as well as on the take-up side. The magazines and the auto-feed mechanism will work with 2″ or 3″ film cores with the 1000 ft magazine. The 2000 ft magazines will only work with 3″ cores. The standard magazine is the 2000 ft version.

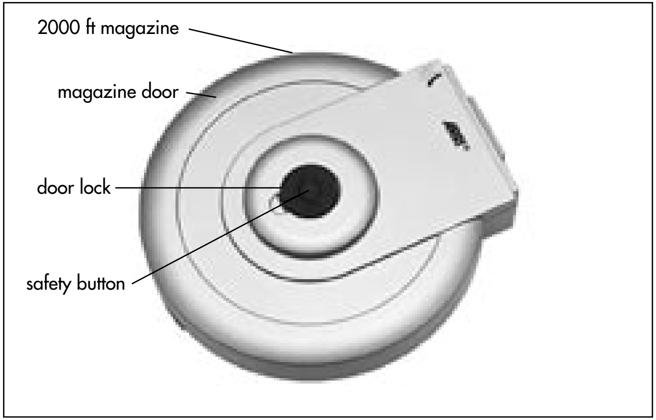
The film stock indicator displays the amount of stock left in meters. It will only give the correct readings if used with a 2″ core on a 1000 foot magazine, and with a 3″ core on the 2000 ft magazines.

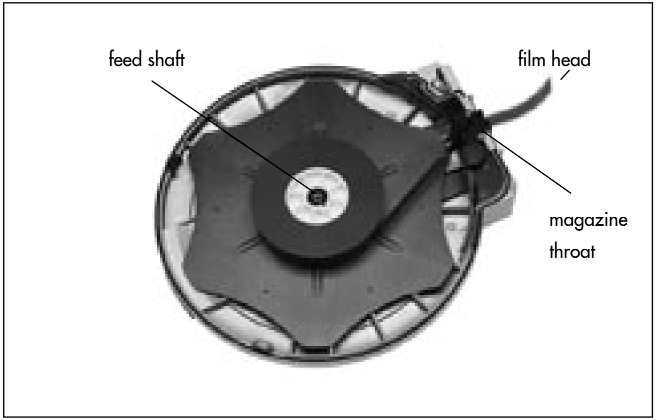



## 4.2.1 Loading the Feed Magazine

- To remove the feed magazine from the film recorder, open the camera door ➪ **photo** by turning the camera door lock counter-clockwise, turn the feed magazine release lever ➪ **photo** to the left and pull the magazine off the feed magazine track.

Note: Load film only in absolute dark, such as in a dark room or changing tent.




- Press the safety button ⇨ **photo** on the magazine door and flip the door lock ⇨ **photo** up. Turn it counter clockwise until it stops and remove the door.
- Remove the raw stock from the film container. Make sure that the tape is completely removed.
- Place the film on the feed shaft ⇨ **photo** of the magazine as illustrated (the film is wound counter-clockwise around the core).
- Unwind some film and slide the film head into the magazine film throat ⇨ **photo**, leaving film protruding from the magazine.
- Place the magazine door back on the magazine and lock it. Double check by pulling up on the door.

## 4.2.2 Manual Film Threading

Note: The camera status display ➪ **photo** will continually provide useful information during the threading process.

- Open the camera door by lifting the camera door lock ➪ **photo** and turning it counter-clock wise.
  The film gate will automatically move into the threading position.

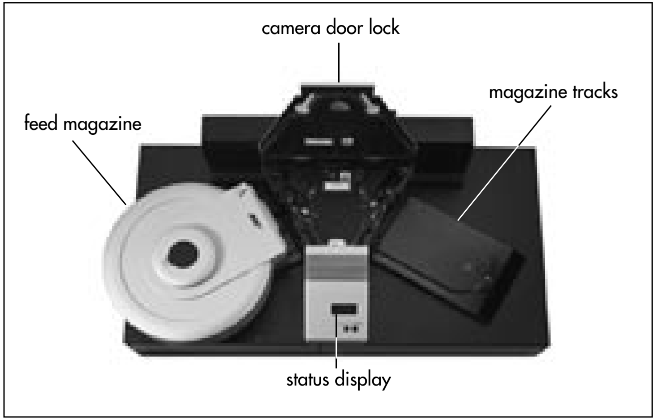
- The camera display indicates the camera status: 'Load Feed Mag'

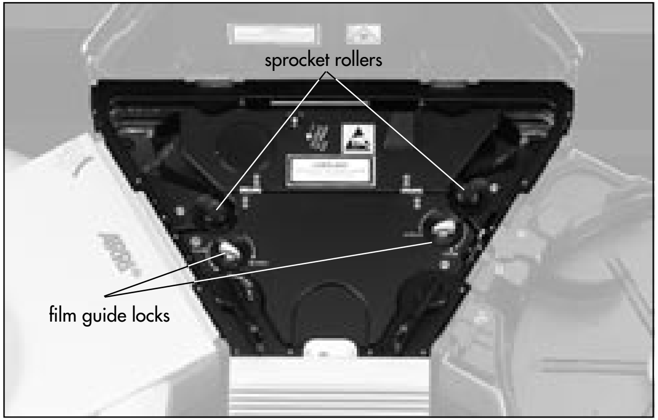
- Place the loaded feed magazine gently on the feed magazine guide rail.

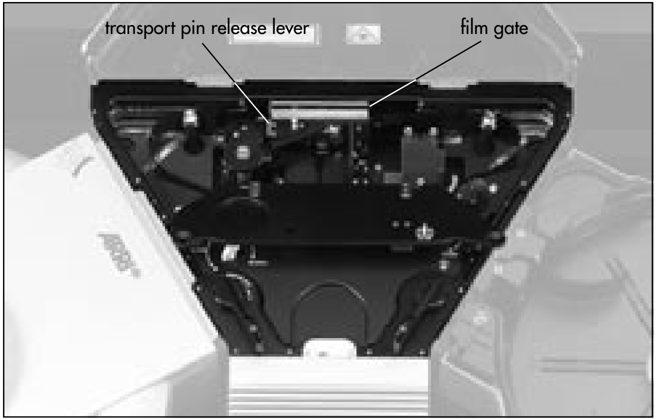
- Pull about three feet (1 m) of film out of the feed magazine and lay it loosely in the film path in the camera.

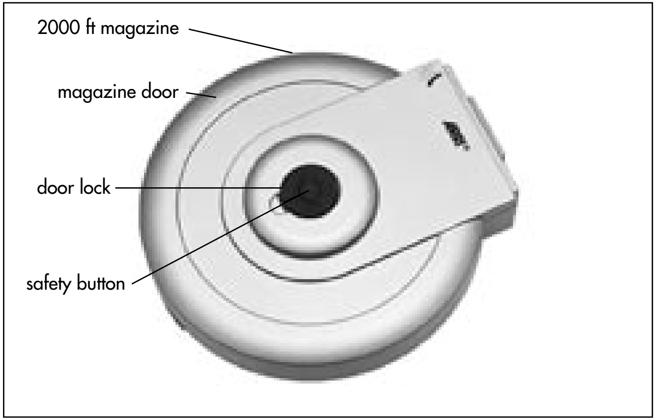
- Open the film guides on both the feed and take-up sprocket roller ➪ **photo**.

- Guiding the film through the camera mouth on the feed side, lay it around the feed sprocket roller.






- Slide the feed magazine towards the camera until it locks in place.

*Make sure not to trap the film between the magazine and the camera.*

- Loop the film loosely around the roller on the left-hand side of the film gate.

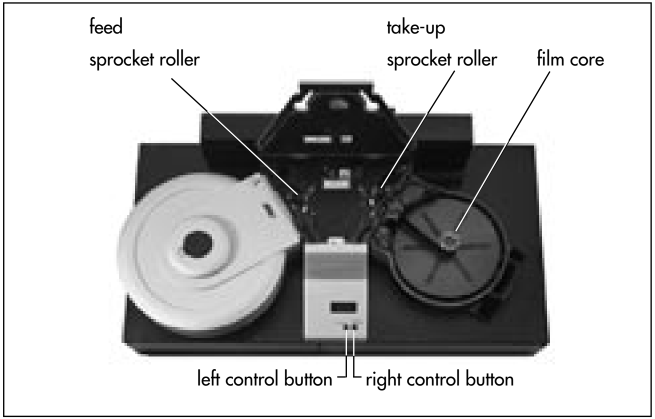
- Pull the transport pin release lever on the film shuttle ➪ **photo** towards you and place the film into the film gate ➪ **photo**. Gently lower the transport pins onto the film. Let the transport pins find their way into the perforations by moving the film back and forth. A mechanical 'click' will be heard as the transport pins lock the film into place.

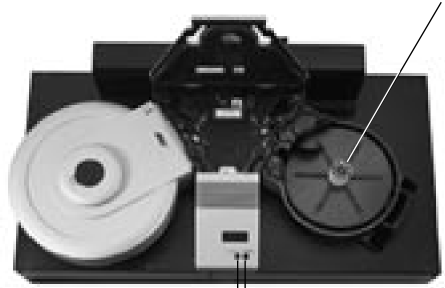
- The camera display indicates the camera status: 'Load Take-Up Mag'

- Place the take-up magazine on the take-up guide rail and slide it towards the camera until it locks into place.

- Press the safety button on the take-up magazine door and flip the door lock up. Turn it counter clockwise and remove the door.

- Loop the film loosely around the roller on the right-hand side of the film gate ➪ **photo**.
- Place the film around the take-up sprocket wheel ➪ **photo** and guide it through the camera mouth on the take-up side and into the opened magazine.
- Wrap the film head anti-clockwise around the film core ➪ **photo**. Ensure that the film is tightly wound around the core.
- The camera display indicates the camera status: 'Close Film Guide'
- Ensure that the film is placed correctly on the sprockets. Then close the film guides on both the feed and take-up sprocket wheels by turning the silver knobs ➪ **photo** anti-clockwise, until you feel the film guides lock.
- The camera display indicates the camera status: 'Adjust Loop Size'
- By pushing down on the sprocket wheels the loop size can be individually adjusted. The status display will indicate the direction in which the loop has to be adjusted. The display will show 'OK' for the left and right side when the loops are correctly adjusted.
- The camera display indicates the camera status: 'Local; Idle'
- Push the right control button ➪ **photo** to activate the camera.
- The camera display indicates the camera status: 'Local; Ready'
- To check the frame advance, push the control button on the right again.
- Replace the take-up magazine door and lock it. Close the camera door and lock it.






### 4.2.3 Threading with Auto-Feed

Note: When guiding the film through the magazine mouth and into the take-up mag, there is no need to wrap the film around the core when using auto-feed.

- The camera display indicates the camera status: 'Idle; Local'
- Simply let the film head protrude into the take-up magazine, close and lock the magazine door.
- Press the control button ➪ **photo** on the right.
- The camera display indicates the camera status: 'Auto Feed'
- The film will feed into the take-up magazine automatically and wrap itself tightly around the film core.
- The camera display indicates the camera status: 'Ready; Local'
- To test the frame advance, push the control button on the right again.

## 4.2.4 Unloading the Take-up Magazine

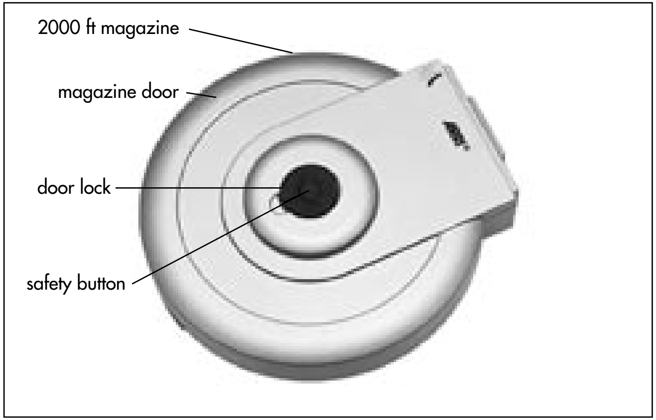
Note: It is a good idea to clean each magazine every time film is taken out. You can use a stiff brush and/or compressed air to clean the magazine interior.

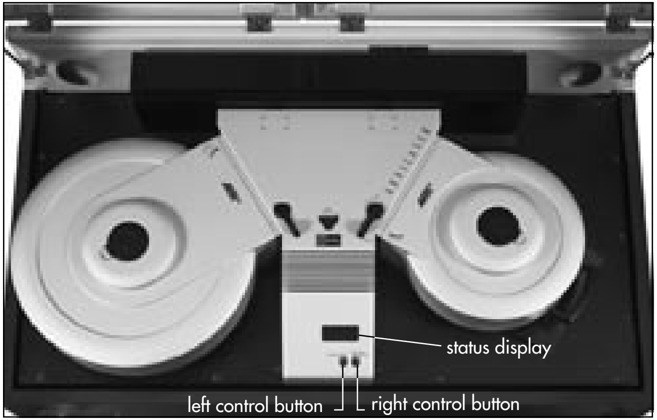
- To remove the take-up magazine from the film recorder after a recording job has been completed or the magazine is full, turn the feed magazine release lever photo all the way to the right. This will cut the film and release the magazine.

Note: The following steps should be carried out only in absolute dark, such as in a dark room or changing tent.

- Press the safety button ⇨ **photo** on the magazine door and flip the magazine door lock up ⇨ **photo**. Turn it counter clockwise until it stops and remove the door.

- Carefully remove the film from the magazine and place it in a black plastic bag, then into a film can which should be closed with tape around the lid.




## 4.2.5 Loading the Take-up Magazine with Auto-Feed

Note: If raw stock is still loaded and threaded inside the camera, there is no need to open the camera door when loading the take-up magazine.

Note: Remember to place a film core onto the shaft before attempting to auto-feed into the take-up magazine.

- Camera status: 'Load Take-Up Mag'
- Place the take-up magazine on the take-up guide rail ➪ **photo** and slide it towards the camera until it locks into place.
- Camera status: 'Idle; Local'
- Press the control button on the right ➪ **photo**.
- Camera status: 'Auto Feed'
- The film will feed into the take-up magazine automatically and wrap itself tightly around the film core.
- Camera status: 'Ready; Local'
- To test the frame advance, push the control button on the right photo again.

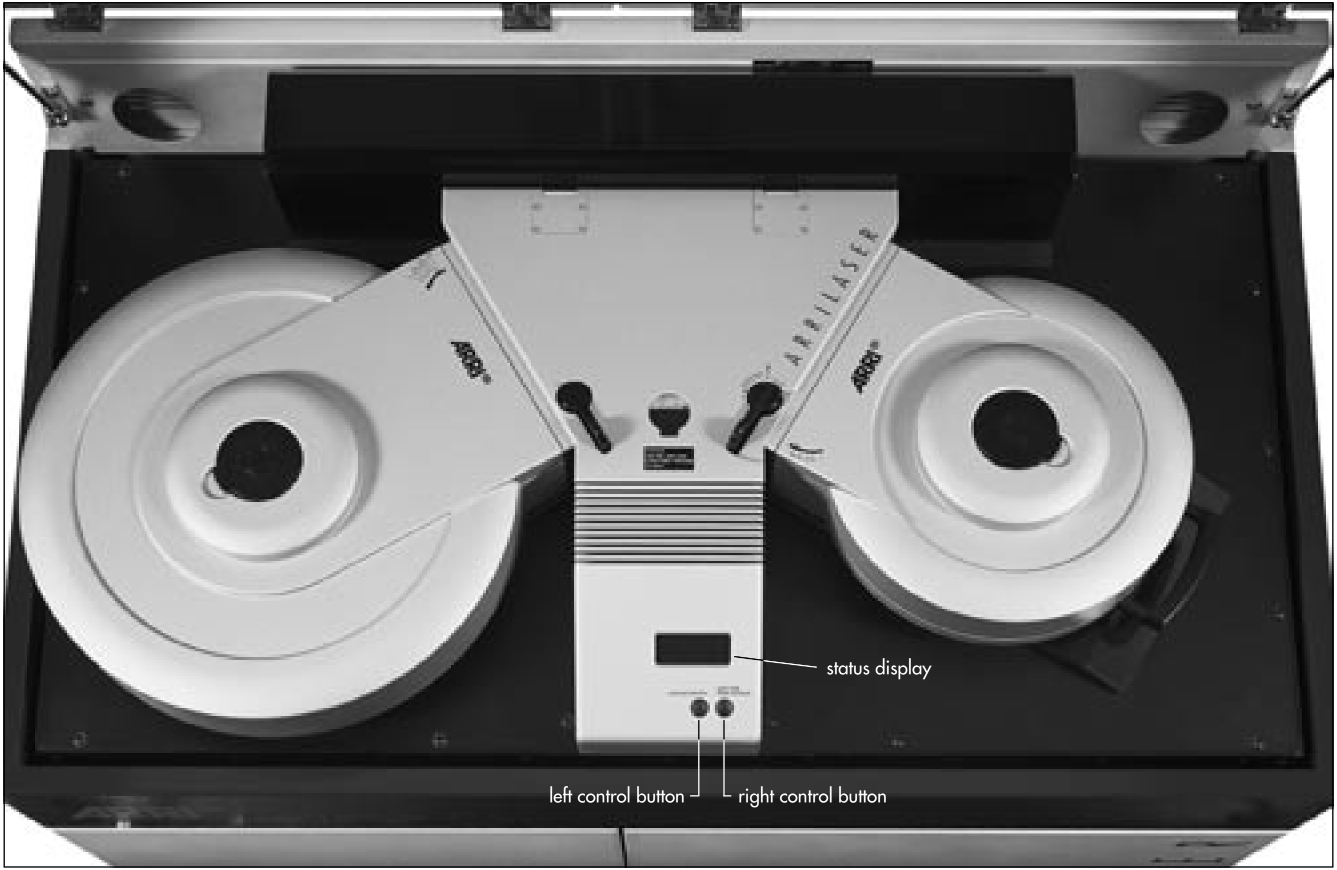
## 4.2.6 Cleaning the Gate

Note: Ideally, the gate should be cleaned before new raw stock is loaded, and when there is no film in the camera.

- Push the left control button to move the film gate into the cleaning position.
- Pull out the pressure plate ⇨ **photo**, which is held magnetically on the rear of the film gate. The pressure plate should only be removed when the shuttle is in the cleaning position.

⚠ *Do not use compressed air to blow out gate area, as this will only force small particles deeper into the gate area.*

- Clean the gate with a wooden skewer or a sticky tape and the pressure plate just with your finger making sure that no particles remain stuck on the material.
- Replace the pressure plate and push the left control button to move the shuttle back into the loading position. Ensure that two red dots on the pressure plate are always on the right-hand side.


ARRILASER
status display
left control button
right control button

## 4.2.7 Control Buttons

*Caution: When pushing any of the control buttons to move the film gate or engage auto-feed, keep hands clear of moving parts to avoid injury!*

The control buttons are only enabled, if the camera status is 'local'. For safety reasons the control buttons are disabled while the camera status is 'remote'. Releasing a magazine or opening the camera door sets the camera status to 'local'. Any camera operation from the host computer sets the camera status to 'remote'.

The two control buttons on the camera have the following functions:
LEFT – cleaning position:
toggle between the following positions

- move gate into cleaning position
- move gate into take-up position for film loading
- move gate into start position

RIGHT – the function of the right button depends on the camera status:

- auto-feed: thread film into take-up magazine
  (if camera status is 'local, idle')
- frame advance: advance film by one frame
  (if camera status is 'local, ready')

# 5 Software Operation

## 5.1 Execution Levels

To integrate the ARRILASER film recorder in a specific system environment, a hierarchical command level structure provides various operating levels for job executions.

Command levels of job execution are:

**Graphical User Interface (GUI)**
The GUI is the most comprehensive user interface for the ARRILASER. It is recommended for users who do not have to integrate the ARRILASER into their workflow on a 'programming level.'

The ARRILASER GUI implementation is Java based. One part of the GUI represents a job script builder. It generates a master script for every recording job, including shuttling and slates. The script control flow is integrated in the Java environment.

Progress monitoring and error handling is controlled by the GUI. There is a queue manager for job queuing, and a progress status report window shows how long the current job is still running.

**ALICE (ARRILASER Interactive Configuration Editor)**
The ALICE is an optional add on to the GUI software that offers the fastest, easiest and safest way for the configuration of image processing actions. It gives a visual control of the images to be recorded.

**Command Line Level (CLIF)**
The CLIF interface is recommended for experienced users who want to modify the provided shell scripts and adapt them to individual needs. Knowledge about C-shell programming is necessary.

CLIF, or command line interface, is the acronym for the software engine that drives the ARRILASER film recorder. The engine is implemented as a set of command line executables, which are communicating with a master daemon process. This daemon process controls the image data flow while running in the background. It synchronizes the communication with the film recorder and provides status information for all command line executables.

The daemon is running on the lowest level of the hierarchical command level structure to control machine status and memory. The CLIF commands are communicating with the daemon process. They can be called from a command prompt level.

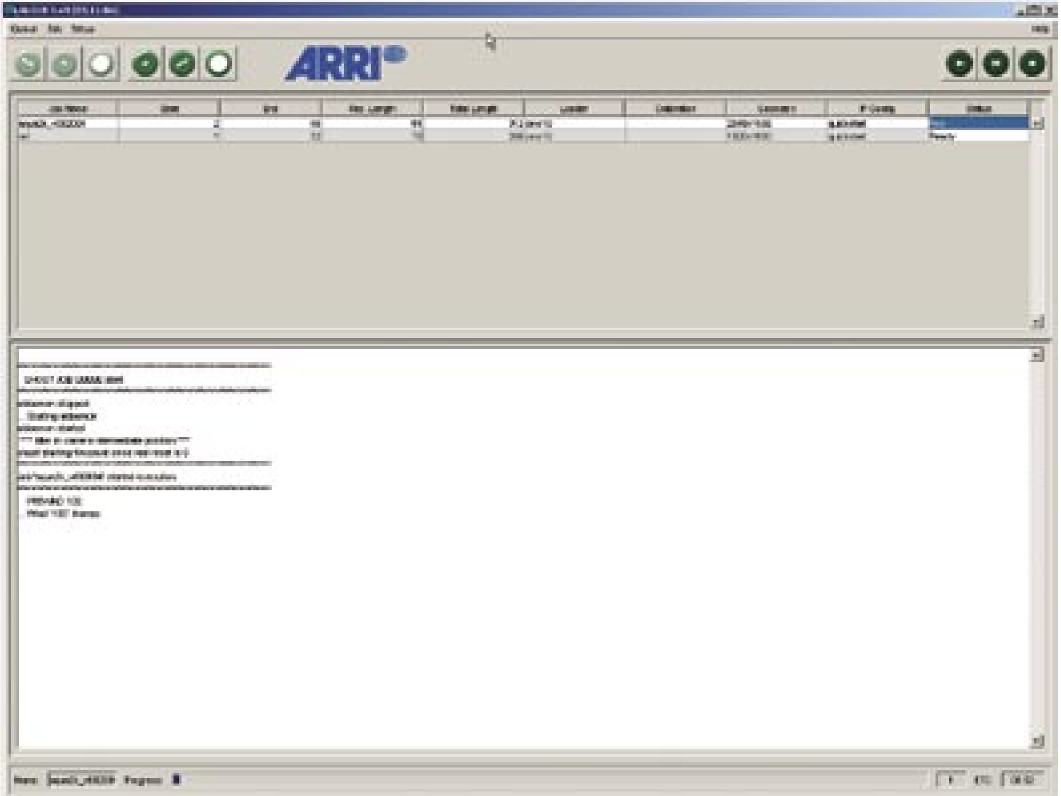
The CLIF version comes with a proposal for using a scripting hierarchy in a C-shell environment. The scripting hierarchy is mapped to directories within the CLIF software distribution tree. The files can be interpreted as sample scripts and customized with any word processor.

- Standard Scripts
  Several basic scripts are provided, performing tasks of shooting a sequence of frames and shooting a specific frame several times.

- Recording Scripts
  Recording scripts combine standard scripts into a job specific form, including black frames, slates or test frames.

- Queue Scripts
  A queue script lists several recording scripts, and determines the order they are processed in.

**Application Programming Interface (API)**
The API is intended for experienced users, who want to integrate the ARRILASER control and operation into their workflow on a program integration level.
Detailed documentation, object code of the API library and sample programs may be requested from the ARRI-headquarters service group.



# 5.2 ARRILASER Graphical User Interface (ALGUI)

To operate the ARRILASER film recorder, you can create and save shoot jobs, using the ALGUI Job Editor and (optional) ALICE the ARRILASER Interactive Configuration Editor.

The basic idea behind a shoot job is to define all steps of actions, needed to record an image sequence – including job completion or error notification handling – prior to the actual recording.

The ALGUI software provides functions to form a shoot queue. Job execution (including recorder calibration and the set up of designated recording options) is processed and controlled by the ALGUI queue manager.

## 5.2.1 Getting Started

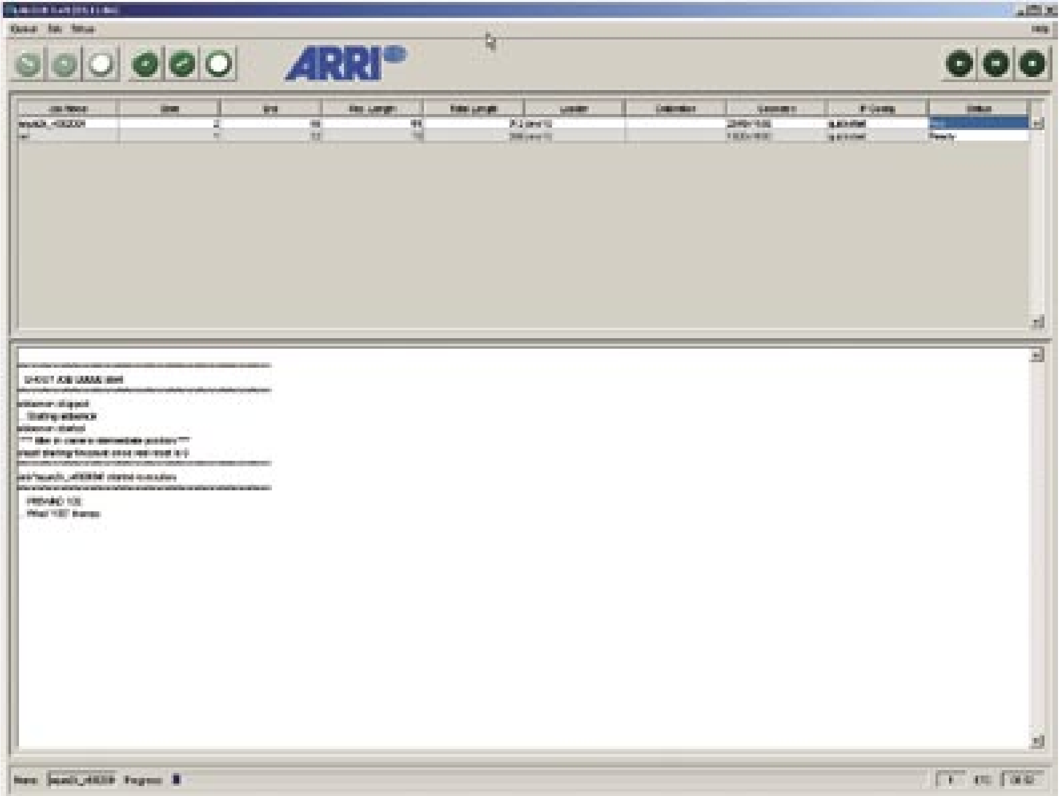
To start the ALGUI software click on the ALGUI desktop icon. This will open a C-Shell window showing ALGUI start up and default information. After the initialisation process the ALGUI window shows up.

*Warning: Please do not close the C-Shell window while the ALGUI is running.*

To start the GUI from a C-Shell enter the following command:

```
java -jar c:\algui\applet\algui.jar -q
```

The -q option enables the GUI to start with the Quickstart dialog.



## 5.2.2 Overview: The ALGUI Main Window

The following sections provide a description of the ALGUI window structure, and explain its menus, buttons and keyboard functions.

The ALGUI window shows the ALGUI menu bar, the ALGUI tool bar and the queue manager section.

The queue manager section is subdivided into the 'Queue Table', the 'Shoot Status' and the 'Shoot Job Progressing' area.

### The ALGUI Menu Bar

The ALGUI menu bar contains menus, which provide commands used for queue-, job- and setup configuration management. Click on a menu heading to reveal a drop-down menu of related commands.

**Queue menu items:**

- 'Add Queue':
  Opens a file browser to select a queue file.
  Jobs referenced by the queue file will be added/inserted to the shoot queue.

- 'Save':
  Opens a file browser to save the current shoot queue as queue file.

- 'Delete':
  Removes all job references from the current shoot queue.

- 'Exit':
  Presents a Yes/No dialog box to make sure you want to exit the application.
  On exit, the ALGUI window closes without saving the shoot queue.

**Job menu items:**

- 'New':
  Opens the 'Job Edit' window. The ALGUI job editor populates the input fields according to the settings, found in the 'default.job' file, which is located in the job directory.
  (To prevent the 'default.job' file from an accidentally overwriting, the job name is automatically set to 'Untitled'.)

- 'Add':
  Opens a file browser to add/insert job references to the shoot queue. The last inserted job is always set 'selected'. The browser window remains open to add several jobs into the shoot queue and can be closed by the cancel button.

- 'Delete':
  Removes the selected job reference from the shoot queue. If the shoot queue is empty, this function opens the delete file browser.

**Setup menu items**

- 'Calibration':
  Starts the 'Recorder Calibration Setup' window to maintain (add/edit/delete) calibration lookup tables and recorder calibration files.

- 'Geometry':
  Starts the 'Recorder Geometry' window to maintain (add/edit/delete) format files. A geometry format is used to set up image geometry parameters of the ARRILASER film recorder.

- 'Control':
  Starts the 'Control Job' window to maintain (add/edit/delete) control jobs. Control jobs are defined to be shot out before the image sequence.

- 'Image Processing':
  Starts the 'Image Processing' window to maintain (add, edit and delete) image processing configuration files. The files are used to define an image processing pipeline.

- 'Quickstart':
  Starts the 'Quickstart Dialog' to create job files derived from a reference job.

### The ALGUI Tool Bar

The tool bar is subdivided into three icon groups, providing the following commands:

- Shoot queue icons:
  The 'Add Queue',
  'Save Queue' and
  'Delete Queue' icons perform the same functions as the 'Queue' menu commands.

- Shoot job icons:
  The 'New Job',
  'Add Job' and
  'Delete Job' icons perform the same functions as the 'Job' menu commands.

- Shoot control icons:
  : 'Start/Restart' shooting the queue
  : 'Pause' shooting the queue.
  Click the 'Start/Restart' icon to restart shooting.
  : 'Stop' recording

**The ALGUI Queue Manager Section**

- 'Shoot Queue' table:
  Shows the shoot jobs to be recorded in the given sequence. Each line item in the 'Shoot Queue' table is representing one job, showing a job parameter subset ('Job Name', 'Start' and 'End' frame of the image sequence, 'Rec. Length' the number of all frames to be recorded, 'Total Length' which is 'Rec. Length' including winds, 'Loader' the name of the format conversion LUT, 'Calibration' indicating a calibration process, 'IP Config' indicating the usage of the Image Processing Software Engine) and the job's actual recording status ('Status').

The recording status of a job within the shoot queue could be:

- 'Ready': the job is ready to shoot.
- 'Skip': the job will be skipped during the shoot queue execution.
- 'Run': the shooting of the job is active.
- 'Finished ok': the job has been shot out successfully.
- 'Finished error': the job has been shot out completely, but an error occurred during job execution.
- 'Aborted': the job execution has been aborted by the user.
- 'Error': the job execution has been interrupted due to an error condition.
- 'Edit': the job is opened in the Job Edit window.
  In this status the job won't be recorded,
  the execution at this point stops and can only be restarted after the window is closed.

After the editing, the job status is set to 'Ready'.

The queue manager updates the current job status, but 'Status' is also an editable field.
Click on the field to reveal a drop down list where you can change the status of a job to 'Ready' or 'Skip' in order to restart the shooting.

- 'Shoot Status' area:
  Shows the queue manager output, logging the processed steps of action while executing the shoot queue. The area is cleared each time the queue manager starts shooting the queue. The same information can be found in the job log file, which is saved under 'c:\algui\config\logs'.

- 'Shoot Job Progressing' area:
  Shows the name of the current shoot job, a progress bar showing the percentage of the job's execution, the currently recorded frame number and the estimated time of completion (ETC).

**Keyboard shortcuts to navigate within the Queue Manager section**

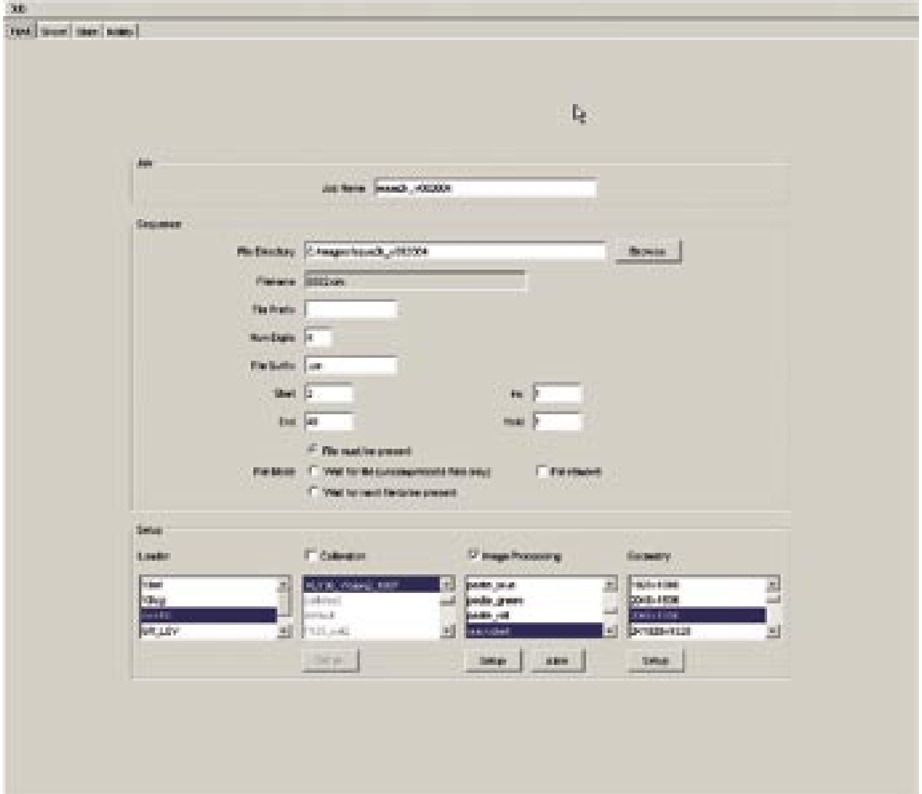
- 'Up' or 'Down' arrow key:
  Use the arrow keys to select the next or previous job within the shoot queue table.

- 'CTRL' + 'Up' or 'Down' arrow key:
  Move the selected job up and down the queue.

- 'CTRL' + 'E':
  Open the Job Edit window to edit the selected job.

- 'CTRL' + 'C':
  Copy the selected job reference.

- 'CTRL' + 'V':
  Paste a new job reference after the selected one.



## 5.2.3 Overview: The Job Edit Window

Creating or editing shoot jobs includes the entering of detailed information that will be saved as job file. This information is provided by the Job Edit window, which is divided into a series of 4 tab pages with parameter fields ready for your input.

### The Job Edit Menu

The 'Job' menu houses general commands for the job file handling and commands, related to the shoot queue management.

**Job menu items:**

- 'New':
  Resets all field entries within the Job Edit window to the definitions given by the default job.

- 'Open':
  Opens a file browser to select a job file. Selecting a job file will update the Job Edit window.

- 'Save':
  A validation check on the first frame is performed before saving the job. This means that the first frame of the input sequence must be available, a lookup table for the image format conversion and a suitable geometry format must be assigned. If image processing is enabled, the settings must fit to the definitions set by the geometry format. In case a shot slate is assigned, it must have the same format as image sequence. In case of errors, an appropriate message shows up, giving you the choice to cancel or to save the job.

- 'Save As'
  After the validation check (see 'Save' menu item) a file browser shows up to save the current job settings under a new job name.

- 'Replace':
  Replaces the selected queue job by the current job.

- 'Insert':
  Inserts the current job to the shoot queue preceding the selected queue job.

- 'Add':
  Adds the current job behind the selected shoot queue job.

- 'Append':
  Adds the current job to the end of the shoot queue.

- 'Quit':
  Closes the Job Edit window returning to the ALGUI window.

## The Input Tab Page

The Job Edit - Input tab page is divided into the 'Job', the 'Sequence' and the 'Setup' section.

Use the 'Job' section to enter a job name:

- 'Job Name':
  Input field, used to enter a job's name.

Use the 'Sequence' section to specify the image sequence together with additional recording options:

- 'File Directory':
  Represents the directory path where the image sequence is located.

- 'Browse':
  Click the button to open the 'Image Sequence' browser. If you select an image sequence the 'File Directory', 'File Prefix', 'Num Digits', 'File Suffix', 'Start' and 'End' fields are filled in accordingly.
  Browse in the tree view for the directory where the image sequence is located. Favorite directories or drives can be dragged into the shortcut panel left to the tree view. To remove favorites, use the right mouse button.
  In the 'sequence view', image information such as geometry, bit depth, image type, start/end-frame and sequence length is identified automatically. Incomplete sequences are identified with a warning icon and are displayed in red instead of green. Choose 'show image sequences only' to hide all non-image files.

- 'Filename':
  Represents the image sequence name. The filename is given by the 'File Prefix', the 'Num Digits' and the 'File Suffix' entries.

- 'File Prefix':
  Indicates the part of the filename prior to the image counter.

- 'Num Digits':
  Indicates the numbers of leading zeros within the file counter.

- 'File Suffix':
  Indicates the part of the filename succeeding image counter.

- 'Start':
  Use the field to specify the first frame to be recorded within the input sequence.

- 'End':
  Use the field to specify the last frame to be recorder within the input sequence.

- ‘Inc’:
  Edit the field if you want to skip a specific number of frames after each recorded frame. Otherwise the value should be ‘1’.

- ‘Hold’:
  Edit the field if you want to record each frame more than once. Otherwise the value should be ‘1’.

- ‘File Modes’:
  Select one of the following options to specify the preferred recording mode:

- Choose the ‘File must be present’ option, if all images are completely rendered in the specified file directory, and you want to provoke an error exception handling, in case one file is missing.

- Choose the ‘Wait for File’ option, if the sequence is not yet completed at the time of starting the job. The image size of each frame will be compared to the size of the first frame, before the file will be shot out. You cannot use this option, if you are working with compressed files.

- Choose the ‘Wait for File’ option, if the sequence is not yet completed, at the time of starting the job. The frame number ‘n’ will only be shot out, when frame number ‘n+1’ is in the folder. The last frame will be shot out after 10 min’s. This function may also be used for compressed files.

- ‘File remove’:
  Activate the check box, if you need the file to be removed from the disk after shooting in order to save disk space.

Use the 'Setup' section to assign format conversion, recorder calibration settings, configuration parameter for the image processing engine and geometry format setting:

- 'Loader' list:
  Each job must have a loader LUT assigned as this lookup table is necessary for the internal Cineon format conversion.
  After selecting an image sequence, using the Image Sequence browser, only the loader LUTs from the loader directory, which are corresponding to the bit depth of the images will appear in this list.
  Select a 1:1 lookup table if your files are already in the Cineon format or if you are going to use the ARRI Color Management System (CMS) for recording.
  Please *see chapter 6.3 Format Conversion* for further information regarding loader LUT selections.

- 'Calibration' check box:
  Select the box if you want to perform a recorder calibration prior to the film recording.
  Please *see chapter 6.2 Recorder Calibration* for further information regarding the calibration process.

- 'Calibration' list:
  Select a calibration file which will provide the calibration parameters setups.

- Calibration 'Setup' button:
  Click this button and access the Recorder Calibration Setup window to verify/edit the selected calibration file.
  *See also Recorder Calibration Setup* in the following 'Setup Window Overview' section.

- 'Image Processing' check box:
  Select the box if you want to use the Image Processing Software Engine or if you are going to use the ARRI Color Management System (CMS) for the recording of the input sequence.
  Please *see chapter 6.4.3 Using CMS (linear workflow)*

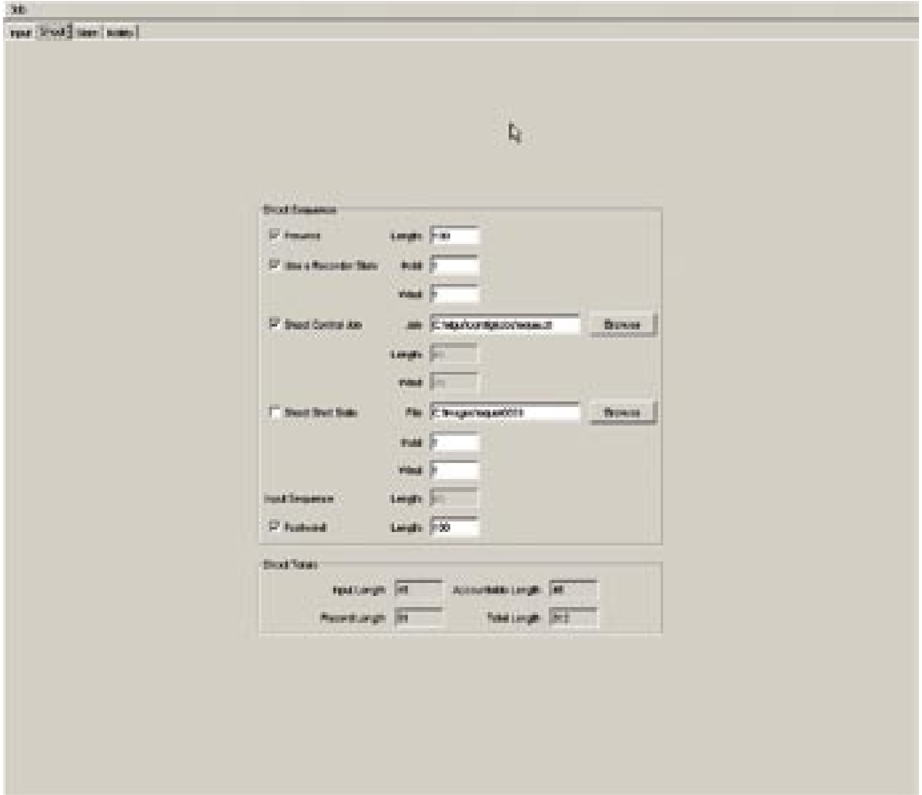
- 'Image Processing' list:
  Using image processing or CMS you have to select an appropriate image processing configuration file which will define the image processing pipeline.

- Image Processing ‘Setup’ button:
  Click this button and access the Image Processing window to verify/edit the selected image processing configuration file.
  *See also The Image Processing Setup Window* in the following ‘Setup Window Overview’ section.

- (optional) ‘Alice’ button:
  Click this button to open ALICE the Interactive Configuration Editor.
  For detailed information regarding ALICE please refer to *chapter 5.3*.

- ‘Geometry’ list:
  Select an appropriate output geometry format file.

- Geometry ‘Setup’ button:
  Click this button and access the Recorder Geometry window to verify/edit the selected format file.
  *See also The Recorder Geometry Setup Window* in the following ‘Setup Window Overview’ section.



## The Shoot Tab Page

The Job Edit - Shoot tab page is divided into the 'Shoot Sequence' and the Shoot totals' section.

Use the 'Shoot Sequence' section to assign general recording settings, following the correct order of the final job processing:

**1. Prewind**

- 'Prewind':
  Select this check box to perform a film shuttle prior to any recordings.

- 'Length':
  Use the field to enter the designated length of the 'Prewind' in frames.

**2. Recorder Slate**

- 'Use a Recorder Slate':
  Select this check box to enable the rendering of a job specific slate at job execution time and to start the recording with the shooting of the slate.
  The slate will be recorded in 2k or 4k format depending on input sequence format settings.

- 'Hold':
  Use the field besides the 'Use a Recorder Slate' check box to specify how often the slate should be recorded.

- 'Wind':
  Use the field beneath the 'Hold' to specify the number of black frames following the slate.

**3. Control job**

- ‘Shoot Control Job’:
  Activate this check box to record a control job defined by the ‘Job’ output field.
  *See also The Control Job Setup Window* in the following ‘Setup Window Overview’ section.

- ‘Job’:
  Represents the control job path selected using the ‘Browse’ button.

- ‘Browse’:
  Click the button to open the control job file browser. Selecting a control job, the ‘Length’ and ‘Wind’ fields are automatically updated according to the definitions given by control job files.

- ‘Length’:
  Represents the number of frames, recorded during the control job execution.

- ‘Wind’:
  Represents the number of frames, shuttled during the recording of the control job.

**4. Shot Slate**

- ‘Shoot Shot Slate’:
  Select this check box to record the slate, defined by the ‘File’ field.

- ‘File’:
  Represents the file name of shot slate, selected by using the ‘Browse’ button.

- ‘Browse’:
  Click the button to open the shot slate file browser.

Note: The file type and geometry format of the shot slate have to correspond to the file type and geometry format of the image sequence.

- ‘Hold’:
  Use the field beneath the ‘File’ field to specify how often the shot slate should be recorded.

- ‘Wind’:
  Use the field beneath the ‘Hold’ field to specify the number of black frames, following the slate.

### 5. Input Sequence

- 'Input Sequence Length':
  Represents the length of the image sequence defined within the Job Edit - Input tab.

### 6. Postwind

- 'Postwind':
  Select this check box to perform a film shuttle after the recording of the input sequence.

- 'Length':
  Use the field to enter the designated length for the 'Postwind' in frames.

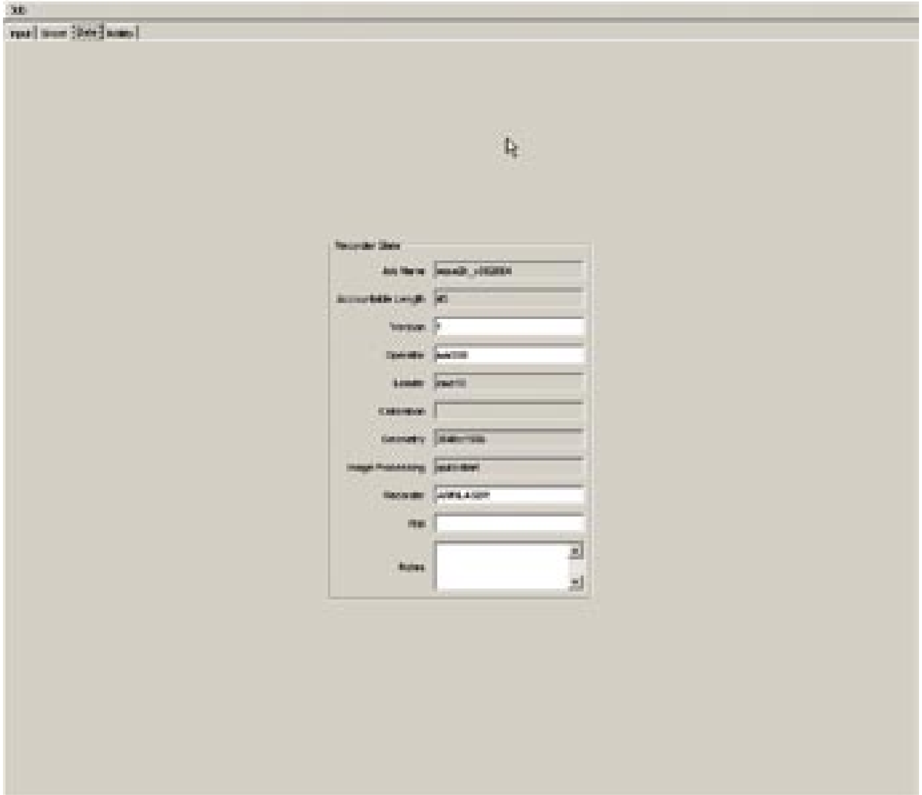
Use the 'Shoot Total' section as visual feedback for the frame lengths, defined by the current job settings:

- 'Input Length':
  Represents the length of the image sequence.

- 'Accountable Length'
  Represents the length of the image sequence and the length of the shot slate.

- 'Record Length':
  Represents the length of all frames to be recorded.

- 'Total Length':
  Represents the recorded number of frames including the number of winds.



## The Slate Tab Page

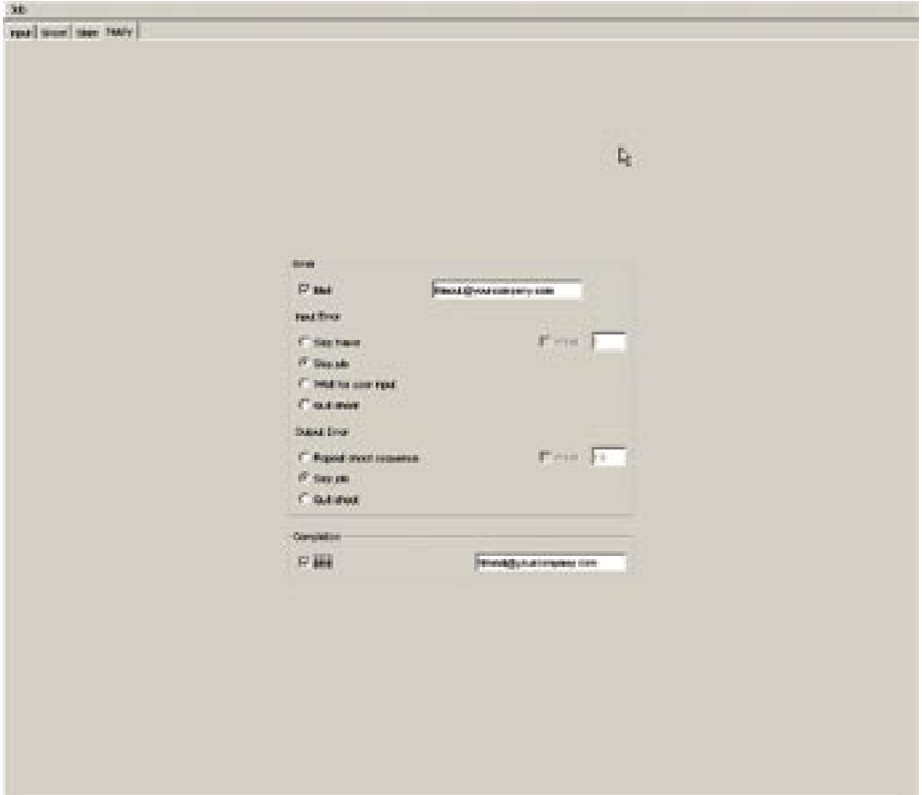
The Job Edit - Slate tab page shows the information, which will be composed for the rendering of the recorder slate.

The fields 'Version', 'Operator', 'Recorder', 'Roll' and 'Notes' are editable.

The other fields are filled in, according to the information, defined within the 'Job Edit' - Input tab page.

In addition a generation date and time stamp will be added to the slate at job execution.

The background frame for the slate is located in
'c:\algui\applet\Arrirecslate.jpg'
and can be customized with a standard photo editing program.



## The Notify Tab Page

The Job Edit - Notify tab page is divided into the 'Error' and the 'Completion' section.

Use the 'Error' section to specify notification methods and error handling strategies.

**Error notification:**

- 'Mail':
  Select this check box if you want to receive a message via mail as soon as an recording error has occurred.

- Enter the designated email address in the field besides the mail check box.

Note: The mail server and sender's address needs to be installed in the email program blat. For that purpose type `blat-install` in a C-shell window.

**Defining error handling strategies:**

Regarding the case of an input error, indicating that the loading process of an image has failed, you can define an error handling strategy, selecting one of the following options:

- 'Skip frame':
  Select this option if you want to skip the frame on loading errors. If so, you can also select the 'Wind' check box besides the 'Skip frame' option and enter the number of frames to be shuttled before the recording continues shooting the next frame.

- 'Skip job':
  Select this option if you want the current job to be stopped on input errors, but the recording to be continued shooting the next job in the queue.

- 'Wait for user input':
  Select this option if you want the recording to be interrupted. In this case an email is sent and the software waits until the user fixed the error and hits the 'Start/Restart' icon within the ALGUI tool bar.

- 'Quit shoot':
  Select this option if you want the shooting of the queue to be stopped.

Regarding the case of an output error, indicating that the image transfer from the host to the recorder was disturbed, you can define an error handling strategy, selecting one of the following options:

- 'Repeat shoot sequence':
  Select this option if you want the recording to start again at the beginning of the shoot sequence. Select the 'Wind' check box and enter the number of frames to be shuttled before a restart.

- 'Skip job':
  Select this option if you want to start shooting the next job in the queue.

- 'Quit shoot':
  Select this option if you want the shooting of the queue to be stopped.

Other types of errors are unrecoverable and will always stop the shooting of the queue.

## 5.2.4 Overview: The Setup Windows

### The Recorder Calibration Setup Window

The Recorder Calibration Setup window serves as calibration file editor.

Please *see chapter 6.2 Recorder Calibration* for the definitions of the following common used terms.

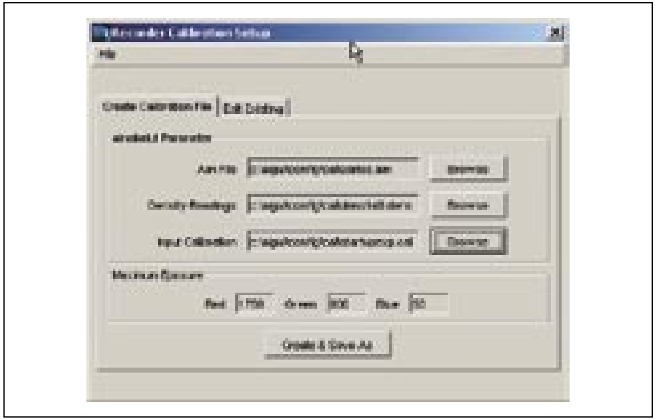
A recorder calibration file ('*.cal') contains maximum exposure values for the red, green and blue lasers and a reference to a calibration LUT.

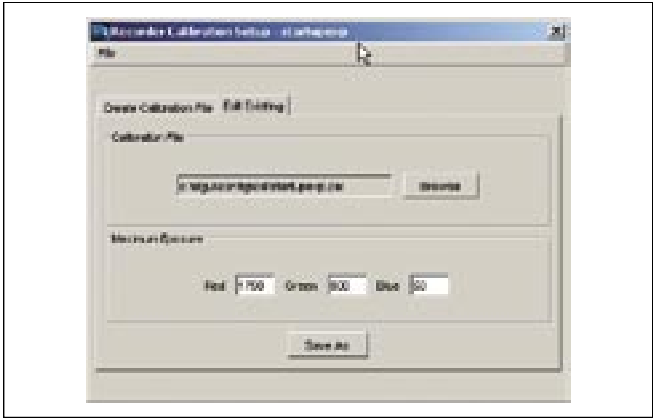
You can either edit the maximum exposure values of an existing calibration file or create a new calibration file.

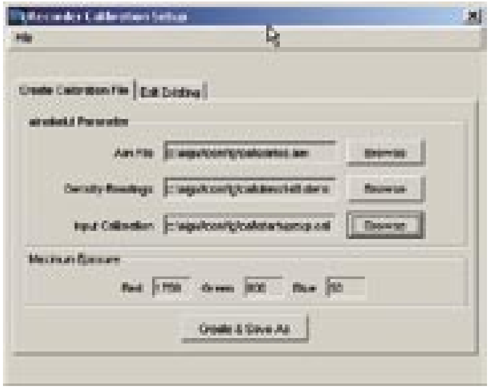
**File menu items:**

- 'Delete':
  Opens a file browser to delete a calibration file and the corresponding calibration LUT.

- 'Quit':
  Exits the window without saving the changes.







**The Create Calibration File tab page:**
To generate a new calibration file, use the 'Browse' buttons to specify the following parameter:

- 'Aim File':
  Select an aim file (regarding the designated film stock), to specify the aim density curves for the recorder.

- 'Density Readings':
  Select a density readings file, created from status M measurements of a calibration wedge, using the ARRI DLC Excel sheet.

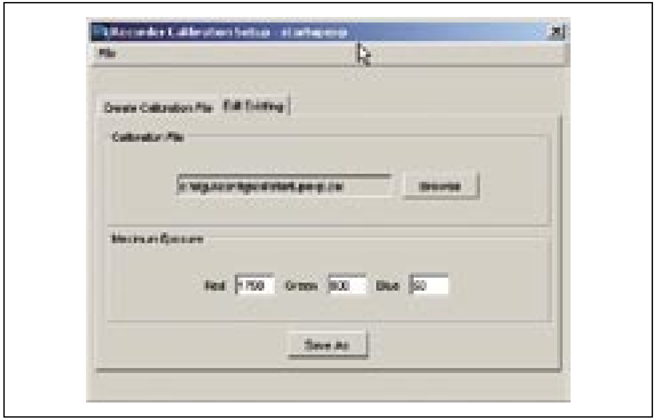
- 'Input Calibration':
  Select the calibration file, which was used to record the calibration wedge.

- 'Maximum Exposure':
  This fields are used to represent the red, green and blue maximum exposure values defined by the input calibration file.

- 'Create & Save As':
  Click the button to create a new calibration LUT (using the 'almakelut' CLIF command) and to create a new calibration file, referring to the calibration LUT and to the given maximum exposures values.

*See also chapter 6.2.3 Recorder Calibration Practices* for a step-by-step instruction, to maintain the recorder calibration.

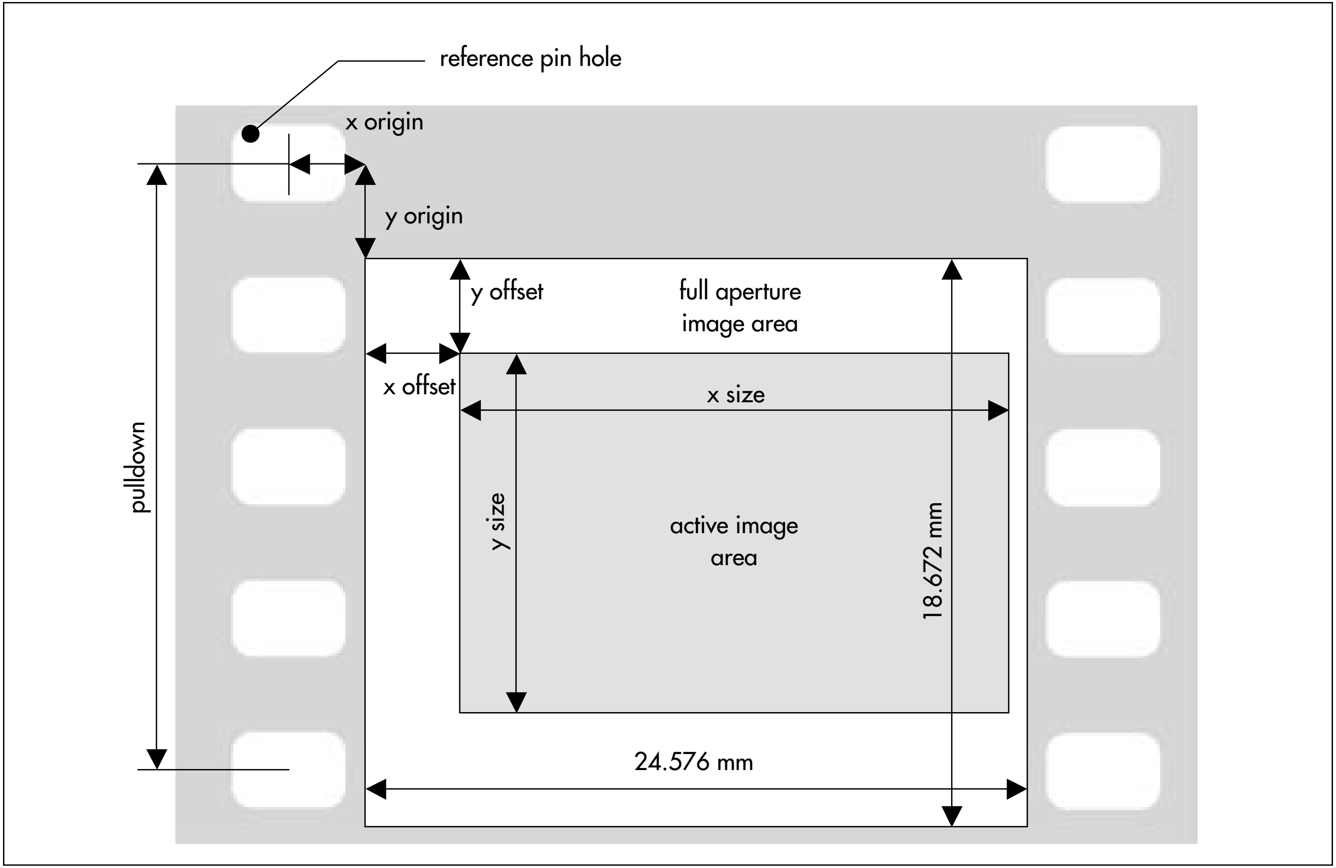
**The Edit Existing tab page:**
Use this tab page to edit the maximum exposure values of an existing calibration file.



- 'Browse':
  Click this button and use a file browser to open a calibration file.

- 'Maximum Exposure':
  Use the 'Red', 'Green' and 'Blue' fields to edit the maximum exposure values from the selected calibration file.

- 'Save As':
  Click this button to save the changes using a calibration file save browser.


reference pin hole
x origin
y origin
y offset
full aperture
image area
x offset
x size
pulldown
y size
active image
area
18.672 mm
24.576 mm

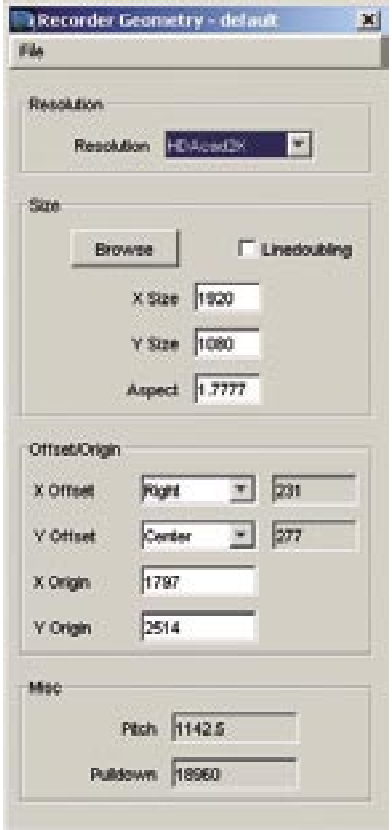
## The Recorder Geometry Setup Window

The 'Recorder Geometry' window supports you to define the geometry format parameter, used by the recorder, to determine the size and position of the images on film.

Note: The format parameters are depending on the recording options, you have licensed for the ARRILASER film recorder.

*See chapter 7.3 Multiple recording formats* for a list of all provided resolutions (regarding the supported recording options), defining pitch and pulldown constants, the image window x-/y-size and the default values for the x-/y-origin of the image window relative to the reference pin.

Using the Recorder Geometry window, you can create, edit and delete geometry format settings as format files.



**File menu items:**

- 'New':
  Resets the field entries to definitions, given by the file 'default.cfg' located in the default format directory.

- 'Open':
  Opens a file browser to select a format file.
  The field entries are filled in, according to the settings found in the selected format file.

- 'Save':
  Before opening the file browser to save the geometry settings, a validation check will be performed on all parameters.

- 'Delete':
  Opens a file browser to delete a format file.

- 'Quit':
  Exits the window without saving the changes.

**Recorder Geometry fields and buttons:**

The 'Recorder Geometry' window is subdivided into the following areas, in order to provide a step-by-step guidance, creating new geometry formats:

***1. Resolution***

- 'Resolution':
  Use this field to reveal a drop down list, presenting all available resolutions.
  Choosing a resolution specifies constant values for the pitch and pull-down parameter and default values for the x-/y-origin parameter. The resolution also implies maximum values for the image x-/y-size.

*2. Size*

There are various ways to determine the active image size in pixels:

- 'Browse'
  Click this button to browse for an image file with the appropriate size.
  The x- and y-size parameter will be derived parsing the image file header.

- 'Linedoubling':
  Activate the checkbox to double the current x- and y-size values.

Note: If the size defined by the geometry format is twice the size, given by the input images, the images will be recorded by use of the 'Linedoubling' feature.

- 'X Size', 'Y Size':
  Use this fields to enter the preferred image size in pixel. The aspect will be automatically updated.

- 'Aspect':
  Use the field to enter a preferred aspect ratio. The y-size will be updated according to the current x-size.

*3. Offset/Origin*

Offset values specify the image position within the image window (given by the current resolution).

- 'X Offset':
  Use the field's drop down list to specify a 'Left' or 'Right' aligned orientation or specify 'Custom' to enter the image's x-offset within the image window.

- 'Y Offset':
  Use the field's drop down list to specify one of the alignments ('Top', 'Center', 'Bottom') or specify 'Custom' to enter the image's y-offset within the image window.

Origins specify the position of the image window in microns. The values are set by changing the resolution, but can be changed within a valid range.

- 'X Origin':
  Use the field to edit the horizontal distance from the perforation hole

- 'Y Origin':
  Use the field to edit the vertical distance from the perforation hole

#### *4. Misc*

- 'Pitch':
  Represents the pitch constant, specified by the current resolution settings. Pitch defines the distance between two pixels [microns*100]

- 'Pulldown':
  Represents the pulldown constant specified by the current resolution settings. Pulldown defines the distance between two frames in microns. The pulldown can be three perforations (14220) or four perforations (18960).

## The Control Job Setup Window

The Control Job window serves as control job file editor.

A control job file handles a list of job file references. If the 'Shoot Control Job' check box is selected in the 'Job Edit'- Shot tab page, the GUI queue manager will process the control job list before recording the shot slate or the input sequence.

Control job file definitions do not differ from any other job files, but during execution, only the input sequence and the 'Prewind' and 'Postwind' parameter are taken into account for the recording. Image processing will not be available. Keep in mind that a valid loader LUT and geometry format has to be assigned, as there will be no dedicated error handling when shooting the control jobs.

#### File menu items

- 'Open':
  Opens an existing control job file, using file browser.

- 'Save':
  Opens a file browser to save the current control job list.

- 'Delete':
  Opens a file browser to delete control job files.

- 'Quit':
  Closes the window, prompting a dialog to save the changes.

**Control Job fields and buttons**

- ‘Job Select’:
  Represents a selected job file.

- ‘Browse’:
  Use this button select a job using a file browser. The selected file name shows up in the ‘Job Select’ field.

Click on a job in the control job list, to set a reference for the ‘Add’ and ‘Delete’ functions.

- ‘Add’:
  Click this button to add the selected job to the control job list.

- ‘Delete’:
  Click this button to delete a job from the control job list.

Save the control job list, using the File ‘Save’ menu item.

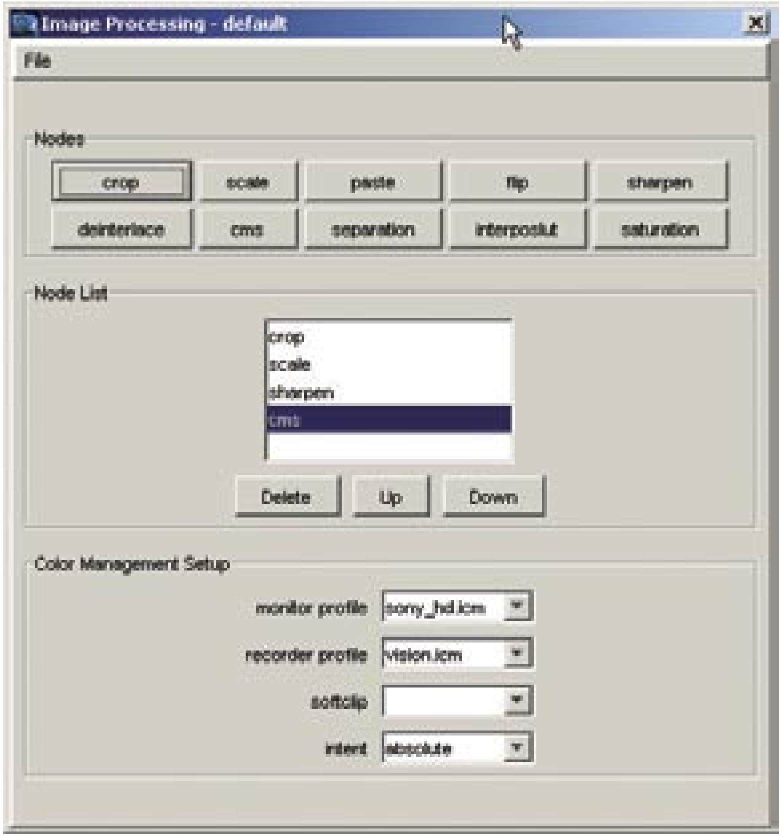


Image Processing - default
File
Nodes
crop
scale
paste
flip
sharpen
deinterlace
cms
separation
interposlut
saturation
Node List
crop
scale
sharpen
cms
Delete
Up
Down
Color Management Setup
monitor profile
sony_hd.icm
recorder profile
vision.icm
softclip
intent
absolute

### The Image Processing Setup Window

The Image Processing window serves as an image processing configuration file editor.

*See chapter 7.2 Image Processing Software Engine* for a detailed description of the image processing functions.

The idea is to define a processing node list, to setup an image processing pipeline. When recording an image, the nodes will be executed in sequential order.

**File menu items:**

- 'New':
  Resets the processing node list.

- 'Open':
  Opens a file browser to select an image processing configuration file.

- 'Save':
  Opens a file browser to save the current node list.

- 'Delete':
  Opens a file browser to delete image processing configuration files.

- 'Quit':
  Closes the window, presenting a dialog to save the changes.

The Image Processing window is subdivided into the 'Nodes' and the 'Node List' area.

**Node buttons**

Click on one of the following 'Node' buttons to add a node to the node list.

- 'crop': to specify a cropping area.
- 'scale': to scale images to any size.
- 'paste': to paste images onto a one color background.
- 'flip': to flip images horizontally, vertical or both.
- 'sharpen': to apply a sharpening process.
- 'deinterlace': to merge two fields of video originated frames.
- 'cms': to apply color management.
- 'separation': to render monochrome images.
- 'interposlut': to assign an addition lookup table for recordings on interpositive.
- 'saturation': to change the saturation of the image by a factor.

**Node List fields and buttons**

- 'Node List':
  This field presents the sequential order of the nodes within the node list. Click on a list entry, to select a specific node.
- 'Delete':
  Click this button to delete the selected node from the list.
- 'Up', 'Down':
  Click the buttons to moves the selected node up or down within the list.

**Node setups**

Adding a node or selecting a node from the node list, will enlarge the Image Processing window to present the appropriate node setup parameters.

The following node setup parameters are listed in alphabetical order:

***CMS node***
The CMS node specifies the settings used by the ARRI Color Management System.

Note: This node is key protected and only functional when the Color Management option has been purchased.

Please *see chapter 6.4.3 Using CMS* for further information about the following CMS parameter:

- 'monitor profile':
  Select a monitor profile from field's the drop down list.

- 'recorder profile':
  Select a recorder (print film) profile from the field's drop down list.

- 'softclip':
  Select a soft clip from the field's drop down list.

- 'intent':
  Select a render intent from the field's drop down list.

***crop node***
The crop node parameter defines a crop area in relation to the original image.

- 'x offset':
  Use the field's drop down list to define the position of the cropped area within the original image ('left', 'center', 'right') or assign 'custom' and enter an x offset value.

- 'y offset':
  Use the field's drop down list to define the position of the cropped area within the original image ('top', 'center', 'bottom') or assing 'custom' and enter a y offset value.

- 'new X size', 'new Y size':
  Use the fields to enter the designated crop area size.

***deinterlace node***
The de-interlace node performs a simple de-interlacing on video images. It has no arguments.

***flip node***

The flip node changes the direction of the specified coordinates.

- 'direction':
  Use the field's drop down list to reverse the image coordinates in 'horizontal', 'vertical' or 'both directions.

***interposlut node***

The interpositive node is intended to make intermediate positive recording easier by reversing the image processing output so that code values are replaced
by 1023 – <original code value> prior to recording.

Note: Using the interpositive LUT node, the recorder calibration doesn't need to be inverted to get a positive image on the intermediate film stock.

***paste node***

The paste node allows to paste an image onto a one color background image.

- 'X offset', 'Y offset':
  Use this fields to specify the image position on the background image.

- 'new X size', 'new X size':
  Use this fields to specify the size of the background image.

- 'fillcolor':
  Use the 'R[%]', 'G[%]', 'B[%]' fields to enter the color of the background in percent.

***saturation node***

The saturation node is used to change the color saturation of the image.

- 'factor':
  Use this field to enter the saturation factor in percent.
  A negative factor will reduce the saturation, a positive factor will enhance the saturation.

### *scale node*

The scale node is used to scale images to any size.

- 'interpolation mode':
  Use the field's drop down list to select one of the interpolation modes ('nearest neighbor', 'bilinear', 'bicubic') used for the scaling algorithm.

- 'new X size', 'new X size':
  Use the fields to specify the preferred size image.

### *separation node*

The separation node calculates a weighted sum of the three color channels and writes a monochrome image.

- 'weight':
  Use the 'red', 'green' and 'blue' input fields to enter a weight factor for each color channel.

- 'sum':
  This fields outputs the sum of the three color channel weights as a reference value. To keep the lightness, the sum should be always 100 %.

### *sharpen node*

The sharpen node is used to apply one of the following sharpening methods to the image.

- 'Unsharp Masking':
  Select this option to perform an unsharp masking process by selecting an '3x3', '5x5' or '7x7' smoothing kernel and use the 'Strength[%]' field to enter an arbitrary strength factor. Reasonable values for filter strength are between 0% and 200%.

- 'RGB Kernel':
  Select this option to perform a convolution of the image with a kernel, provided by the drop down list.

- 'Kernel Channels':
  Select this option to perform a convolution of the image assigning the kernels, provided by the drop down lists to each channel 'Red', 'Green', 'Blue.
  Note: You have to select a kernel for each color channel.

*See chapter 7.2 Image Processing Software Engine* for a discussion of filter kernels.

**The Quickstart Dialog**
For in depth information *see 5.2.5: Step-by-step* using the Quickstart dialog.

The Quickstep dialog provides functions to create jobs, selecting only the image sequence. Based on a predefined job file (quickstart.job), a predefined image processing file (quickstart.cfg) and default format files, a new job file will be created.

**Quickstart fields and functions:**
The Quickstart window presents a subset of the job parameters as visual reminder.

- 'Add':
  Use this button to add the job to the shoot queue.

- 'Edit':
  Use this button to open the Job Edit window, if you want to view or change job settings.

- 'Cancel':
  Use this button to cancel the dialog.

## 5.2.5 Step by step: Starting a recording job

ALGUI provides several ways to create shoot jobs. If the job settings vary primarily in the input sequence file directory, Quickstart will be the fastest way to set up job files.

### Creating a job using the Quickstart dialog

***1. Starting the Quickstart dialog:***

- Once you've started ALGUI, the software displays a message box that offers you the option to start the Quickstart dialog.

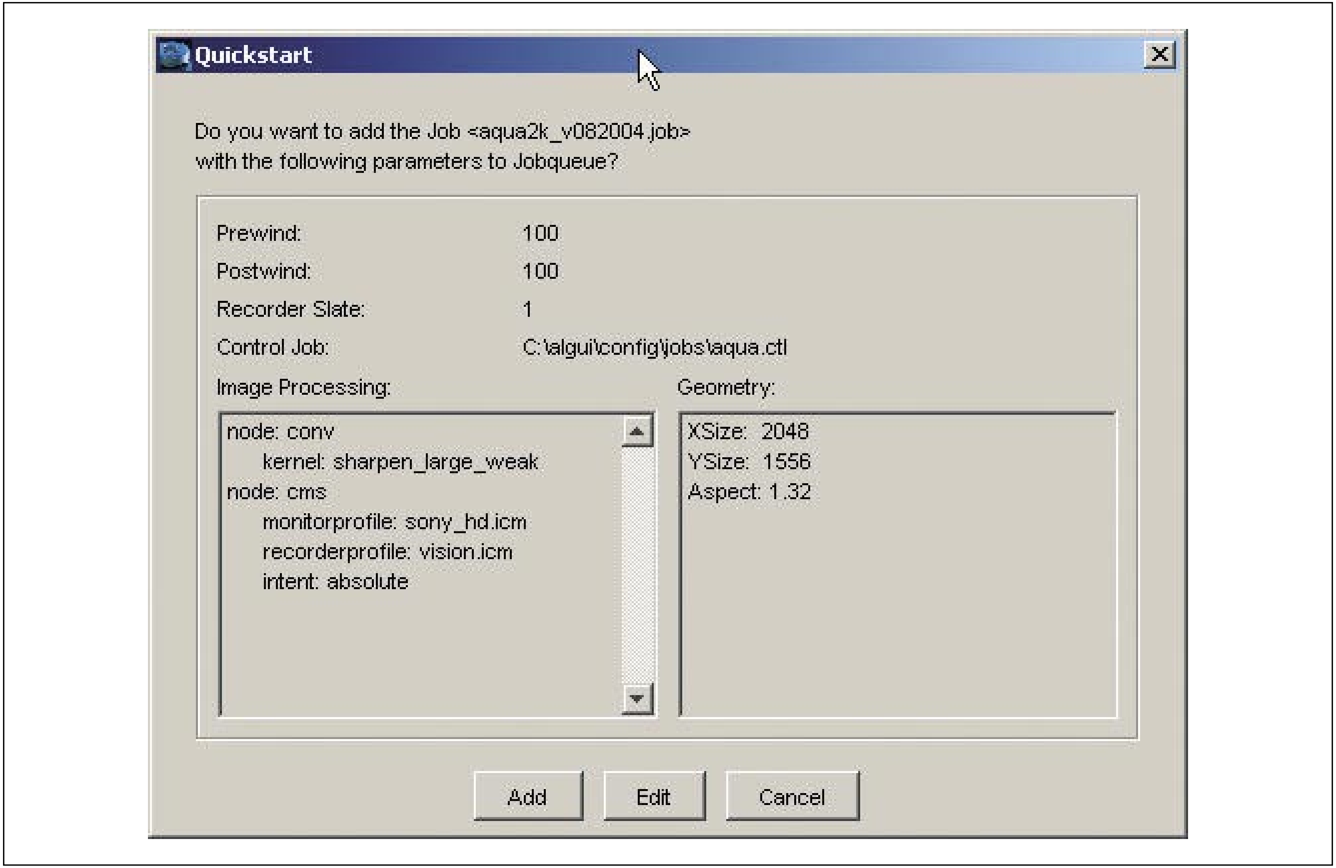
Note: If the dialog does not appear, check the property settings from the ALGUI desktop icon for the –q option in the target window.
The target should be defined as:
`C:\cshell\bin\csh.exe -L -c java -jar c:\algui\applet\algui.jar –q`

- Later on you can access the Quickstart dialog from the ALGUI window with the 'Quickstart' command located in the Setup menu.


***2. Selecting a shoot sequence:***

- Selecting a shoot sequence with the Image Sequence browser will automatically create a new job file based on the predefined job called 'quickstart.job' (located in the default job directory).

- According to the size of the images, Quickstart assigns a geometry format file called {x-size}x{y-size}.cfg (for example 2048x1556.cfg). Please assure that appropriate files are already defined and accessible from the default format directory.
According to the bit depth of the images Quickstart assigns a loader LUT called {depth}bit.lut (for example10bit.lut)


Quickstart
Do you want to add the Job <aqua2k_v082004.job>
with the following parameters to Jobqueue?
Prewind: 100
Postwind: 100
Recorder Slate: 1
Control Job: C:\algui\config\jobs\aqua.ctl
Image Processing:
node: conv
kernel: sharpen_large_weak
node: cms
monitorprofile: sony_hd.icm
recorderprofile: vision.icm
intent: absolute
Geometry:
XSize: 2048
YSize: 1556
Aspect: 1.32
Add
Edit
Cancel

or if image processing is enabled and CMS is assigned by the configuration file, the loader LUT is called cms{depth}.lut.

Quickstart validates the input sequence associated with the image processing settings defined by the file 'quickstart.job' and the derived geometry format settings.

- If the validation fails, Quickstart presents an appropriate error message.
  At this point the Quickstart dialog ends and the ALGUI starts the Job Editor to give you the ability to adjust parameter settings as needed.

- If the validation succeeds, Quickstart will save the job using a filename derived from the input sequence directory name.
  Is the name already assigned to a file within the job directory, the software presents you with a Yes/No dialog box, to make sure you want to overwrite the existing file. Otherwise you will get a job file browser to enter a new filename.

***3. Verifying job settings:***

- Quickstart issues a dialog box, and displays the 'Prewind', 'Postwind', 'Recorder Slate', 'Control Job', 'Format' and 'Image Processing' parameter settings.

***4. End Quickstart using the 'Edit', 'Add' or' Cancel' buttons:***

- At this point you have the options to add the new created job to the shoot queue, to start the 'Job Edit' window or to cancel the dialog.
  'Cancel' will not delete the newly created job from the job directory.

## Create or edit jobs using the Job Edit window

***1. Opening a job within the Job Edit window***

There are several ways to open a job within the 'Job Edit' window:

From the ALGUI window:

- use the 'New' command located in the 'Job' menu, to open the 'Job Edit' window showing default job settings.

- click the 'New Job' icon located in the tool bar section, to open the 'Job Edit' window showing default job settings.

- double click on a job reference within the queue table, to open the 'Job Edit' window showing the selected job settings.

From the Quickstart dialog:

- click the 'Edit' button to open the Job Edit window showing the job settings automatically created by the Quickstart dialog.

From the Job Edit window:

- use the 'Open' command located in the 'Job' menu to open a file browser for a job file selection.

- use the 'New' command located in the 'Job' menu to reset the window's fields to the default job settings.

Note: To customize default job settings, edit and overwrite the file 'default.job' from the default job directory.
To customize the quickstart settings, edit and overwrite the 'quickstart.job' from the default job directory.

*__2. Customizing job parameter__*

To customize job parameter, start at the 'Job Edit' - Input tab page. This tab page is used to set up the image sequence you want to record.

- Use the 'Browse' button to select an image sequence. The browser will fill in the 'File Directory', 'File Prefix', 'Num Digits', 'File Suffix', 'Start' and 'End' fields and will switch the loader list according to the bit depth of your images.
- Verify the image sequence settings and mind the selected 'File Mode' option. Check that the 'File Remove' check box is deselected, if you don't want the files to be deleted after the recording.

Special care has to be taken on the settings within the 'Setup' area of the 'Input' tab page:

- Depending on the file type and the origination of the images and relating to the image processing functions you want to apply to the images, you have to select an appropriate Loader lookup table.
- If you want to perform a recorder calibration, check if the 'Calibration' check box is selected showing the appropriate calibration file selected from the 'Calibration' list.
- If you want to use the Image Processing Software Engine to process the images prior to the recording, check that the 'Image Processing' check box is selected and the appropriate configuration file is selected from the 'Image Processing' list.
  Verify the configuration settings using the Image Processing Setup window or (optional) the ALICE Interactive Configuration File Editor.
- Be sure to have the intended geometry file selected from the 'Geometry' list.

Saving the job settings will perform a validation check regarding the image sequence settings.

Turn to the 'Shoot' tab page to define and to verify the general job settings.

- Assign 'Prewind' and 'Postwind' frame lengths, if you want to shuttle film at the beginning and at the end of the job recordings.
- Select the 'Control Job' check box and assign a predefined control job if you want to monitor image quality parameters and/or negative and print process characteristics.
- Select the 'Recorder' or the 'Shot Slate' check box, if you want to record slates before the image sequence.

Verify the settings and take a look at the 'Shoot Totals' fields.

Turn to the 'Slate' tab page and adapt the slate parameter, if you want a recorder slate to be generated and recorded prior to the image sequence

Turn to the Notify tab page and verify the 'Error' and 'Completion' notification settings and the applied error handling strategies.

***3. Saving the job settings***

Save the settings using the Job menu commands. A job will be saved before a 'Replace', 'Insert', 'Add' or 'Append' action takes place.

Keep in mind that the shoot queue handles references to job files. The same job file could be referenced more than once within a shoot queue. Changing job file parameters will affect the execution of all the references related to this job file.

## Performing a shoot queue:

***1. Creating the shoot queue***

To add jobs to the queue from the 'ALGUI' window:

- Use the 'Add' command located in the 'Queue' menu or click the 'Add Queue File' icon from the tool bar to open a file browser for a queue file selection. All jobs referenced within the queue file will be added to the queue.

- Use the 'Add' command located in the Job menu or click the 'Add Job File' icon from the tool bar to open a file browser for a job file selection.

- Use the keyboard shortcuts to add jobs using the cut and paste function available within the 'Shoot Queue' table.

To add jobs to the queue from the 'Job Edit' window:

- Use the commands located in the 'Job' menu to insert, add or append a job to the queue.

To add jobs to the queue from Quickstart dialog:

- Click the 'Add' button from the Quickstart window.

***2. Maintain jobs within the queue***

- To select a job within the queue click on the corresponding line item in the 'Shoot Queue' table. The highlighted line indicates the selected job.

- Use the keyboard shortcuts and move jobs up or down the queue to change the processing order of the jobs.

- Use the 'Save' command located in the 'Queue' menu or click the 'Save Queue' icon from the tool bar to save the current shoot queue definitions.

***3. Shooting the queue***

- The shooting always starts from the beginning of the queue at the first job showing status ready.

- To control the status of a shoot job, click directly on the status field in the 'Shoot Queue' table. This will open a drop down menu to switch the job status to either 'Ready' (to start recording) or 'Skip' (to prevent from execution).

- Use the 'Shoot Control' Icons from the tool bar to start, stop or pause the queue recording.

**3. Verifying the recording process**

- Verify the job status Information. The queue manager will update the job status from ‘Ready’ to ‘Run’ and will signal completion or paused states in the job status field.

- View logging information. Whenever you start recording, the ‘Shoot Status’ area will be cleared and the queue manager starts logging the single steps of actions while shooting the queue. The logging information will also be added to the job log files in the ‘~/algui/config/logs’-directory.

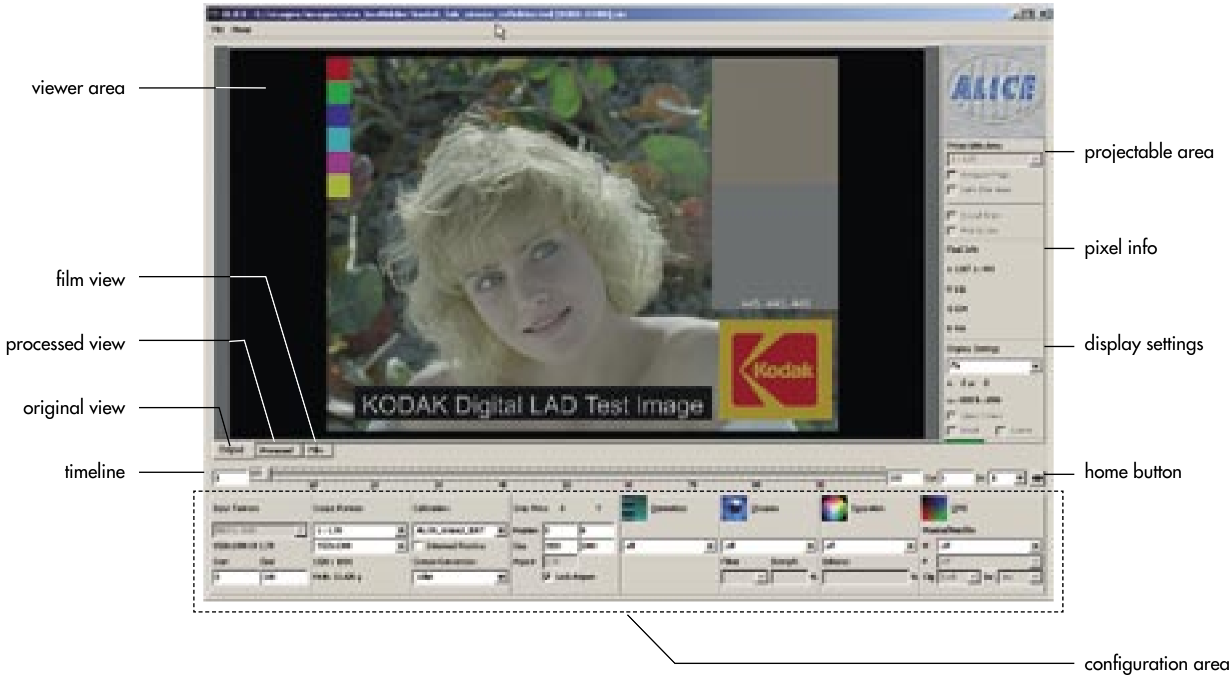
# 5.3 ARRILASER Interactive Configuration Editor (ALICE)

The ALICE offers the fastest, easiest and safest way to generate a new image processing configuration file and gives visual control over the whole image process from the raw input sequence to the final images positioned on the film. General input parameters like start/end frame, calibration and loader-LUT can also be specified and will be transferred to the GUI input window when quitting and saving the ALICE window. Furthermore additional information is provided about the input images such as image type, pixel size and bit depth. Analyzing and controlling tools further simplify the configuration process.

The purpose of ALICE is

- to judge the quality of the input images
- to select the frame range visually
- to build a job and select appropriate job settings with visual control of the final rendered images positioned on the film.
- By choosing an ICC profile for the workstation monitor, the effect on the actual output on film can be previewed. This is especially helpful in transferring colors that lie outside of the normally reproduced color space of the choosen film. All results can be accurately previewed.

ALICE uses the same image processing as the image processing used during recording. Therefore, the results of image processing operations previewed in ALICE are completely identical to those being recorded later. Zooming in and out is always done by replicating or omitting pixels to exclude all possibility of inaccuracy of the displayed image.



viewer area
film view
processed view
original view
timeline
projectable area
pixel info
display settings
home button
configuration area
KODAK Digital LAD Test Image
Kodak
ALICE

## 5.3.1 Operation

To start ALICE click the ALICE Button beneath the image processing configuration list in the 'Input' tab of ALGUI. Any preselected image processing file will be applied in ALICE, as long as it is compatible with ALICE's configuration. If not, or if no file is selected at all, ALICE will be opened with default settings. Geometry, loader LUT and calibration can be preselected before opening the ALICE window or inside the ALICE window. If a chosen setting is not compatible with the ALICE configuration default values will come up.

The ALICE window is separated into the viewer area and the configuration area ⇨ **photo**.

## 5.3.2 Viewer area

The viewer area includes the viewer window, timeline, projectable area, pixel info and display settings. It offers a visual control of the raw input sequence and is used to create interactively the configuration parameters. A preview shows the actual position of the final images on the film.

- The 'original' view shows the original raw input images.
- The 'processed' view accurately displays the effects of the chosen filter and geometry settings (output format, crop area, deinterlace, sharpen and CMS, if activated).
- The 'film' view shows the processed images positioned on the film for final control.
- The 'timeline' is simply a display of a frame range. By default it is the length of the clip or sequence. It does not limit or control the actual start/end parameters saved in the jobscript.

**Timeline**

- To change the displayed frame range, enter the start/end frame in the corresponding text field at the beginning and end of the timeline ➪ **photo**.

  The ‘cur‘ field shows ➪ **photo** the actual displayed frame number. Typing a particular number in that field will show this frame on the display.

  The ´inc´ value ➪ **photo** indicates the step width for moving through the timeline using the arrow keys on your keyboard. To skip frames, change the ‘inc’- value numerically or by choosing the predefined values in the drop down list.

- To reset the displayed frame range click on the home button at the right end of the timeline. This will refresh the images and reset the frame range.

- Additional keyboard shortcuts can be used.
  **Arrow left/right**:
  retreat/advance a step based on the frame increment setting.
  **Page up/down**:
  retreat/advance by approx. a tenth of the timeline range.
  **CTRL + arrow up/down**:
  double/half the increment value.

**Projectable Area**

- By choosing an output format in the ‘projectable area‘ ➪ **photo**, internally the corresponding ‘projector mask‘ is selected. The ‘projector mask‘, the ‘save title area‘ or both together can be activated. Additionally the reserved region for the soundtrack and the frame line can be displayed.

Note: The areas are only seen in the film view and have no effect on the processed images!

**Pixel Info**

- With the mouse pointer you can pinpoint the RGB code values (CV). The x/y position is shown in the upper left corner of the ‘pixel info‘ ➪ **photo** section.

Note: In the ‘original’ view the original CVs from the input images (8, 10, 12 or 16 bit) are displayed. In the ‘processed’ view 16 bit RGB values are shown, because internally all image processing is done in 16 bit. The ‘film’ view shows the 10 bit cineon CV as they are sent to the recorder. Those values will change by changing the loader LUT.

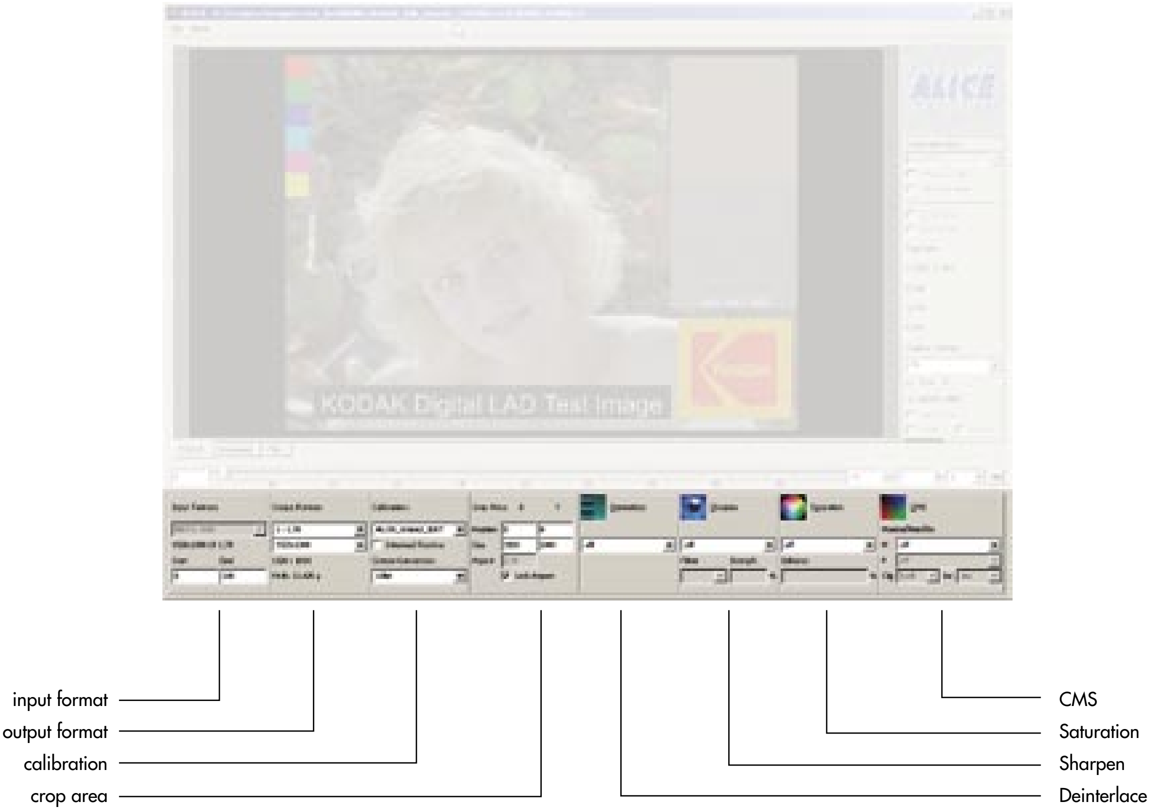
**Display Settings**

- Choose a zoom factor from the drop down list in the ‘display settings’ area Í photo to zoom in/out (25% - 200%) or use the right mouse button or keyboard shortcuts.
  **Right mouse button**:
  zoom in/out, fit, 100% (the mouse pointer must be positioned in the viewer window!)
  Keyboard shortcuts:
  **ctrl –/+** (numerical keypad),
  **ctrl F** (Fit)
  **ctrl 0** (100%)

  Beneath the zoom factor drop down list the information about the position of the upper left image corner (X,Y) and the size (width, height) of the displayed image part is shown ➪ **photo**.

  While the image is usually displayed as a linear image (exception: Cineon files), the ´view cineon´ button will display the image in cineon logarithmic space, as they will be transferred to the recorder. In that mode the influence of changing the loader LUTs can be seen. The ´view cineon´ button is only activated in the film view.

  To judge the influence of the Color Management, use the ‘proof‘ and the ´gamut´ button [*see chapter 5*].


KODAK Digital LAD Test Image
input format
output format
calibration
crop area
CMS
Saturation
Sharpen
Deinterlace

## 5.3.3 Configuration Area

This chapter explains all available ALICE nodes and their parameters in a systematic way according to the standard GUI configuration. It is mainly intended as a reference.

In this window a configuration file for the image processing can be build.

Note: This configuration file works only together with the chosen geometry.

*See chapter 7.2, Image Processing Software Engine* for a detailed description of the image processing function.

**Input Format**

- In the 'input format' section ➪ **photo** the size, bit depth and pixel aspect ratio of the selected sequence are displayed.
  By default images of the size
  1920x1080 are automatically recognized as HDTV 1080 (pixel aspect 1.0),
  of 1280x720 as HDTV 1280 (pixel aspect 1.0),
  of 720x486 as NTSC (pixel aspect 0.9385),
  and images of the size 720x576 are recognized as either PAL (pixel aspect 1.067) or PAL Plus (pixel aspect 1.416).

  ⚠ *The right choice for PAL or PAL Plus must be selected by the user*

  All other formats are taken as generic and a pixel aspect of '1' is assumed. For modifying this default selection please refer to *chapter 5.3.5*.

  Start and end frame for the selected sequences are taken from the ALGUI window.

- To change the recordable frame range, enter the start/end frame in the corresponding text fields ➪ **photo**.

**Output Format**

- The determination of the 'output format' ➪ **photo** is a two-stage selection procedure:

  First the desired projection aspect ratio must be chosen (i.e.: 1:2,35 CS means squeezed for projection with cinemascope lenses).

  All available geometries for this aspect ratio will appear in the second drop down list. The pixel resolution and the pitch size provides additional information about the chosen output geometry.

  A crop box with the appropriate aspect ratio will appear on the display. Geometries which are not available in the list can be generated in the ALGUI geometry setup as described in *chapter 5.2.4*. Restarting the ALICE software will place those new geometries in the list.

Note: Changing the 'output format' will reset the crop area to the maximum appropriate settings to fit into the new 'output format'.

**Calibration**

- Select the actual 'calibration' ➪ **photo** and 'loader LUT' ➪ **photo** for the used film stock and lab and the format conversion look-up-table (LUT).

  The LUT converts the given files into the Cineon format. Choose 10log, if the files are already in the Cineon format. Those settings are taken from the ALGUI input window; changes will be returned to the ALGUI input window.

- 'Intermed Positive' ➪ **photo**:
  Adds the necessary changes to the image processing config file for intermed positive recording.

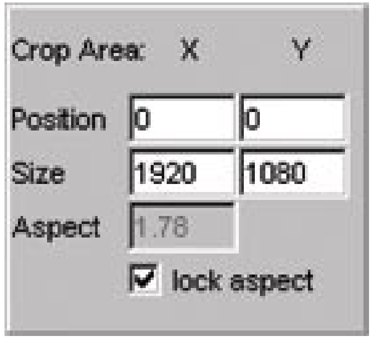
  Necessary adjustments like flip the image, paste on black background and invert the loader LUT (interposlut) are automatically done. Results can be seen in the film view. No other adjustments need to be done for intermediate positive recording.

## Crop Area

- With the crop node a 'crop area' ⇨ **photo** can be specified by the x/y-size and the origin of the crop box in relation to the original image.

  By selecting a projection aspect ratio (e.g. 1.66) in the 'output format' node the maximum appropriate 'crop area' settings are adjusted automatically and, if necessary, the image is auto scaled to fit into the chosen 'output format'.

  By default the x-size of the crop box is set to maximum input image width and the image height is selected according to the aspect ratio.



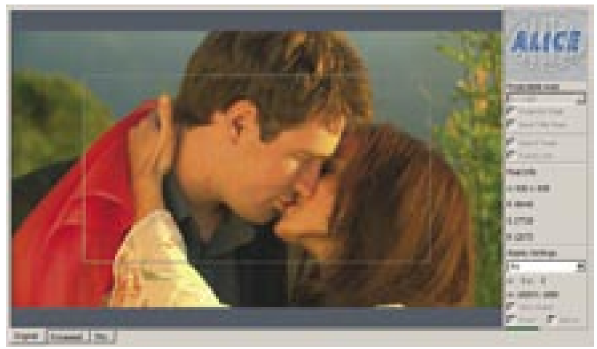

***Crop box handling with the aspect locked:***

CTRL + drag the center -> move the crop box.

ALT + drag the border -> vary the size fixed to its center.

Drag a corner -> vary the size fixed to the opposite corner.

Drag a side -> vary the size fixed to the opposite side.



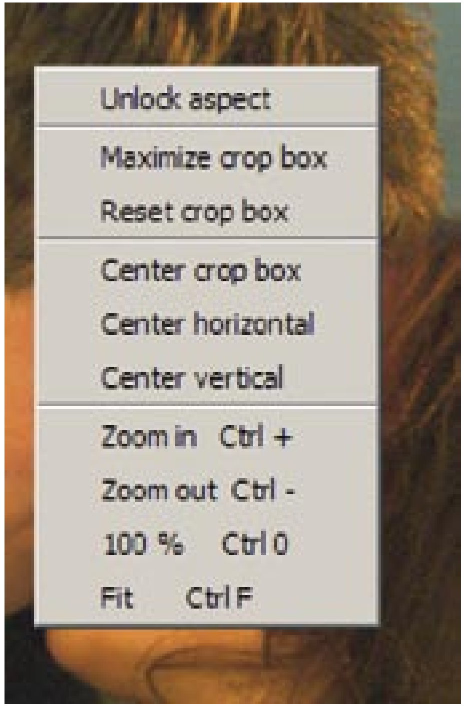


***Crop box handling with the aspect unlocked:***
If the image should not be cropped in order to get the selected output format the ´lock aspect´ button ⇨ **photo** can be switched off. This mode allows to only downsize the aspect ratio starting from the chosen ratio in the 'output format' node. The result is a horizontally-centered image with a letterbox on both sides. Check in the film view for the look. The projectable image height remains constant according to the chosen projection aspect ratio.

To enlarge the aspect ratio (e.g. 1.66 to 1.85) means to decrease the projectable image height. To do so, change the projection aspect ratio in the output node!

| | | |
|---|---|---|
| Drag a side | -> | vary the size fixed to the opposite side. |
| ALT + drag a side | -> | vary the size and aspect fixed to the center. |

**Right mouse button:**
To reset the crop box to its default, to maximize or center the crop box use the right mouse button, when the mouse is located in the image area.




**Deinterlace**
The ‘deinterlace’ ➪ **photo** node enables the merging of two fields of video originated frames. There are no arguments required.

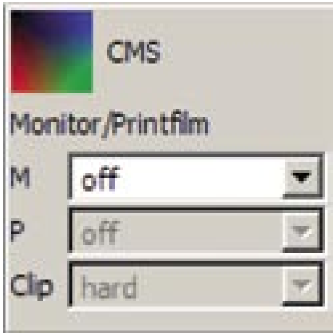
- For quick comparison between ‘deinterlace’ on/off toggle key D in the processed view mode. Pushing down the key will disable the effect on the image and the color of the icon will change to black & white. For ‘effect on’ release the key.


**Sharpen**
The ‘sharpen’ node ➪ **photo** applies a sharpening process on the image. The details of the sharpening process are determined either by choosing a predefined kernel file and following the description of the convolution node [*see chapter 7.2.2.4*], or by choosing variable and using the unsharp masking. In this case a filter size and strength must be choosen. Filter strength is set in percentage and can be varied from 0 to 200.
To judge the sharpening effect set the display settings to 100%.
For quick comparison between sharpen on/off toggle key S in the processed view mode.

**Saturation**

The ´saturation´ node ➪ **photo** applies a saturation change on the image. The factor of saturation change can be choosen by the using the fixed settings on the pulldown menu or by setting a percentage value In the enhance window. Negative percentage values will decrease the saturation, positive percentage values will Increase the saturation.

Note: When using the saturation process, the CMS the perfect match between the monitor and the projected printfilm is influenced.




**CMS**
The Color Management system (‘CMS’ ➪ **photo**) node is used to apply high quality profiles for standard devices such as Sony HD Monitor and Kodak Vision print stock projected by a xenon lamp in order to bring the colors of the film output close to what can be seen on the monitor.

- In the ‘CMS’ node a monitor profile (M) and a print film profile (P) is selected.

For images with highly saturated colors the soft clip can be adjusted by choosing one of the prepared soft clip settings from the list. To Influence the white point mapping on the CMS, choose an Intent setting from the list.
*See chapter 6.4 The ARRI Color Management System* for more detailed information on the Color Management.
To judge the CMS settings switch the proof button on.
For quick comparison between CMS on/off toggle key C.

Note: This node is key protected and only available, when the Color Management option has been purchased.

Note: The toggle on/off feature for ‘De-interlace’, ‘Sharpen’ and CMS only works in the processed view!

## 5.3.4 The File Menu

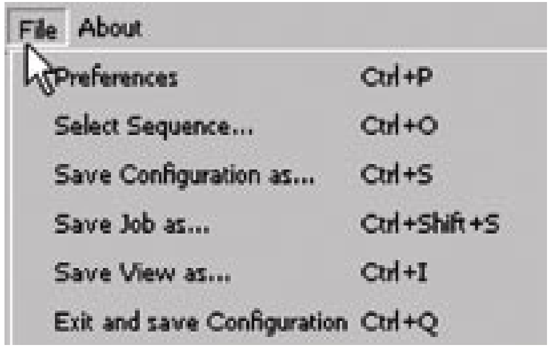
'Preferences' has four tabs:

- Appearance:
  to adjust the background, perforation, film, soundtrack and frame line color in the film view. Transparency of soundtrack and frame line can also be adjusted. The general ALICE font can be changed as well.

- Color Management:
  The profile for your workstation monitor can be selected here. It is necessary to make a selection in order to use the ´proof´ button. Settings for the out-of-gamut display can also be modified in this dialog (*see chapter 6.4.3* for more detailed information).

- Network:
  Available DVS hard disk recorders as well as appropriate network timeouts can be determined in this dialog (*see chapter 5.3.8 Accessing DVS Disk Recorders* for more detailed information).

- Node:
  The Nodes deinterlace and saturation can be made invisible here. If those node are normally not in use they can be removed from the configuration area for a better overview.




- 'Select sequence':
  The file browser opens and the sequence can be selected in the display. This change will also be returned to the ALGUI, if ALICE is left with saving.

- 'Save configuration as…'
  will open the file menu. The actual image processing configuration can be saved without leaving ALICE.

- 'Save job as…' will save the actual job (including all settings from the ALGUI) without leaving ALICE. You will first be asked to save the image processing configuration file for that new job and then be prompted to save the job.

- 'Save view as…'
  is used to save the current view as a
  - JPEG-image (8bit uncompressed or compressed) with overlays, if activated or a
  - TIFF-image (8 or 16 bit) without overlays.

  Overlays are the 'projector mask' and the 'save title area'.

Note: JPEG image saves the view as displayed, with a size according to the present magnification factor. TIFF images are always saved in the true image size, regardless of the magnification factor. They also preserve the internal data range used, so images with bit depth less than 16 will appear dim as TIFF files.

- Choose 'Exit and save configuration'
  or close the ALICE window with the X
  to save the image processing configuration file and exit ALICE.

## 5.3.5 Configuration

**Naming Conventions in ALICE**

On startup, ALICE analyzes all configuration files, directories and environment variables relevant for recording. In addition to the information stored in the files, there are some conventions for naming files. These are relevant for ALICE only:

**Cinemascope geometries**

Geometry files with "CS" (in capital letters) in their file name are assumed to define cinemascope geometries, thus causing the recorded image to be warped for anamorphic projection.

Example:

```
Format:    CS_2K1828x1556
xSize:     1828
ySize:     1556
xOffset:   220
yOffset:   0
xOrigin:   1797
yOrigin:   2514
pitch:     1200.0
pullDown:  18960
```

**Inter Positive fullap geometries**
Geometry files named 'ipfullap*.cfg' are used as fullap geometries for intermed positive recording. For each supported pitch there must be one (and not more than one) ip fullap geometry file. ALICE is installed with ip fullap geometries for all supported pitches.

Example:

```
Format: 2Kipfullap
xSize:  2048
ySize:  1583
xOffset:   0
yOffset:   0
xOrigin:   1797
yOrigin:   2352
pitch:  1200.0
pullDown:  18960
```

**Loader LUTs for Color Management** [*see also chapter 6.4.3*]
Loader LUTs are used to convert images to cineon code values prior to recording. Since the cineon conversion is built in the ICC profiles used for the Color Management, Color Management will fail if incorrect loader LUTs are selected. Therefore, ALICE automatically selects the appropriate loader LUT if Color Management is turned on. They are distinguished from other loader LUTs by starting their name with CMS.
If there is more than one CMS LUT for a bit depth, the user can choose between these LUTs, but will be prevented from selecting other LUTs. ALICE is installed with CMS loader LUTs for each bit depth, named cms08.lut, cms10.lut, cms12.lut and cms16.lut.

Note: Do not change the loader LUT in the ALGUI, if Color Management is selected.

## 5.3.6 Input Format File Specification

**Location of input format file**

The fully qualified path and filename of the input format file is specified in the environment variable 'ALICE_INPUT_FORMAT_FILE'.
The suggested location is
'c:\al\alice\config\aliceInputFormats.cfg'.

**Syntax of input format file**

The syntax of the input format configuration file follows the general syntax of ARRILASER configuration files, as for example the film format file. Each entry defines a valid input format that is a pixel aspect (pixel width/pixel height) associated with an image size. Whenever images of this size are selected, ALICE displays a choice of pixel aspects, denoted by names, in the "Input Format" drop down list. Instead of giving image width of height in pixels, the keyword "any" denotes any arbitrary width or height. Definitions using the keyword "other" are selectable if (and only if) no other entry matches the current image size.

```
################################################
# ARRILASER ALICE Input Format Configuration File
#
# ARRI Film & TV
#
################################################

# examples of entries for images scanned from
# cinemascope film, thus having a pixel aspect
# of 1:2 :
imageformat: 2k_cinemascope
  xSize       : 2048
  ySize       : 1556
  pixelAspect : 0.5

imageformat: generic_cinemascope
  xSize       : any
  ySize       : any
  pixelAspect : 0.5

# PAL size image, but with square
# pixels
imageformat: PAL_square
  xSize      : 720
  ySize      : 576
    pixelAspect: 1.0
```

Software Operation

ALICE uses the following internal rules to determine the list of input formats:

It internally maintains a list of input formats, consisting of the entries of the user defined file followed by predefined HD and SD formats. For any given input image, each format matching the size of the image is displayed in the input format panel. If no format is found in both the user defined and the internal list, a generic format with pixel aspect 1.0 is assumed.

## 5.3.7 Fine-tuning ALICE

**Memory Footprint**

The amount of memory ALICE consumes depends on the maximum image size to be processed, and the maximum size of its internal image cache.

The image cache limit can be influenced by the environment variable 'ALICE_MEM_FRACTION'.
Its value is the percentage of the memory marked available to the application by the operating system. Default is 0.25, meaning that a quarter of the memory is the upper limit of the image cache. Note that this is the image cache only, not the total memory footprint of the application. The environment variable can be set in '`c:\cshell\login.csh`'.

**Multi Threading**

Besides running parallel to image loading and recording, the image processing can operate multi-threaded to make optimal use of the dual CPU system.

When running ALICE at the same time as recording on the same host computer, multi-threading can be switched off by setting ALIP_THREADS to 0.

This affects both ALICE as well as image processing for recording. Setting ALIP_THREADS to 1 turns on multi-threading, while setting it to "auto" causes the multi threading to be turned on, but to be disabled it temporarily if both ALICE and aldaemon are running at the same time, to allow interactive working with ALICE while computing data-intensive recordings. The auto setting is also the default if the environment variable is not set. The environment variable can be set in '`c:\cshell\login.csh`'.

## 5.3.8 Accessing DVS Disk Recorders

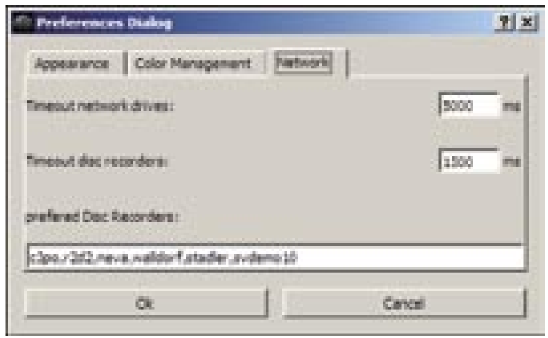
Together with ALICE comes the possibility to directly access DVS HDTV and SDTV disc recorders. Direct access to disc recorders is also possible via the command line interface (CLIF).

The direct frame access uses the DVS API, and does not need the DVS virtual file system to be installed. Frames are accessed as raw YUV data, and converted to RGB by the ARRILASER software. The conversion follows the DVS SMPTE274cgr matrices, thus converting the video save range into full 16 bit range.

Since the conversion is done at a very early processing stage, the images are seen by the ARRILASER software as 16 bit RGB images. They also require 16 bit LUTs for recording, regardless of being stored as 8 or 10 bit YUV on the disc recorder. Also, YUV data exported from the disc recorder as YUV16 can be read, if given the file extension `.yuv16`.

**Browsing Disc Recorders**

To make disc recorders visible in the sequence dialog panels, define their host names or ip addresses in the 'preferred disc recorders' section within the 'network' tab in ALICE preferences. The entry is a comma separated list of the disk recorders. Disk recorders can be specified by ip addresses or by name. If specifying names, make sure there is a domain name server entry for the disc recorders, or list them in the windows host file `c:\winnt\system32\drivers\etc\hosts`.



**Network Timeouts**
Whenever browsing file servers or disc recorders with the 'Open Sequence' dialog in ALICE, or the 'Browse" dialog in the ALGUI, waiting for inactive servers can be annoying. Therefore timeouts can be adjusted in the network tab ➪ **photo** of the preferences panel of ALICE.

When accessing a DVS disc recorder, the check if the recorder is reachable is done by sending a ping request to its host. A value of 0 disables checking, connections to unreachable disc recorders will then timeout by the DVS defaults.

The timeout is ignored whenever loading images from the disc recorder, both by ALICE and CLIF. Therefore, it does not affect recording.

**Partition Change Policy**
On DVS disc recorders, frames of different sizes are stored in different partitions. Only one partition can be active at a time, and only frames on active partitions can be accessed.

Since changing the active partition will prevent all other applications and real time operations to be stopped, the ARRILASER software can be allowed or forbidden to automatically switch to the partition it needs.

If the environment variable 'AL_DR_PARTITION_CHANGE' is set to 1, both CLIF and ALICE will switch partitions without notice. If unset or set to 0, CLIF will never change partitions, while ALICE will ask the user. The environment variable can be set in 'c:\cshell\login.csh'.

**Command Line Interface Syntax**
Frames on a disc recorder can be accessed by the alexpose command as files, using the protocol-like filename convention:
‘`dr://<host name>/<partition name>/<clip name>/<frame number>`‘

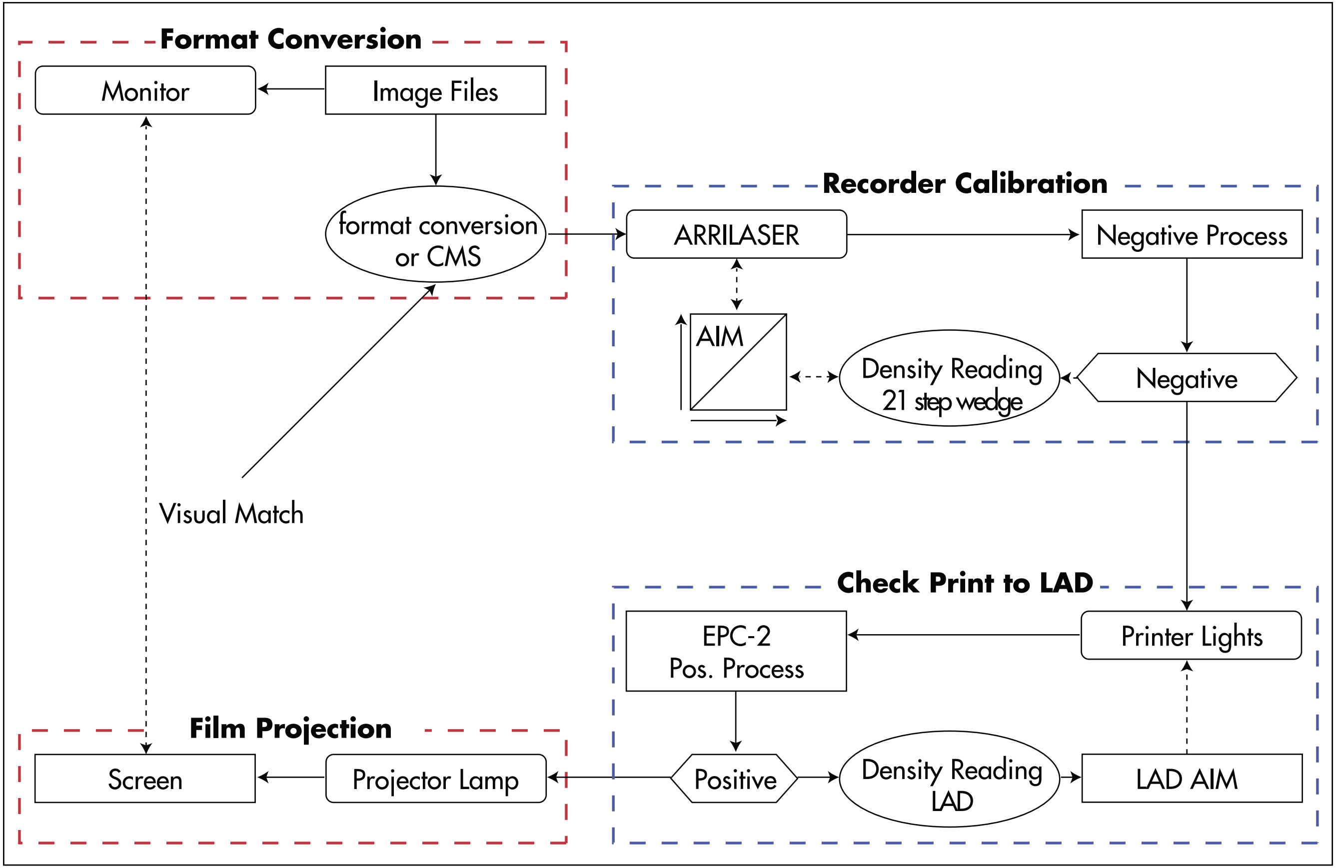
e.g.

‘`dr://mydiscrecorder/PART1/testclip/42`‘

means frame 42 within the clip testclip. Frame enumerations starts with frame 0.

Omitting the clip name addresses the complete partition, e.g.
‘`dr://mydiscrecorder/PART1/500`‘

Note: This is a name convention built in the CLIF and ALGUI software, not a protocol. Therefore, no extra drives have to be installed to use this feature. Although the DVS software allows the creation of partition and clip names containing ‘/‘ or ‘\‘, these will not work. The reserved clip name ‘.‘ (a single dot) shall also be avoided.


Format Conversion
Monitor
Image Files
format conversion or CMS
Visual Match
Recorder Calibration
ARRILASER
Negative Process
AIM
Density Reading 21 step wedge
Negative
Check Print to LAD
EPC-2 Pos. Process
Printer Lights
Film Projection
Screen
Projector Lamp
Positive
Density Reading LAD
LAD AIM

# 6 System Integration

## 6.1 Summary

The following sections are addressing the integration of the ARRILASER film recorder in the production workflow.

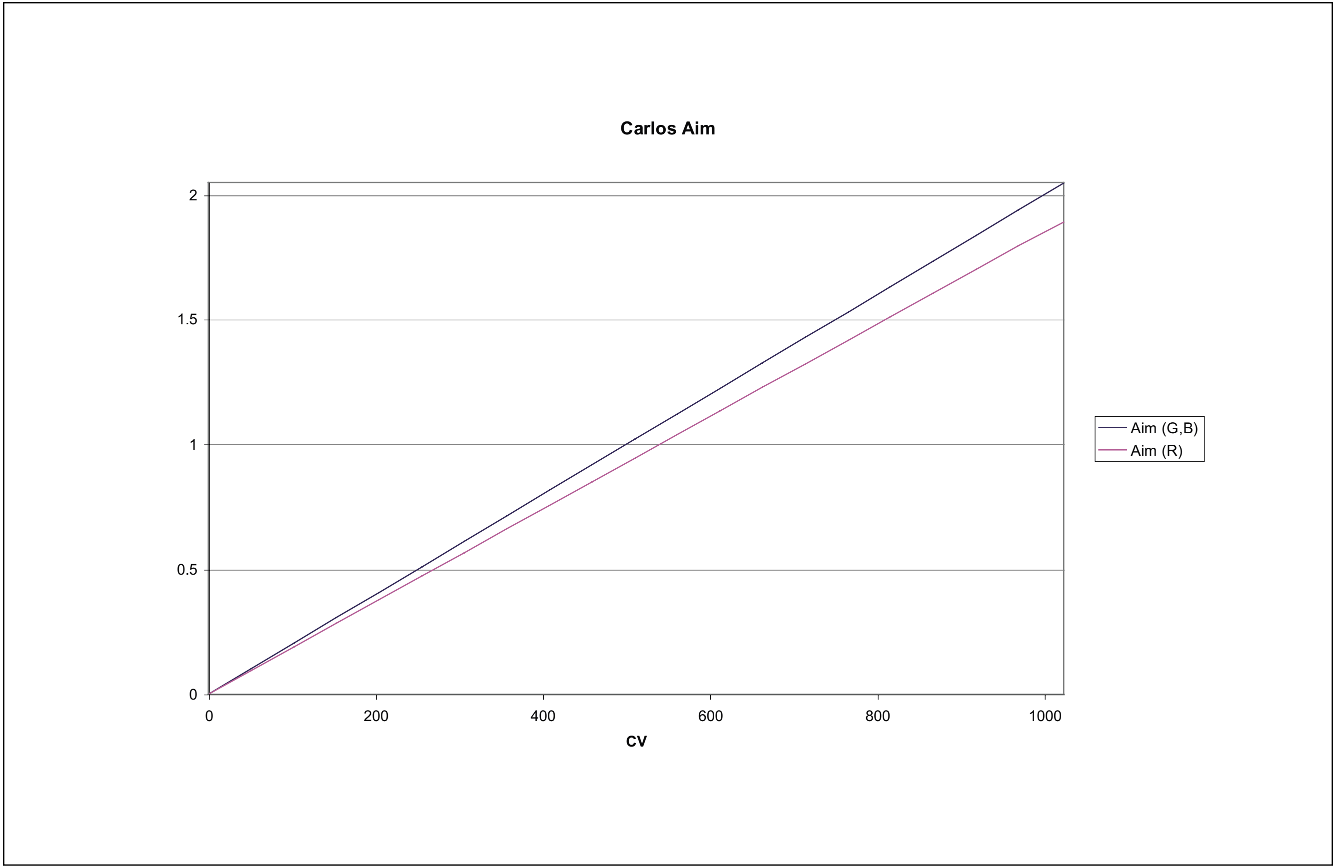
*See chapter 6.2 Recorder Calibration* to understand calibration as ongoing process, depending on the film stock used for the recording and depending on the negative process employed in the lab. Find step-by-step instructions to maintain the recorder calibration and additional guidelines to record on different film stocks.

*See chapter 6.3 Format Conversion* to understand the recorder's internal image data conversions depending on the delivered image file formats.

*See chapter 6.4 ARRI Color Management System* (CMS) for general application strategies and for operational instructions using CMS in a linear production workflow.

*See chapter 6.5 ARRI Digital Lab Control* (DLC) to understand the possibilities given by the DLC Excel sheet to provide negative and positive process control. Find background information regarding the usage of CMS and DLC.

*See chapter 6.6 Optimize Applications with ARRILASER HD* to learn more about the tools and actions, needed to provide best possible print results.


Carlos Aim
2
1.5
1
0.5
0
0
200
400
600
800
1000
CV
Aim (G,B)
Aim (R)

# 6.2 Recorder Calibration

## 6.2.1 Recorder Calibration Basics

The ARRILASER film recorder utilizes the Cineon image file format as internal image data representation. The Cineon image file format is a 10 bit logarithmic exchange format. It is mainly designed to reflect film densities. The relationship between digital code values (CV) and densities are well-defined by the so called aim file.

Note: Regarding Cineon specifications, the aim is determined by the equation: CV = 500 * density The densities in this relationship are printing densities. As the aim file is indicating status M densities, the aim curves can be different for the colors R, G, B and the curves can differ for calibrations on different film stocks.

➪ **photo** The diagram shows aim curves defined by the aim file provided as 'C:\algui\config\cal\carlos.aim'. 'Carlos.aim' is the name for the aim used to perform initial recorder calibrations and quality checks. It is also used for the generation of the ICC recorder profiles provided with the ARRI Color Management System (CMS).

With a given aim specification, the setup of appropriate recorder calibration parameter shall be understood as an ongoing process.

Test sequences need to be recorded, developed and measured with a status M densitometer in 2k and 4k. If the density readings don't reach the aim specification, the first approach is to adjust the red, green and blue laser power limits (maximum exposure values) as they determine the highest densities on film. The second approach is to generate a compensation lookup table (calibration LUT) based on the aim file (how should the curve look like), the density readings (how does the curve look like) and the calibration file (used for the recording).

If the process is carried out multiple times per week, excellent accuracy can be achieved. At a minimum it should be done after a new negative stock is placed in the recorder (new batch number), the stock type changes (Kodak, Fuji, etc.) or when the film lab changes the composition of the bath.

*See also chapter 7.1.3.4* for a description of the aim file syntax.

## 6.2.2 Recorder Calibration Practices

The following section will give you a step-by-step instruction to maintain the recorder calibration. We suppose that you use ALGUI to operate the ARRILASER film recorder and that you have the ARRI Digital Lab Control (DLC) Excel sheet available to verify the calibration results.

To start the calibration procedure, use the 'startupexp.cal' calibration file, supplied with system delivery.

**Calibrating the ARRILASER using ALGUI:**

***1. Define a shoot job to record a grey wedge***

- Open a job in the Job Edit window and set up the aqua (ARRI Quality Analysis) sequence which is consisting of 46 images, including the grey wedge: 21 steps of different grey intensity (frame number 5 to 25). The images are provided in the aqua directory ('c:/images/aqua' or 'c:/images/aqua2k').
  Either use the 'Browse' button in the 'Sequence' section of the 'Job Edit' - Input tab page to select the aqua images as input sequence,
  or use the 'Shoot Control Job' option of the 'Job Edit' - Shoot tab page to get the grey wedge recorded prior to an arbitrary image sequence.

- Be sure to have the 'Calibration' flag enabled in the 'Setup' section of the Job Edit - Input tab and 'startupexp' selected from the 'Calibration' list.

- Click on the 'Setup' button beneath the 'Calibration' list to check the maximum exposure values, set by the 'startupexp.cal' calibration file.

  Common startup values for maximum exposure values are:
  Red: 1750 Green: 800 Blue: 40

*For further information how to create a shoot job see chapter: 5.2 Graphical User Interface (GUI)*

***2. Record the grey wedge***

- Click on the 'Start/Restart' shoot control icon from the ALGUI tool bar to start the recording.

- Verify with the logging information in the ALGUI window that the maximum exposures and the calibration LUT are successfully loaded.

***3. Measure and create a density readings file***

- Receiving the negative back from the lab, perform a measurement of the status M densities of the recorded grey wedge and note the values using the Data Input chart of the ARRI DLC Excel sheet.
  *See chapter 6.5.2: Using the ARRI DLC Excel sheet.*

- Compare the density readings to the aim file specifications using the Recorder Calibration chart of the ARRI DLC Excel sheet.

- Save the density readings, clicking the 'Export Dens File' button on the ARRI DLC Excel sheet, as you will need this file to generate a new calibration LUT.

The calibration procedure has completed as soon as the densities fit into the aim curve shape (respectively as soon as they are within the accepted tolerance range).

***4. If necessary, adjust maximum exposure values***

- If the highest densities on film are lower than the values specified by the aim file, increase the maximum exposure values within your calibration file.

- To edit the values access the Calibration Setup window from the ALGUI Setup menu.

- Use the 'Browse' button from the Edit Existing tab to open the calibration file. Adjust the 'Maximum Exposure' values and click the 'Save As' button to save the changes.

- Go back to step 2: Record the grey wedge, to verify the changes.

**5. Generate a new calibration LUT**

Note: If you generate a new calibration LUT on too low maximum exposure values, you will get a warning message: "maximum headroom exceeded" and the resulting LUT will perform a hard clipping in the highest densities.

- When the highest densities match the aim file specifications (this means that they are equal or higher than the aim), but the densities don't fit into the shape of the aim curve, generate a new calibration LUT.

- Access the Calibration Setup window from the ALGUI Setup menu. Switch to the Create Calibration File tab. Use the 'Browse' buttons to select the 'Aim File', the 'Density Readings' file (created with the ARRI DLC Excel sheet) and the 'Input Calibration' file (used for the recording).
  Click the 'Create and Save As' button to create a new calibration file. Herewith a new calibration LUT file is calculated.

- Go back to step 2: Record the grey wedge, to verify the changes.

Note: Usually not more than one or two iterations are necessary to achieve a good result. If your result is still unsatisfying after the second iteration, it is recommended to start the calibration again, using the 'startupexp' and to control the stability of the negative process in the film lab.

To perform a recorder calibration means to update (by downloading) the calibration parameter within the recorder hardware. These hardware settings are permanent and therefore it is not necessary, continuously to calibrate prior to the recording. However if you are recording on different film stocks, perform a calibration (select the 'Calibration' check box and assign a calibration file) from the first shoot job within your ALGUI shoot queue.

### 6.2.3 B&W Recording

Note: Be aware that there are various possibilities to perform B&W recordings, as you can record on different B&W stocks utilizing diverse developing times or processes and B&W developing is quite different from lab to lab. Therefore it is absolutely necessary, that you plan extensive calibration testing with your lab before starting a B&W job.

Please understand the following section as a reference to support you finding out your preferred strategy on B&W recordings.

We recommend to use only one laser for B&W recordings. Regarding the sensibility of film it is appropriate to use the blue or the green laser.

Regarding the steps listed in *chapter 6.2.2 Recorder Calibration Practices* please consider the following additions to calibrate the ARRILASER film recorder for B&W:

***1. Define a shoot job to record a grey wedge***

- Create a special ‘bw.cal’ calibration file and set the maximum exposure values for the two unused lasers to 0. To do so, access the ALGUI Recorder Calibration Setup window and open the existing ‘startupexp.cal’ file.

- Save your changes, creating a new “bw.cal” calibration file.

***2. Record a grey wedge***

- Use the new ‘bw.cal’ calibration file to set up the shoot job.

- Be sure to have the ‘Calibration’ check box selected and ‘bw’ selected from the ‘Calibration’ list.

***3. Measure and note density readings***

- Measure the densities using the visual mode on the densitometer. Use the Data Input chart of the ARRI DLC Excel sheet and fill in the measured density values in all three channels before exporting the density readings file.

***4. If necessary adjust maximum exposure values***

*5. Generate a new calibration LUT*

- Use ‘carlos.aim’ or a custom-made ‘bw.aim’ to create a new calibration LUT.

Use the ARRILASER Image Processing Software Engine to record B&W separations of the color images or to render B&W images of the color images.
*See chapter 7.2.2.4 Image Processing for Color Separation node settings.*

Lessons learned:

- Recording has been tested on the following Kodak materials:

5234 Duplicate Negative Film
5366 Duplicate Positive Film
5242 Intermed
2376 Sound Recording Film
5302 Positive Film
5363 High Contrast Positive Film
2238 Panchromatic Separation Film

- You will get satisfactory calibrations on 5234 material, developed in a positive process of 3 minutes and printed on 5302 developed in a positive process of 4,5 min. Developing the negative material in a positive process raises the gamma of the material and you can easily reach 2.2 densities above base.

- If your printer lights are to low, you can get your printer lights in a reasonable range, shifting the aim curve so that CV 95 is set to 0. To do so, use ‘bw_pos.aim’ in your cal directory (‘C:\algui\config\cal’) and set the maximum exposure values to 0, 0, 40 as starting point.

- A considerable B&W print can also be achieved by recording only one color on color intermed negative and making a B&W print. In this case, of course you won’t get a B&W negative.

### 6.2.4 Recording on 5245 Camera Negative

*WARNING:*
*You can't record on camera negative without the upgrade option for camera negative. The upgrade includes an extra switch on the internal camera cover plate.*

- After loading the film, bring the switch in the position 50 D. (50 ASA daylight).
  This will insert a filter in the beam path.

- Check the filter position in order to avoid misexposed images. When starting a recording with the ALGUI, the queue manager will indicate the filter position. Otherwise use the 'alstatus densfiltstate' shell command to check the current filter position. The command should return '1' to indicate that the filter is in place. (*See chapter 7.1 on how to use Cshell commands* and *chapter 8.2.7 on densfiltstate return values*)

- Since camera negative material provides only a gamma of 0.7, the possible density range is lower than on intermediate film stock. For that reason a separate aim file ('carlos_5245.aim') is provided. This aim file uses only the code values between 95 and 710.
  Please make sure with your loader LUT, that you do not exceed this code value range or assign a soft clip to the data in the post production, as the values will be hard clipped otherwise.

- When you check the calibration with the ARRI DLC Excel Sheet be aware of the camera negative 'inter image' effect. This means that if one color is suppressed the others will be increased. Therefore it will usually take two iterations to get close to the aim.

- To achieve a better result already on your first iteration, a specific 'startupexp5245.cal' is provided. Using the same maximum exposure values as on 5242 usually brings the density readings into the expected range.

Note: To avoid unwanted film exposure by the light sensors in the camera, always perform a prewind prior to the recording of the next image sequence if the film transport rests longer than 15 min on the same position.

## 6.2.5 Recording on Interpositive

You can use the ARRILASER Image Processing Software Engine to perform the data conversions necessary for the recordings on interpositive.

**Creating an ipconfig file for the interpositive recording:**

- Using ALICE to create the ipconfig file, you only have to click the interpositive button.

- Using the ALGUI Image Processing setup window you have to create an ipconfig file consisting of the following nodes:
  1. 'interposlut' node: Inverts the images, so that a positive image will be recorded on film.
  2. 'flip' node: Flips the image horizontally.
  3. 'paste' node: Pastes the image on a black fullap background.

In order to avoid blank areas between two frames on interpositive recording, it is possible to record out overlapping frames.

If you reduce the y-origin and enlarge the size of the black background image that surrounds the pasted image, you will get two overlapping frames, while your image is still located at the same position. This gives you a better master for the copying process.

**Choosing an appropriate geometry format:**

The recorder geometry settings must correspond to the paste node settings. The format's y-origin must be reduced in order to fit the image completely on the film.

Examples for corresponding image processing and geometry settings are:

4K:

| | | | |
|---|---|---|---|
| Node | paste | Format | fullap4kinterpo |
| xOffset | right | xSize | 4096 |
| yOffset | center | ySize | 3166 |
| newXSize | 4096 | xOffset | 0 |
| newYSize | 3166 | yOffset | 0 |
| fillcolor.red | 0.0% | xOrigin | 1797 |
| fillcolor.green | 0.0% | yOrigin | 2352 |
| fillcolor.blue | 0.0% | pullDown | 18960 |
| | | pitch | 600 |

2K:

| | | | |
|---|---|---|---|
| Node | paste | Format | fullap2kinterpo |
| xOffset | right | xSize | 2048 |
| yOffset | center | ySize | 1583 |
| newXSize | 2048 | xOffset | 0 |
| newYSize | 1583 | yOffset | 0 |
| fillcolor.red | 0.0% | xOrigin | 1797 |
| fillcolor.green | 0.0% | yOrigin | 2352 |
| fillcolor.blue | 0.0% | pullDown | 18960 |
| | | pitch | 1200 |

HD:

| | | | |
|---|---|---|---|
| Node | paste | Format | fullap2kinterpo |
| xOffset | right | xSize | 2152 |
| yOffset | center | ySize | 1663 |
| newXSize | 2152 | xOffset | 0 |
| newYSize | 1662 | yOffset | 0 |
| fillcolor.red | 0.0% | xOrigin | 1797 |
| fillcolor.green | 0.0% | yOrigin | 2352 |
| fillcolor.blue | 0.0% | pullDown | 18960 |
| | | pitch | 1142 |

## 6.2.6 ARRILASER HD Calibration

The ARRILASER HD is targeted on recording on camera negative material, such as EK5212, EK 5245, Fuji 8522 and Fuji 8532. As it is recommended to use the ARRI Color Management System (CMS) for the recording, a special aim-file is provided, which works with the respective CMS profiles. ('c:/algui/config/cal/ALHD.aim')

Regarding the steps listed in *chapter 6.2.2 Recorder Calibration Practices* please consider the following additions to calibrate the ARRILASER HD:

***1. Define a shoot job to record a grey wedge***

- Use the presets of startup_EK5212.cal, startup_EK5245.cal, startup_Fuji8522, startup_Fuji8532, to start with the right maximum exposure values.

***2. Record a grey wedge***

- Be sure to have the 'Calibration' check box selected and the respective calibration file selected from the 'Calibration' list.

***3. Measure and note density readings***

- Measure the densities with the status-M densitometer. Use the Data Input chart of the ARRI DLC Excel sheet and use the 'ALHD.aim' as comparison file.

***4. If necessary adjust maximum exposure values***

***5. Generate a new calibration LUT***

- Due to the `inter image' effect on camera negative, it is quite likely that more than one iteration is necessary to get a good result.

| lut.name | lut.depth | comments |
|---|---|---|
| cms08.lut | 8 bit | 1:1 LUT used for CMS |
| cms10.lut | 10 bit | 1:1 LUT used for CMS |
| cms16.lut | 16 bit | 1:1 LUT used for CMS |
| 10log.lut | 10 bit | 1:1 LUT used for recording logarithmic images |
| 8lin.lut | 8bit | lut needed in the ALGUI to record the slate frame |
| video.lut | 8bit | Conversion from video images according to the cineon standard.<br>CVs span a range or 95 to 685. |
| 8bit.lut | 8 bit | Conversion LUT derived from measurements.<br>Converting video images to cineon, when using ALHD.aim. |
| 10bit.lut | 10 bit | Conversion LUT derived from measurements.<br>Converting video images to cineon, when using ALHD.aim |
| 16bit.lut | 16 bit | Conversion LUT derived from measurements.<br>Converting video images to cineon, when using ALHD.aim |
| 8to10.lut | 8 bit | Conversion LUT derived from measurements.<br>Converting video images to cineon, when using carlos.aim |
| 10linto10log.lut | 10 bit | Conversion LUT derived from measurements.<br>Converting video images to cineon, when using carlos.aim |
| 16to10.lut | 16 bit | Conversion LUT derived from measurements.<br>Converting video images to cineon, when using carlos.aim |
| TV_Lev.lut | 10 bit | Lut to convert 10 bit linear images according to the ‘video safe’-standard.<br>CV 64 is mapped to 95 and CV 940 is mapped to 685. |
| GR_Lev.lut | 10 bit | Lut to convert 10 bit linear images according to the ‘fullrange’-standard.<br>CV 0 is mapped to 95 and CV 1023 is mapped to 685. |

# 6.3 Format Conversion

Image files are not necessarily delivered as Cineon Files. *See chapter 10.1* for a list of supported file formats.
To convert incoming file formats (8bit, 10bit, 12bit, 16bit) to the internal 10 bit Cineon file format, a conversion lookup table (loader LUT) ➪ **photo** is needed.

Using the ALGUI Job Edit window to set up a shoot job, you can assign a loader LUT by selecting the appropriate conversion from the 'Loader' list within the 'Setup' section of the 'Input' tab page. Depending on the bit depth of the image sequence files the 'Loader' list presents available LUTs from the loader directory ('C:\algui\config\luts') as choices.

At this point knowing detailed information about the origin of the image data and the applied post production workflow is important.

Note: Using ARRI Color Management (CMS), the format conversion is included in the color profile. Nevertheless the software applies a loader LUT. Hence 1:1 LUTs (named 'cms08.lut', 'cms10.lut', 'cms12.lut', 'cms16.lut') are provided and need to be assigned as loader LUTs.

*See chapter 6.4.3 Using CMS (linear workflow).*

You find a short description of standard loader LUTs referring to the Cineon specifications from Kodak and of loader LUTs calculated from practical experience in the loader table ➪ **photo**

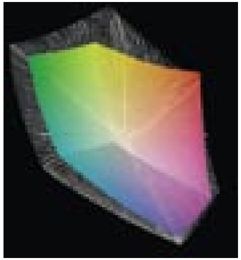
If you need to customize the loader LUTs, edit the appropriate files using a text editor or generate new LUTs using the 'ipmakelut' tool (provided as image processing utility command, *see chapter 8.3.4* ).

Using the ARRILASER Image Processing Software Engine the incoming file formats will be converted into a 16 bit format based on an input LUT. After processing the data will be converted by an output LUT into the 10 bit log format.

Using ALGUI you don't have to explicitly assign an input and an output LUT. The queue manager will use the iplutconvert tool (also accessible as command line tool) to transform the loader LUT to an input and output LUT pair prior to the recording.

For more details regarding format conversions see:
*chapter 7.1.3.3: alexpose command*
*chapter 7.2.3.1: Image processing Input and Output LUTs*
*chapter 8.3.3: iplutconvert*

HD/Xenon film projector



HD/DLP

film projector / DLP

# 6.4 The ARRI Color Management System (CMS)

Note: The ARRI Color Management System (CMS) is an optional extension to the ARRILASER Image Processing Software Engine and not included in the standard software configuration.

## 6.4.1 Understanding Color Management

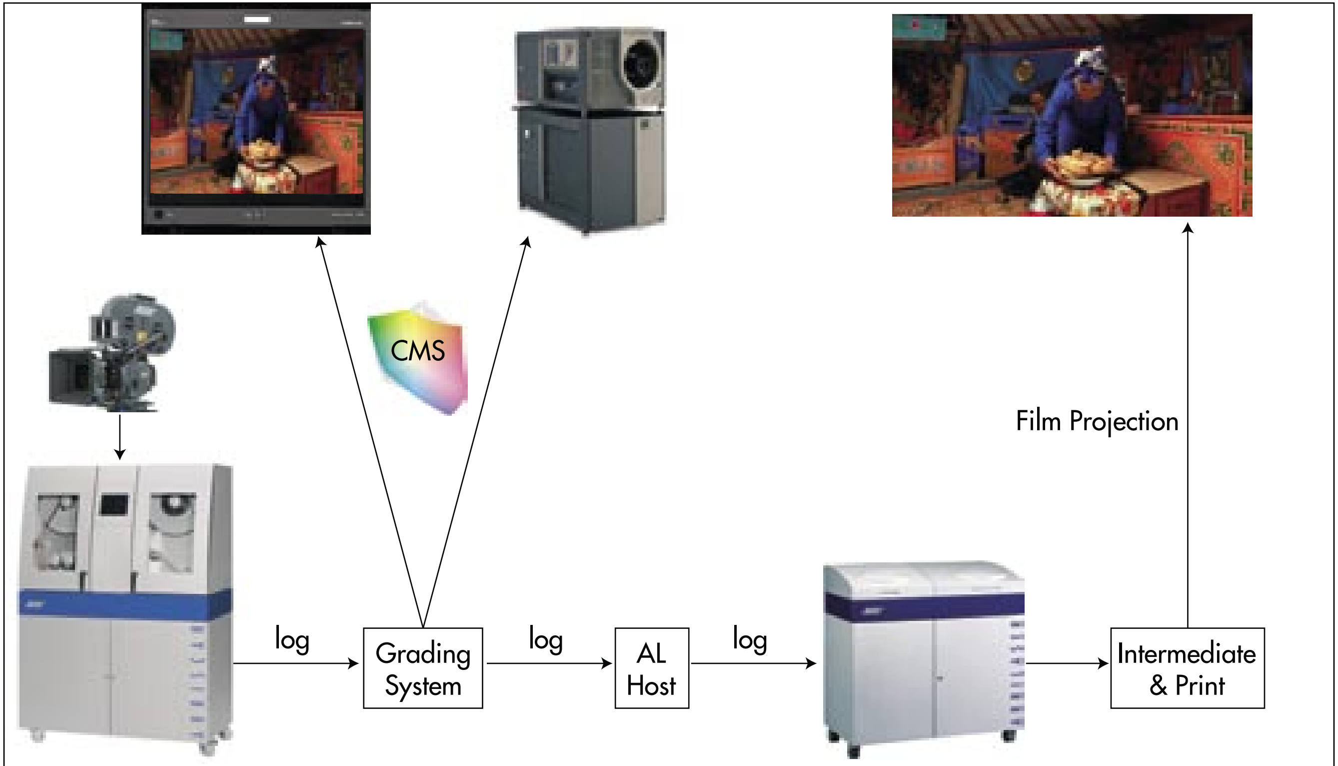
On film colors are created by multiplicative color mixing (color creation with filtering gelatine layers in a white light source) while on monitors, colors are created by an additive color mixing method (color creation by active light sources) ⇨ **photo**.

Hence two different color gamuts are defined by these varying ways of color creation. This means that the same color values do not necessarily give the same color sensation, and not every color exists in both gamuts.

As in most video projects (SD or HD) the directors judge the colors on a standard monitor, in cinema they often recognize that the colors do not look as they are intended. Therefore it is essential to have a tool that converts the images prior to the recording, so that the film in projection matches the look on the monitor.

## 6.4.2 Application Strategies

The ARRI Color Management System (CMS) supports two different application strategies one for a logarithmic and one for a linear production workflow.




ARRI CMS is used as 3D preview LUT to modify the display of logarithmic images in the grading session

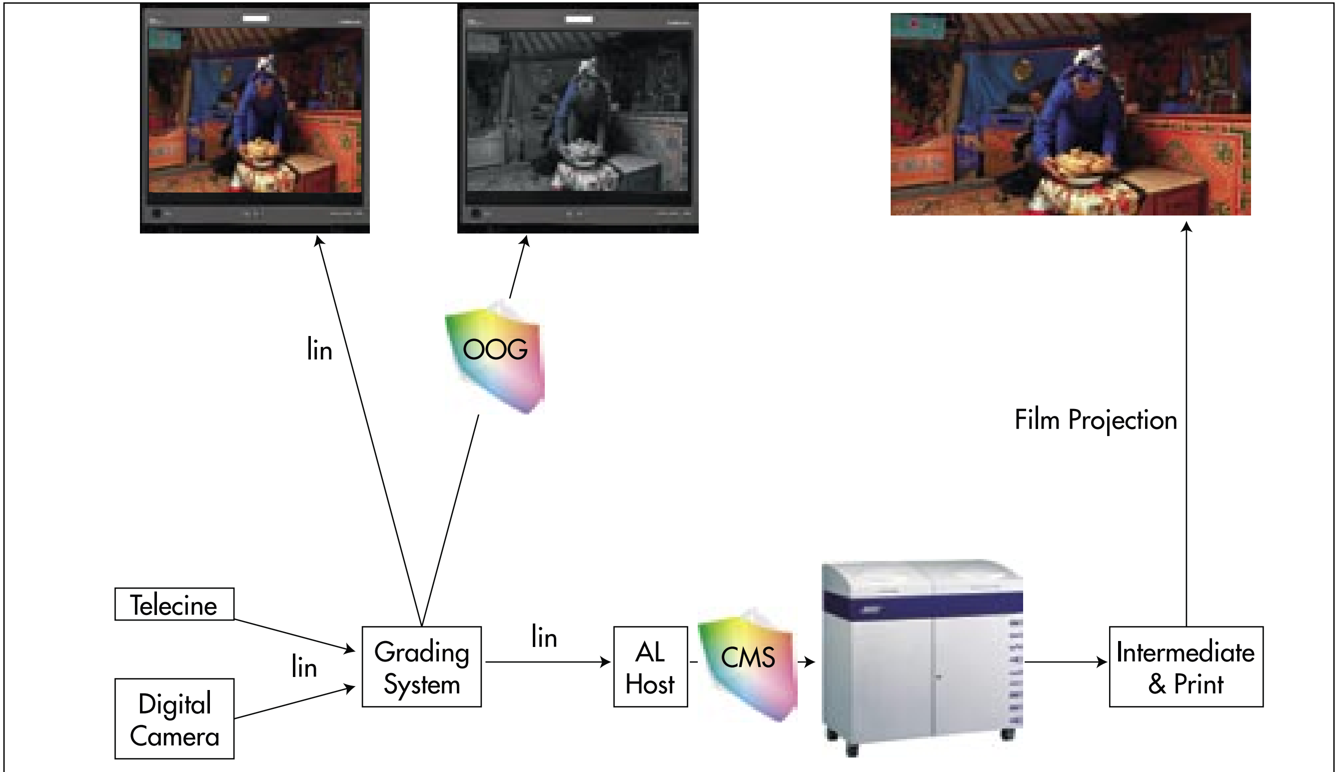
**Logarithmic workflow**

The logarithmic production workflow is characterized by logarithmic image data representations all along the digital production chain ⇨ **photo**.

Most likely the acquisition is done on film using a film scanner to digitize the image data, since logarithmic file formats are best to represent film densities. This means the applications make use of the complete film gamut as the film color space is never left.

In this case preview lookup tables are used to change the monitor display or the DLP projector in a way that the displayed colors will match the film projection look. Keep in mind that, despite using preview lookup tables, there are colors in the film projection, which cannot be displayed on a monitor.

As the preview lookup tables need to be used in the grading session, ARRI provides preview lookup tables for partner companies.




ARRI CMS is used to modify the linear files in the ARRILASER prior to recording.
Out-of-Gamut (OOG) LUT is applied in the grading session to verify the color gamut.

**Linear workflow**

The linear production workflow is characterized by linear image data representations originated from a digital camera or scanned by a telecine ⇨ photo.

The entire post production will be processed on linear data representations and the images will be displayed on a monitor or with a DLP projector for color corrections.

In this case the ARRI Color Management System (CMS) gives you the ability to apply monitor profiles and recorder (print film) profiles to setup the conversion from the linear data format to the recorder's logarithmic data representation on the film out.

Using CMS the colors, seen in the film projection will match the ones, seen on the monitor.

Take into account that due to the different color gamuts there are colors which can be displayed on the monitor but do not exist on film. By default those out-of-gamut colors would be hard clipped into the film gamut leading to a detail loss in those areas.

To smoothly clip out-of-gamut colors, you can use a soft clip, which will compress the monitor gamut in the highly saturated areas. Keep in mind, that the usage of soft clipping is a compromise that will result in less-than-ideal color reproduction.

It is best to avoid out-of-gamut colors from the very beginning. ARRI out-of-gamut indication is available within the ALICE Software, but also available in form of Out-of-Gamut (OOG) lookup tables for products of our partners.

## 6.4.3 Using CMS (linear workflow)

You can access the ARRI Color Management System (CMS) from the ARRILASER Image Processing Software Engine.

The CMS interface fits into the scripting interface of the image processing. To set up CMS features, you just have to add a CMS node to the node list of an image processing configuration file.

Using ALGUI open the 'Job Edit' window and select the 'Image Processing' check box from the 'Setup' section in the Input tab page, to activate CMS for a specific job.

Be sure to have the appropriate configuration file from the 'Image Processing' list selected.

The CMS node creates a 3D lookup table from the ICC profiles, specified as monitor and recorder (print film) profile. An optional gamut compression can be activated by specifying one of the presets, defined in a soft clip configuration file.

**CMS node configuration settings:**

Using the Image Processing setup window or ALICE to setup the configuration file, you have to define values for the CMS node parameter.

***1. Select a monitor and recorder (print film) profile.***

| | Monitor type | Color temperature |
|---|---|---|
| **Monitor Profiles** | Sony BVM-D24E1WE | 6500 K |
| | Sony GDM-VW 900 | 5400 K |
| | Sony GDM-VW 900 | 6500 K |

| | Negative Filmstock | Print Filmstock |
|---|---|---|
| **Recorder Profiles** | EK 5242 | EK 2383 |
| | EK 5242 | Fuji 3510 |
| | Fuji 8502 | EK 2383 |
| | Fuji 8502 | Fuji 3510 |
| | EK 5245 | EK 2383 |
| | EK 5212 | EK 2383 |
| | Fuji 64 | EK 2383 |
| | Fuji 125 | EK 2383. |

Adhering to standards wherever it is possible, the following parameters had been taken into account to generate the recorder profiles, provided with the ARRILASER film recorder:

- Negative film characteristics (intermediate film stock)
- Recorder calibration
  - carlos aim
- Print film characteristics (print film stock)

- Printer lights (LAD aim)
  - Kodak 1.09 1.06 1.03,
  - Fuji 1.10 1.05 1.05

- Positive processing bath
  - according to Kodak Specifications

- Film projection lamp and screen reflection
  - SMPTE 196
  - Xenon Lamp 5500ºK, 55cd/m² (16fL)
  - D55 x0.332 y0.347

The following monitor setups are required for the monitor profiles:

- Monitor type:
  - Sony BVM-D24E1WE (grade one monitor)
  - Sony GDM-VW 900 (computer monitor)

- Monitor white point Calibration:
  - D65 x=0,3127 y=0,3290
  - D55 x=0,332 y=0,347

- Monitor Setup (TV safe Level):
  - 20% grey 2.2 cd / m²
  - 100% white 80 cd/m²

If you want to use other ICC profiles, copy them to the folder 'c:\al\ipconfig\icc'.

***2. Select the correct loader LUT***

Select a 1:1 loader LUT in the appropriate bit depth. The 1:1 LUTs are named cms_xxx.dat.
When using the ALICE software, the correct LUTs are automatically chosen.

***3. If necessary, assign a soft clip setting.***

Colors outside the film gamut cannot be recorded without changes, since they do not exist on film. By default, these colors are hard clipped into the film gamut. To smoothly clip these colors, a compression of the monitor gamut has to be done. In order not to lose too much details in those areas, it is required that either the lightness or the chromaticity of these areas is reduced.
The strength of the compression can be controlled by the soft clip settings defined by a soft clip configuration file. Use the 'softclip' dropdown list to select a preferred soft clip setting. Keep in mind that using a soft clip will not only affect the out-of-gamut colors, but also the colors that are just within the gamut. Therefore the lowest possible soft clip should be taken.

***4. If necessary, edit the soft clip configuration file***

*see 7.2.2.5* for a brief description.

***5. Set the rendering intent (optional)***

The ICC profile specification allows four different conversion types from a device dependent color space (RGB or Cineon) to a device independent color space (Lab or XYZ), and back. These differ mainly in terms of gamut compression and white point adaptation. These intents are:

'**absolute**':
colors are matched as absolute colors, regardless of the white point of the source and destination devices. This means, a D65 white on an HD monitor will appear as D65 in the cinema after recording. Use this option only when a direct side-by-side comparison is required, as artefacts can occur.

'**relative**':
colors are matched with respect to the white point of the devices. A D65 white on a HD monitor will appear as a D55 white in a cinema which is on D55.
This option is not useful for a side-by side comparison, but gives very good results for general cinema purposes.

In general the 'relative' rendering intent is recommended.

'**perceptual**':
The perceptual intent tries to avoid clipping of out-of-gamut colors, regardless of the size of the source gamut. Therefore, it has to perform some overall gamut compression. Think of the perceptual intent as of the relative intent with some soft clip applied. In practice, the perceptual table is often identical with the relative table.

For a detailed explanation of rendering intents *refer to the ICC home page www.color.org*.

***6. Verify CMS settings using the ALICE Proof and Gamut Viewing Modes***

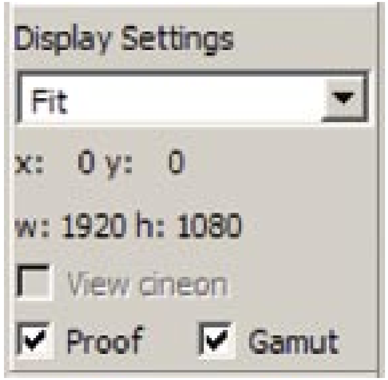
Proof:
Since the color profiles directly generate Cineon data, judging the effect of the color management on screen can be difficult. Therefore, the proof mode allows for simulating the appearance of the recorded image on the workstation monitor.

- To use the proof-mode, an ICC profile for the monitor has to be selected in the ALICE Preferences dialog.

Note: It is also handy to select the HDTV monitor as workstation monitor, regardless of the fact that it is not a HD monitor, since this display allows checking the effect of clipping out-of-gamut colors easily by using the 'C' toggle key.

- Open 'Preferences - Color Management' from the 'File' menu. Choose the workstation profile.

There it can be judged, if the loss of resolution in those areas is acceptable, or not. If not, a soft clip can be applied. Using a soft clip, it is recognizable, that more colors are different to the original, but at the same time more detail can be achieved in back.



Gamut:
The out-of-gamut colors can also be indicated separately, if the 'Gamut' check box is selected. This will highlight the areas which are out-of-gamut.
These areas can be reduced by changing the soft clip parameters.
The way of highlighting can be modified in the 'Preferences'-Color Management dialog. Assign the color in which those areas are indicated (preferable a color which is not so present in the images) and select how to show the distance of those colors to the gamut.

fixed color:
All out-of-gamut pixels are drawn with the out-of-gamut color selected in the Preferences dialog.

blend to fix color:
The color of all out-of-gamut pixels is smoothly blended with the out-of-gamut color selected in the Preferences dialog. The mixing ratio depends on the distance of the color to the gamut, so that colors being far outside the film gamut finally are displayed in the out-of-gamut color only.

color distance mask:
In gamut pixels are displayed as grey, while out-of-gamut pixels are blended between the grey and the original color. The more saturated a color appears in this view, the more it is out-of-gamut. Note that since the blending is done between the grey and the original color, turning proof on has no effect herewith.

### 6.4.4 Using CMS on Low Key and Low Saturation Images

With low key or low saturated images the color reproduction is critical for an automated work with the CMS. Therefore it is recommended to disable the CMS for these images, and to use only the conversion LUTs derived from measurements [*see chapter 6.3*].

# 6.5 ARRI Digital Lab Control (DLC)

## 6.5.1 Controlling the Recorder Calibration and the Lab Processing Services

The ARRI Digital Lab Control covers recorder calibration and lab processing services in order to ensure constant image quality while working on a project over weeks or months.

To control calibration parameter and to compare the print film results, a selection of reference images (greyfield and AQUAs) must be assigned to the beginning and to the end of each recorded job queue. The reference images includes a LAD test patch and a 21 step grey wedge sequence to allow the status M measurement of the intermediate negative and the status A measurement of the print film.

Having the status M density readings and the aim file specifications on-hand you can calibrate the ARRILASER film recorder to the characteristics of the negative bath. *See chapter 6.2 Recorder Calibration*.

There is no way for clients to modify the print process. This is done by the chemist who monitors a set of parameters like concentration of chemicals, developing speed, temperature and density readings of a sensitometric test strip.

To provide reliable quality management statements you have to analyse the film lab process characteristics and you have to be able to track final results.

Using a calibrated densitometer and using the ARRI DLC Excel sheet, gives you the possibility to compare successive lab processes or to compare a lab process to a reference process.

Acquiring not only the LAD density reading used for the printer lights set up, but also status A densities for the entire 21 step grey wedge, enables you to analyse the characteristic of the positive bath.

Archiving the dens readings over a long period can help you to detect lab specific offsets, periodical drifts or changes in the positive bath.

Organizing measurement readings and additional project and process information as process data records (*.dlc files) supports you to ensure the quality and consistency of the final deliverables.

## 6.5.2 Using the ARRI DLC Excel Sheet

The ARRI Digital Lab Control (DLC) Excel Sheet is part of the ARRILASER film recorder software distribution ('path/name.xls').

Take advantage of the DLC Excel Sheet using it as analysing and monitoring tool to control the recorder calibration and the lab processing services (aim print and positive bath parameters)

Maintain process data records containing all process specific parameters, using the ARRI DLC Excel Sheet to create, analyse and archive '*.dlc' files.

The ARRI DLC Excel sheet provides 3 charts:

- The Data Input chart is used to enter negative and print film density readings as well as process and project related data.

  In addition an integrated LAD calculator calculates the printer light correction values. Lab specific settings and the selected print film stock (Fuji or Kodak) are taken into account.

- The Recorder Calibration chart shows the relationship between the status M densities of the current readings and the readings from a reference process and compares them to the specifications defined by the appropriate aim file.
  Use the 'Export dens file' function to create a dens file from the current status M densities (required for the recorder calibration process).

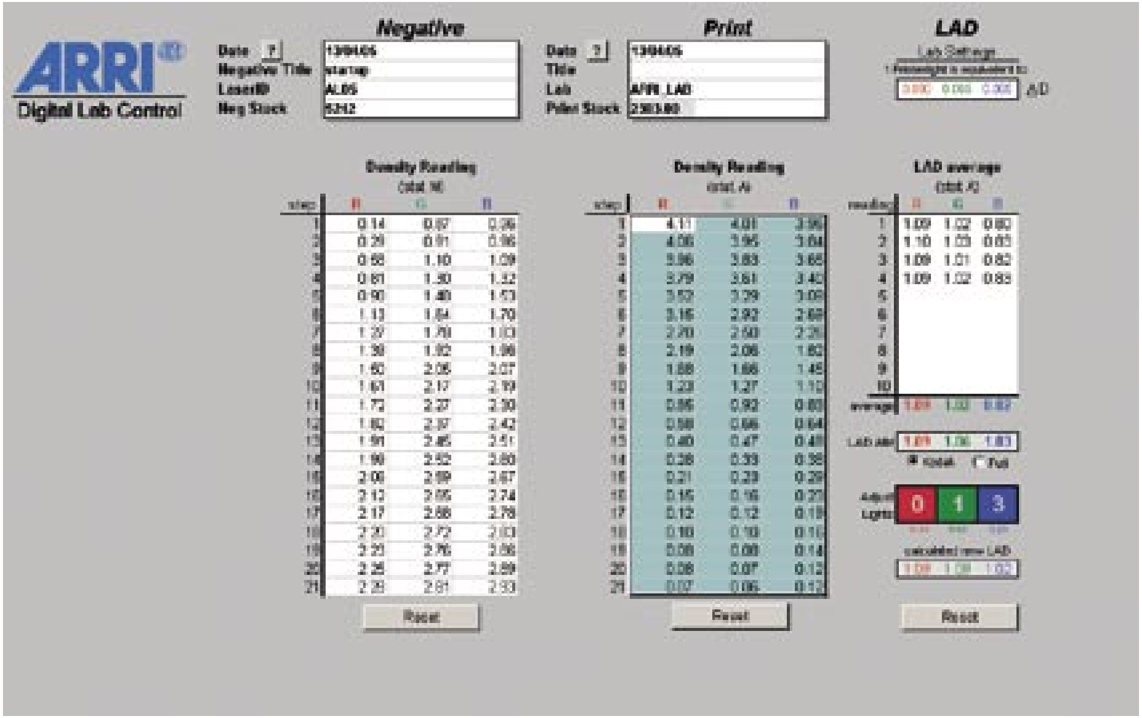
- The Lab Process chart shows the relationship between the status A densities of the current readings and the readings from a reference process.
  It provides extended quality indicators to verify and compare different lab processes.

In the following sections the usage of the DCL Excel sheet will be explained. To follow the instructions please open the Excel sheet with the execution of macros set to be enabled.

**How to install the Engineering Plug-in**
Before using the DLC-sheet, the excel engineering plug in had to be installed. To do so, copy the file `XlXtrFun.xll` into the folder: `c:\Documents & Settings\user\application data\Microsoft\AddIns`.

In excel open the menu Tools -> Add-Ins and go on the browse button. Add the XlXtrFun.xll to the list of Add-Ins.

Note: To use the excel sheet properly the decimal symbol needs to be set to a point. (Adjustable in the control panel / regional settings)


ARRI
Digital Lab Control
Negative
Print
LAD
Density Reading
Density Reading
LAD average
Reset
Reset
Reset

## Data Input Chart

**Use the 'Negative' input fields to enter negative process data:**

- 'Date' input field: to enter the date of the negative can.
- 'Negative Tiltle' input field: to enter the title of the negative project.
- 'LaserID' input field: to enter the film recorder ID.
- 'NegStock' input field: to enter the negative stock used.

**Use the 'Print' input fields to enter positive print process data:**

- 'Date' input field: to enter the date of the print film can.
- 'Title' input field: to enter the title of the negative project.
- 'Lab' input field: to enter the name of the lab.
- 'Print Stock' input field: to enter the print film stock used.

**Use the tables to fill in density readings:**

- 'Status M' input table: to fill in negative density readings.
- 'Status A' input table: to fill in printing densities.

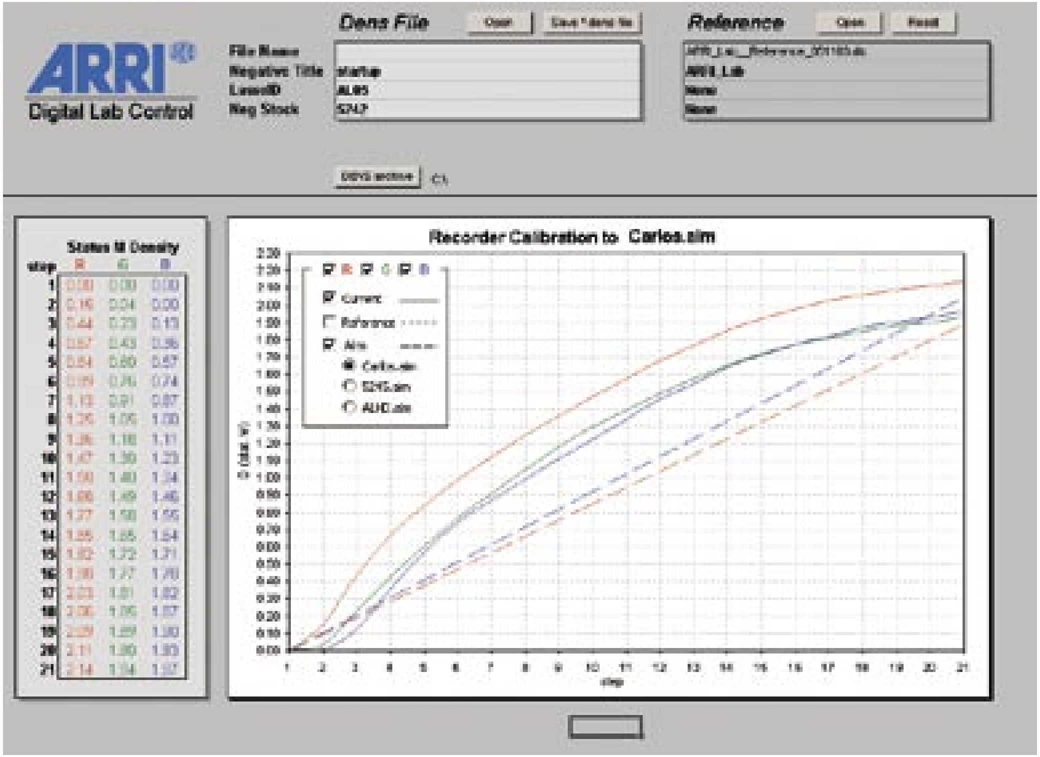
**Use the buttons to maintain the data input:**

- 'Reset' (Status M) button: deletes the density entries in the Status M table.
- 'Reset' (Status A) button: deletes the density entries in the status A table.

**Use the LAD area to calculate printer light correction values**

- '$\Delta$D' fields: Input the average value of densities for one printer light in each color in your lab.
- 'LAD average' fields: enter up to ten status A readings from a LAD field.
- 'Kodak' and 'Fuji' switch: to indicate the used print film stock.

The integrated LAD calculator outputs the printer light correction values in the 'Adjust Lights' area. Lab specific settings and the selected print film stock (Fuji or Kodak) are also taken into account. The calculated new LAD values shows the results including the printer light corrections.


Dens File
Open
Reference
ARRI
Digital Lab Control
File Name
Negative Title
Neg Stock
Status M Density
Recorder Calibration to Carlos.slm
Current
Reference
Aim
step

### Recorder Calibration Chart

The Recorder Calibration chart shows the current status M negative densities in comparison to the aim file specifications (carlos.aim, ALHD.aim or carlos-5245.aim) and/or in comparison to the calibration of a reference process.
To load a reference calibration, use the 'Open' button in the reference area.

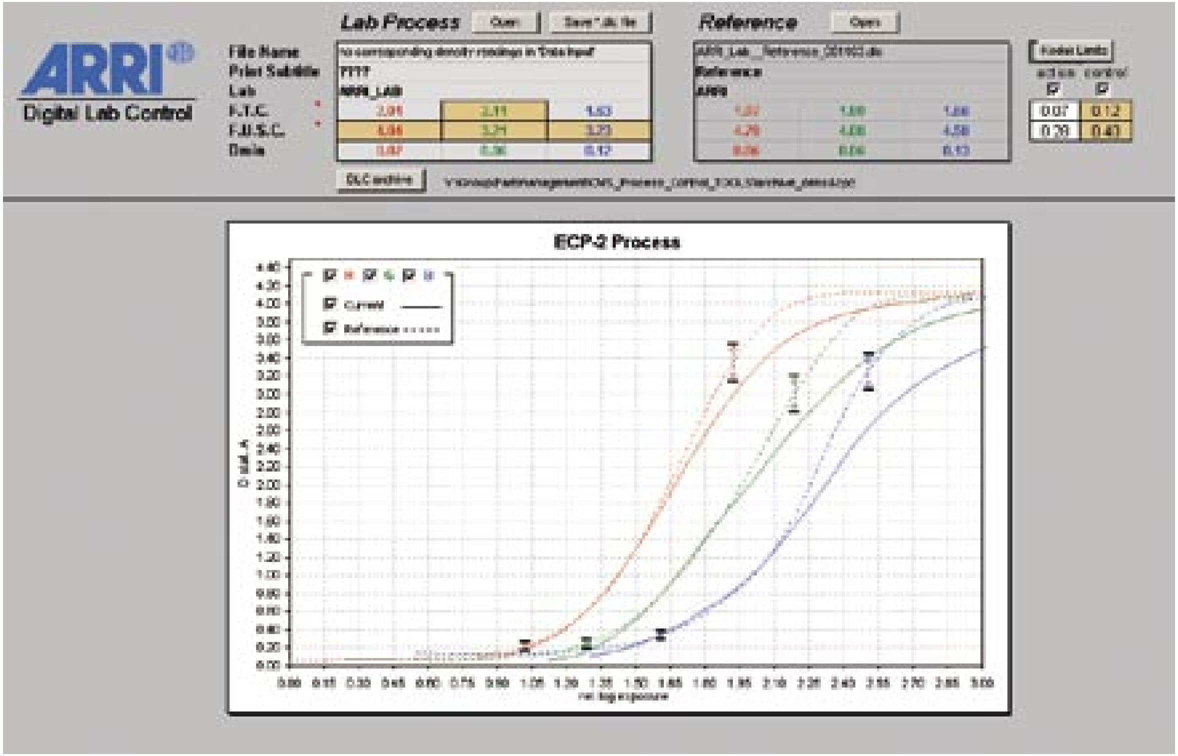
The status M density readings are base balanced.
The target values will change depending on the selected aim file.

Use the curve legend to switch between the following presentation options:

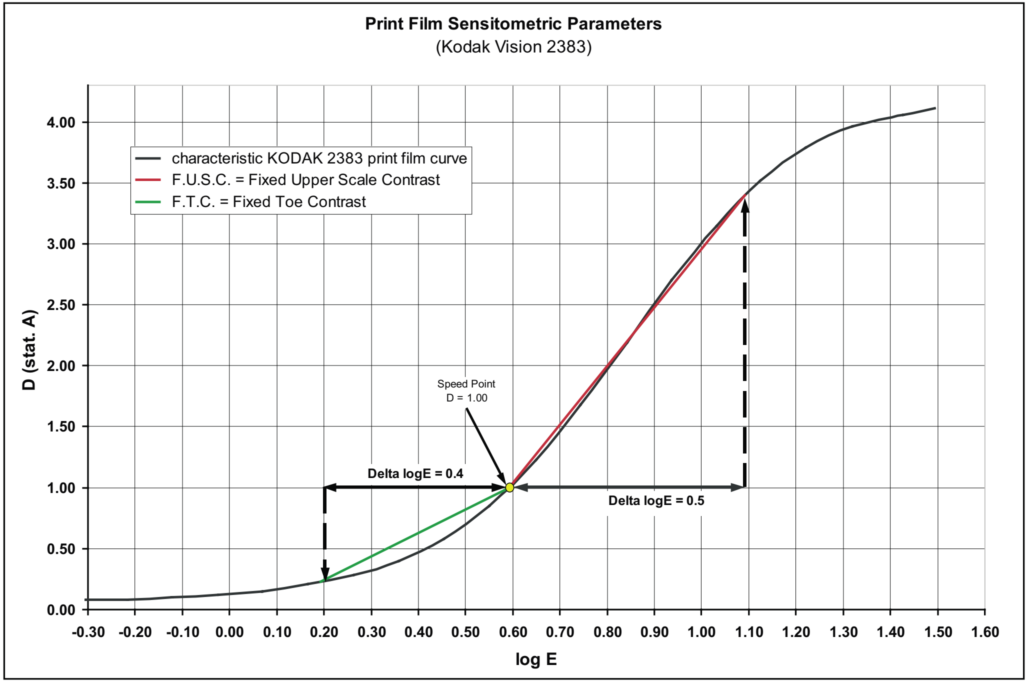
- 'R', 'G', 'B' check boxes: select the channels to plot the appropriate curves.
- 'Current' check box: show/hide the current density readings.
- 'Reference' check box: show/hide the current reference calibration.
- 'aim' check box: show/hide the selected aim specifications Select an appropriate aim file specification. Supported aims are Carlos, 5245 or ALHD (only use with CMS).

Use the buttons to restore or save the data input:

- 'Open dens file' button: opens an existing dens file.
- 'Save dens file' button: opens the 'Dens Archive' folder with a file browser to save the current density readings. You will need this file for the recorder calibration process. The name convention is: 'AL<#>_2K_<title>-<subtitle>-<YYMMDD>.dens
- 'Dens Archive' button: opens a browser to select the density file folder


Lab Process
Reference
ARRI
Digital Lab Control
File Name
Print Subtitle
Lab
ARRI_LAB
ECP-2 Process
Current
Reference

**Lab Process Chart**
The Lab Process chart shows print film characteristics and parameters of the current lab process in comparison to a reference process.


Print Film Sensitometric Parameters
(Kodak Vision 2383)
characteristic KODAK 2383 print film curve
F.U.S.C. = Fixed Upper Scale Contrast
F.T.C. = Fixed Toe Contrast
Speed Point
D = 1.00
Delta logE = 0.4
Delta logE = 0.5
D (stat. A)
log E
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.30 -0.20 -0.10 0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60

For a better understanding see ➪ **photo** The Print Film Sensitometric Parameters diagram. The parameters of interests are:

- Minimum Density (Dm (D.min))
  Density of unexposed and fully processed area of film.

- Fixed Relative Printer Rating (F.R.P.R.)
  100 (3-logE) where E represents the exposure at a point on the curve at a density of 1.00 above minimum density.

- Fixed Toe Contrast (F.T.C.)
  Slope of the straight line connecting the F.R.P.R. point on the density curve and the point corresponding to a 0.40 log E interval to the left.

- Fixed Upper Scale Contrast (F.U.S.C.)
  Slope of the straight line connecting the F.R.P.R. point on the density curve, and the point corresponding to a 0.50 log E interval to the right.

The Lab Process chart shows the following output parameter to verify and compare different lab processes:

- 'File Name' output field: showing title of the negative project

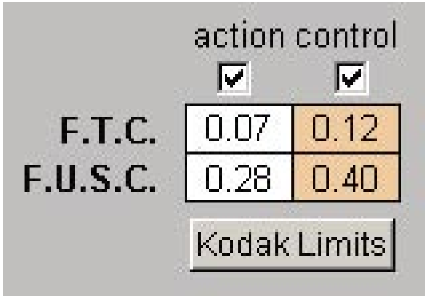
- 'Print Subtitle' output field: showing the

- 'Lab' output field: showing the

- 'F.T.C.' output field: showing the fixed Toe Contrast

- 'F.U.S.C' output field: showing the Fixed Upper Scale Contrast

- 'Dmin' output field: showing the




Use the following fields and buttons to verify the current process:

- ‘action’ check box: to show/hide action limits for the F.U.S.C
- ‘control’ check box: to show/hide control limits for the F.U.S.C
- ‘Kodak Limits’ button:  resets the editable action and control limits for F.T.C and F.U.S.C. to Kodak limits.

If the values are out of ‘action limit’ the appropriate output fields will be bordered with a black line.

If the values are out of ‘control limit’ the appropriate output fields will additionally be highlighted in orange.

The EPC-2 Process diagram shows the current process with solid lines and the reference process with dotted lines. The diamonds mark the action limits for the F.U.S.C. and the black bars beneath mark the control limits.

The example ⇨ **photo** shows the green channel within the limits. The red channel is out of action limit and the blue channel is out of action and control limit.

- Use the ‘open’ and ‘save’ .dlc buttons in the Lab Process area to open or save a complete DLC sheet.
- Use the ‘Open’ button in the Reference area to open a reference process.
- Use the ‘DLC Archive’ button to specify the folder where your DLC-files are archived.

## 6.5.3 Using DLC and CMS

The film lab has the final word regarding colorimetric parameterisations. Therefore the final print is the reference to which the digital images must be balanced.

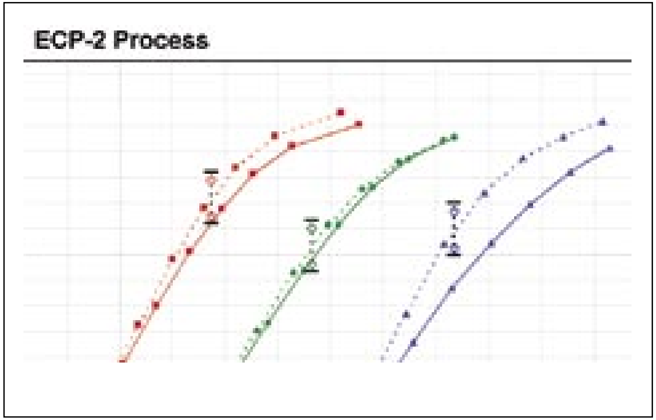
If the film lab is calibrated to Kodak aims then calibrating the digital workflow environment (scanner, workstation monitor & recorder) to Cineon specifications will result in an accurate print process.

Each print film profile comes with a process record (.dlc file), describing the 'profile master' which is the print used for the spectral measurements to generate the profile.

Working with the DLC Excel sheet and having the densitometer calibrated to the provided reference specification, it is possible to judge the final print in comparison to the status of the lab at the time the 'profile master' was processed.

If both processes the 'profile master' and the current client process are at every stage (negative bath, recorder calibration, positive bath, "on-aim" print) within tolerances, the final result and color reproduction should look alike.

As extra service provided by ARRI customized recorder (print film) profiles and monitor profiles can be generated. This will be necessary if you use the ARRI Color Management




System (CMS) and for example parameter values regarding the positive process differ to the ones used for the recorder profile generation.

**Checking Print to LAD**
As printer lights are used to expose film they can control the relative density of the print film by varying the amount of light that is made available. For example, increasing the amount of source printer light will make the print more dense overall and vice versa.
If all printer lights are out by the same value the overall color balance will be maintained, the image will simply be lighter or darker depending on the direction of the error.
If one or two printer lights are out, or all lights are out in different directions, the print will have a color bias as well as being potentially brighter or darker.

In order, to attain continuous and comparable results on print film, balance the LAD patch (e.g. code value 445 as 10bit) to the following, film stock dependent aim densities:

- Kodak Vision (2383) and Vision Premier (2393) print stock (stat. A)
  R-1.09  G-1.06  B-1.03

- Fuji (3510) and Fuji DI (3513) print stock (stat. A)
  R-1.10  G-1.10  B-1.05

For CMS use a technical adjustment of the printer lights, based on objective densitometric measurements of the LAD patch is highly recommended due to the fact that the ARRI CMS profiles and preview LUTs are generated in reference to these aim values.

Note: Using the ALHD.aim and CMS correct results can only be achieved with a modified LAD frame having the CV´s R=536 G=498 B=416. This LAD frame is provided within the Aqua images on the ARRILASER HD.

# 6.6 Verifying CMS results

The following section will give you step-by-step operating guidelines to achieve best possible results using the ARRI Color Management System (CMS) and locating errors.

## 6.6.1 Tools Needed

- Supplied by ARRI:
  ARRI CMS HD Tape with reference image data
  ARRI CMS reference negative and print film
  Barbieri densitometer (comes with ARRILASER HD)
  ARRI DLC Excel sheet with reference measurements

- To be provided on site:
  Monitor calibration tool

  Densitometer for status a and status m measurements (if not provided by ARRI)

## 6.6.2 Verifying Workflow Setups

To verify your workflow setup please check the calibration and adjustments of all system components:

**Calibrating the Monitors:**

1. Use a monitor calibration tool with a high quality calibration sensor, e.g. a Phillips PM 5639 to calibrate your reference Monitor used for the grading session.

2. Calibrate the monitor to a color temperature of 6500K or 5500K, with:
   100% white at a luminance of 80cd/m2 or 23fL and
   20% grey at a luminance of 2.2cd/m2 or 0.64 fL.

   The two test images should have the following specifications (TV-safe-level):

   | | | | |
   |---|---|---|---|
   | 100% white | Y940 | U512 | V512 |
   | 20% grey | Y240 | U512 | V512 |

   Test images are provided on tape.

3. Make sure using the right Monitor profile, when activating the CMS Node.

**Verifying the Disk Recorder Setup:**

1. To verify the disc recorder's import/export functions, transfer the reference image data provided by the supplied HD Tape onto the disc recorder.

2. If you are not going to record straight from the disk recorder, export the image data to the designated location within the ARRILASER Host file system.

3. Start the ARRILASER Interactive Configuration Editor (ALICE) to check the HD images from the disk recorder. Use the colorpicker tool within the ALICE preview section to examine the data. Image #3 is a Macbeth Color Chart with indicated code values in 8, 10 and 16 bit. Compare the values of the color picker (in the original view of the ALICE), with the values written on the image. They should not differ more than 2 code values in 8 bit.

4. On differences between corresponding CV values, check if there are legalizer options on your disk recorder and that if it is set to full range or TV-safe-level. ARRI profiles are calculated for full range.

**Verifying the Film- and Digital-Projection Setup:**

1. The projection should be calibrated to a color temperature of 5500K and a brightness of 13 Ft./L or 55 cd/$m^2$

2. Use the ARRI CMS reference print film and make side-by-side comparisons with the digital data from the ARRI CMS HD tape displayed on a calibrated HD monitor and/or digital projection in your projection suite.

3. If you're not satisfied with the HD data to film comparison, please verify the legalizer settings, monitor calibration and projection setups.

**Verifying the Densitometer Setup:**

The densitometer used for status M and status A measurements should be calibrated to the (standard) specifications of the densitometer. Compare your readings of the ARRI CMS reference negative and print film with the reference measurements provided by ARRI. If necessary, please contact the ARRILASER support to generate a compensation matrix for your densitometer calibration.

**Verifying the Print Process Setup:**

1. Strike a print from the ARRI CMS reference negative: Get your film lab to print the ARRI CMS reference negative to the desired printing aims.

2. Measuring status A density of the LAD or neutral grey field: Receiving the print film back from the lab, measure the status A densities.
   Be sure that the densitometer is set to status A density. Place the LAD field underneath the densitometer probe. Center the image at the probe, to measure always the same spot on the print.
   Note the RGB density values and use the DLC excel sheet to calculate new printer lights in order to get an 'on-aim' print.

3. Get your film lab to re-print the negative if the print doesn't reach the designated aims.

Note: Keep in mind that your densitometer has probably measurement variations between +/- 0.01 densities and the lab might only be able to do corrections to a certain point. Therefore start performing a few tests to find out how close your film lab can get the print to the aim.

4. Once you've got an "on-aim" print back from the lab, measure the grey wedge densities and compare the readings with the ones from the ARRI CMS reference print film. If the values are not within the limits [*see chapter 6.5.2*], please check your lab print process.

5. Verify the results with a print to HD data side-by-side comparison.

**Control Results:**

- Make your own recording of the image data on the ARRI CMS HD Tape.
  - Make sure that your recorder is calibrated correctly to the carlos.aim [*see chapter 6.2*]
  - Make sure that you did choose the appropriate monitor and recorder (print film) profile [*see chapter 6.4.3*]

- Make a print of that negative and check the print to LAD as described in chapter 6.5.3: Using DLC and CMS.

- Get your lab to re-print the negative if the print doesn't reach the desired aims.

- Compare the 'on-aim' print in your projection theater against the original HD data

Note: If you used relative intent to shoot out your images a side-by-side comparison will fail, as you have different color temperatures. When you are judging the images in a different environment, the eye will adapt to the different white point settings and the color appearance on projection and monitor will be similar.

**Customized Service:**

If you can not keep the required specifications, you might need a customized service in order to get satisfactory results with your CMS. Please contact your ARRI sales agent.

# 6.7 Setup a CMS job with the ARRILASER HD

We suppose to use the ALGUI software, the ALICE Interactive Configuration Editor and the default configuration setups on the ARRILASER HD to generate recording jobs.

Starting a job based on predefined settings will record out HD images with their full size, applying CMS and recording an appropriate Control Job.

1. Double click on the ALGUI desktop icon to start the ALGUI software and confirm the start of the Quickstart dialog.

2. Select a shoot sequence using the 'Image Sequence' browser.

3. Mind the Quickstart dialog box, to verify the 'Prewind', 'Postwind', 'Control Job', 'Image Processing' and 'Geometry' settings.

4. Click the 'Add' button, if all settings are correct. If you have to make any changes, go to the 'Edit' button. Refer *to chapter 5.2.5* on how to create a job using the 'Job Edit' window.
   If you like to make permanent changes to your quickstart setup, save a job as "quickstart.job" file and the corresponding image processing configuration file as 'quickstart.cfg' file.

5. To preview the images, open the ALGUI 'Job Edit' window and click on the 'ALICE' button. Using the 'Film' view in ALICE you can control the image processing settings and the location of the image on the film.

6. Click the 'Start' icon from the ALGUI tool bar to start the recording, or open the Quickstart dialog from the ALGUI window, with the 'Quickstart' command located in the 'Setup' menu, to generate a new job.

If you want to record out standard definition images, quickstart will fail, as you need to apply resizing to your images. In this case you have to proceed the following steps:

1. Quickstart will open the Job Edit window.
2. Select any geometry in the setup area
3. Click on the 'ALICE' button
4. Determine pal or pal plus in the input format node
5. Define the wanted output geometry in the output format node
6. Adjust the cropping area to your image
7. Control the image positioning in the film view
8. Adjust deinterlace, sharpen and CMS as necessary
9. Close the ALICE window and save the configuration under a new name
10. Add the job to the shoot queue
11. Click the Start icon in the ALGUI tool bar to start the recording, or open the Quickstart dialog from the ALGUI window with the 'Quickstart' command located in the Setup menu to generate a new job

Note: In all cases recorder calibration as described *in chapter 6.2* has to be performed up front.

# 7 System Administration

## 7.1 Command Line Interface (CLIF)

### 7.1.1 Basic Concepts

#### 7.1.1.1 Tasks

CLIF, or command line interface, is the acronym for the software engine that drives the ARRILASER film recorder. The engine is implemented as a set of command line executables, which are communicating with a master daemon process. This daemon process controls the image data flow while running in the background. It synchronizes the communication with the film recorder and provides status information for all command line executables.

Image files accessed through the file system are prepared for recording and sent to the ARRILASER film recorder frame by frame. For each image the daemon process starts and controls the exposure cycle of the film recorder.

In order to keep up with the imaging speed of the film recorder hardware, shooting one image is split into three tasks: First, the image data is loaded to memory (loading), second, the image data is processed in the image processing, if enabled, and third the image data is transferred to the film recorder hardware and recorded onto film (recording).

With a triple buffered memory management for the image data, loading, image processing and recording can run in parallel. This means that the daemon transfers image data for recording stored in one data memory, while processing the next image into a second memory and loading a third image, into a third data memory.

Furthermore, the engine provides commands to calibrate the film recorder, set geometry parameters for positioning the image on the film, as well as commands for film handling.

At any time information about actual film recorder settings and the film recorder's current status can be requested.

### 7.1.1.2 Control and Image Data Flow

The control and image data flow model starts with image data anywhere in the file system, on local disk or network. The image data will be loaded frame by frame to the main memory on the host computer from where it is transferred per direct memory access (DMA) to the image data interface. This PCI interface enables image data transfer line by line to the film recorder via fibre link. It also ensures real time operation, utilizing an internal buffer (50 image lines) to bridge any delays on the host bus.

The daemon process, called 'aldaemond.exe', handles all requests coming from the command line executables and communicates with the Carmille software running on the internal control computer of the ARRILASER film recorder via the serial line connection. (On the ARRILASER HD both programs are running on the same computer)

Interprocess communication is achieved by event mechanisms. After initializations, the daemon process waits in an endless loop for "do something" events, set by the CLIF commands. The control and image data exchange is based on the shared memory concept. Therefore two or more processes, running on the same computer, can access the same part of the virtual memory.

### 7.1.1.3 Process Synchronization

A CLIF command first tests if the daemon process is running. As a second step it checks the daemon's state.

**Daemon States**

- The daemon is 'idle',
  i.e. in the event loop, waiting for 'do-something' events.

- The daemon is 'executing' a command,
  e.g. sending a calibration lookup table
  to the film recorder.

- The daemon is 'recording',
  i.e. sending image data to the film recorder
  and controlling the recording cycle.

- The daemon is in an 'error' state,
  e.g. signaling the film recorder error 'FILM OUT'.

Before a command (except 'alexpose <image>' and 'alstatus daemonstate') starts its execution, it waits until no other command is running and the daemon is 'idle', or the daemon signals an 'error' state.

As soon as the daemon is 'idle', the command sets the daemon's state to 'executing' and before it finishes execution, it sets the state back to 'idle'.

If the daemon signals an 'error' state, the command prints an error message to 'stdout' (per default the PC console) and returns immediately to the command prompt ('C%') with the error code in the return status variable. The error handling could be done on the fly by the user or automated by a script. .

A recording job always executes the commands in a sequential way, step by step within a command prompt window or as defined by a script. Internally, however, shooting one image is split into loading the image data to memory and recording the data onto film. Calling 'alexpose.exe' with the filename of an image as argument, can start loading image data as soon as the daemon gives access to one of its image data memories and does not signal an error state [*see also <CLIF Commands, alexpose.exe>*]. When 'alexpose.exe' returns to the command prompt with '0' as return value, for 'image successfully loaded', the daemon could still be recording the last frame, or it could have just started recording the current frame. In both cases a command 'alstatus.exe damonstate' directly following the last 'alexpose <image>' call, will return the message '1' to 'stdout', meaning "the daemon is still recording an image". This is shown by the timing diagram.

### 7.1.2 Calling CLIF Commands

This chapter explains how to operate the film recorder on command prompt level from a C-shell.

We suggest using a C-shell environment to enter commands. In addition to the windows control panel, global shell settings may be defined per login shell script and local environment setting with the 'setenv' command. The Hamilton C-shell emulator for instance adapts windows prompt commands to UNIX commands and offers more control structures for command execution.

CLIF commands are located in 'c:/al/clif/'. Added to the standard path for executables, they can be called from everywhere in the file system.

### 7.1.2.1 Recording Images

To expose images, you have to start the CLIF software engine, set up the image geometry parameters on the film recorder and start the exposure.

A Hamilton C-shell to type in commands is started from the Windows desktop by double clicking on the C-shell icon.

The following C-shell example shows how to expose one of the AQUA (ARRI Quality Analysis) images, which are part of the standard configuration on the host computer.

```
C% aldaemon start
  aldaemon:          daemon started
C% alsetgeometry fullap4k
  alsetgeometry:    filmformat “fullap4k”
  alsetgeometry:    actual recorder settings
  xSize:            4096
  ySize:            3112
  xOffset:          0
  yOffset:          0
  xOrigin:          1797
  yOrigin:          2514
  pullDown:         18960
  pitch:            600
C% alexpose c:\images\aqua\0001
C%
  successfully exposed “c:\images\aqua\0001”
```

Note  In the last example the command prompt ‘C%’ comes back before the message successfully exposed ‘c:\images\aqua\0001’ appears. This is due to the asynchronous process explained *in the previous chapter 7.1.1.*

```
C% aldaemon start
aldaemon: daemon already running
C% alsetgeometry fullap4k
alsetgeometry: filmformat “fullap4k”
alsetgeometry: actual recorder settings
  xSize:           4096
  ySize:           3112
  xOffset:         0
  yOffset:         0
  xOrigin:         1797
  yOrigin:         2514
  pullDown:        18960
  pitch:           600
C% alexpose c:\images\aqua\0001
C% alexpose c:\images\aqua\0002
  successfully exposed “c:\images\aqua\0001”
C% alexpose c:\images\aqua\0003
  successfully exposed “c:\images\aqua\0002”
C% alexpose c:\images\aqua\0004
  successfully exposed “c:\images\aqua\0003”
C% alexpose c:\images\aqua\0005
  successfully exposed “c:\images\aqua\0004”
C%
  successfully exposed “c:\images\aqua\0005”
C% aldaemon stop
aldaemon: daemon stopped
```

#### 7.1.2.2 Recording a Sequence

To record a sequence of images, a sequence of alexpose commands is necessary. Again, note the asynchronous output:

### 7.1.2.3 Getting Status Information

You can use the 'alstatus.exe' command to get status information. In the next C-shell example 'alstatus.exe' is used to get the name of the image that was exposed last and the name of the loaded geometry format.

*See chapter 7.1.3.7 <alstatus>* for a complete command description.

Status information is important to control job scripts as discussed *in chapter 5.3.5*, and necessary to build up error handling strategies, *see chapter 5.8*.

```
C% alstatus image
alstatus: daemon not running
C% aldaemon start
aldaemon: daemon started
C% alstatus image
c:\images\aqua\0005
C% alstatus geometry
fullap4k
```

## 7.1.3 CLIF Commands

### 7.1.3.1 aldaemon <start/stop>

The command 'aldaemon.exe' starts or stops the master daemon process called 'aldaemond.exe'. It expects that the daemon executable resides in the same directory.

The daemon handles the control, status and memory management. It synchronizes the communication with the ARRILASER film recorder, provides status information for all CLIF commands and manages the high-speed image data transfer to the film recorder hardware. The daemon also starts and monitors recording cycles on the ARRILASER film recorder.

**C-shell example using aldaemon.exe:**

```
C% aldaemon start
aldaemon: daemon started
C% aldaemon start
aldaemon: daemon already running
C% aldaemon stop
aldaemon: daemon stopped
```

Calling 'aldaemon start', the command tests if the daemon is already running. If the daemon is not running, the command starts a process called 'aldaemond.exe' and waits until it receives a "initialization done" or "initialization failed" from the daemon process. The command reacts with a status report message on 'stdout' and returns this result in the status variable.

Calling 'aldaemon stop', the command sends a 'stop execution' event to the daemon and waits until it gets a 'daemon stopped' or 'daemon failed to stop' signal.

Again the result is written to 'stdout' and coded to one of the following return status values.

'0' daemon started or stopped.

'-1' a wrong command line parameter was typed in.

'-11' daemon failed to start/stop.

'-12' system error. For example the system runs out of memory, or the interprocess communication failed.

*See also chapter 8.2.1.*

| Name | xsize [pixel] | ysize [pixel] | xoffset [pixel] | yoffset [pixel] | xorigin [µm] | yorigin [µm] | Pull-down [µm] | pitch [µm] | width [mm] | height [mm] | aspect |
|---|---|---|---|---|---|---|---|---|---|---|---|

Example Formats : (Avaibility depends on ARRILASER Model and options)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fullap 4k | 4096 | 3112 | 0 | 0 | 1797 | 2514 | 18960 | 6.00 | 24.576 | 18.672 | 1.32 |
| Cs_4k | 3656 | 3112 | 440 | 0 | 1797 | 2514 | 18960 | 6.00 | 21.936 | 18.672 | 1.17 |
| 1.37_2k | 1828 | 1332 | 220 | 112 | 1797 | 2514 | 18960 | 12.00 | 21.936 | 15.984 | 1.37 |
| 1.66_2k | 1828 | 1100 | 220 | 228 | 1797 | 2514 | 18960 | 12.00 | 21.936 | 13.200 | 1.66 |
| 1.85_2k | 1828 | 988 | 220 | 284 | 1797 | 2514 | 18960 | 12.00 | 21.936 | 11.856 | 1.85 |
| 1.77_HD | 1920 | 1080 | 231 | 277 | 1797 | 2514 | 18960 | 11.42. | 21.926 | 12.333 | 1.77 |
| 2kacross academy | 2048 | 1744 | 246 | 0 | 1797 | 2514 | 18960 | 10.71 | 21.934 | 18.678 | 1.17 |

### 7.1.3.2 alsetgeometry <format> [<format definition file>]

The command 'alsetgeometry.exe' is used to setup image geometry parameters at the ARRILASER film recorder.

Image geometry parameters are:

- the image width and height in pixels. (xSize, ySize)
- the position of the upper left image corner on film. (xOffset yOffset , xOrigin, yOrigin)
- the inter-frame positioning on the film (pulldown).
- the distance between two pixels (pitch).

Geometry settings are predefined in a geometry format database. To edit or extend the geometry format database, a description of the geometry format and its syntax can be found in *chapter 7.3*.

Formats in the geometry database always describe the geometry on the recorder side. If there is a mismatch between the geometry of the given image and the recorder geometry, use the scale function in the image processing.

For compatibility with older software versions a special feature is still available: in cases, where the size of the given image is half or quarter resolution compared to the recorder geometry, 'alexpose' will automatically resup to the recorder geometry by pixel replication.

For comparison, some camera and projection gates according to SMPTE are listed below:

| Name | Format | width [mm] | height [mm] |
|---|---|---|---|
| Camera gate | Full aperture | 24.920 | 18.670 |
| Camera gate | Academy | 21.950 | 16.000 |
| Projection gate Academy | | 20.960 | 15.290 |

A geometry format is selected by name, as input parameter of 'alsetgeometry.exe'. The database file is specified as optional input parameter or defined by the environment variable 'AL_FILM_FORMAT_FILE'.

**C-shell example using alsetgeometry.exe:**

```
C% alsetgeometry fullap
alsetgeometry: format not found in
"c:\al\config\alfilmformats.cfg"
C% echo $status
-1
C% alsetgeometry fullap4k
alsetgeometry: film format "fullap4k"
alsetgeometry: actual recorder settings
  xSize:      4096
  ySize:      3112
  xOffset:    0
  yOffset:    0
  xOrigin:    1797
  yOrigin:    2514
  pullDown:   18960
  pitch:      600
C% echo $status
0
C%
```

If the daemon is running, 'alsetgeometry.exe' checks the existence of the geometry format database and looks for an entry of the specified format.

It reads and verifies the values and on success, it sends a 'set geometry' request to the daemon process and waits for an answer.

When the daemon is ready to deal with this 'set geometry' event, it sends the geometry parameters to the film recorder. Then the daemon re-initializes the IDI-card interface and signals 'geometry loaded' or 'geometry failed to load'.

'alsetgeometry.exe' outputs a status report message and returns a status value which may be used for job control. For example:

| | |
|---|---|
| '0' | geometry set |
| '-1' | geometry format not found<br>or access to the database failed |
| '-2' | geometry parameter setup failed |
| '-8' | geometry parameter out of range |
| '-11' | daemon not ready to setup geometry parameter |

The return values are summarized and listed in *chapter 8.2.4, <Clif Reference, alsetgeometry.exe>.*

### 7.1.3.3 alexpose <image> [<conversion lut>]

The command 'alexpose.exe' is used to record an image onto film. As a generic image loader, 'alexpose.exe' accepts several image formats as <image> input data.

Note: For more information on file formats see *chapter 10.1*. For more information on environment variables and default settings see *chapter 7.1.4.1*. A description of the daemon error states can be found in *chapter 8.2.17*. All values returned by alexpose.exe are listed in *chapter 8.2.2*.

Cineon packed 10 bit logarithmic files conform to the internal data format of the CLIF software engine. To indicate how other image data formats should be converted to '10 bit log' space, specify the name of a lookup table <conversion lut>. This is done through an optional input parameter or through one of the environment variables, 'AL_PICT_LUT_FILE', 'AL_SGI_LUT_FILE', 'AL_TIFF_LUT_FILE', or 'AL_DPX_LUT_FILE', depending on the file format of the given image.

See also *chapter 7.1.4.1* to verify the default definitions, and *chapter 6.3* for a description of the conversion lookup tables.

C-shell example using 'alexpose.exe':

```
C% alexpose c:\Images\Aqua\0001
C%
  successfully exposed "c:\Images\Aqua\0001"
```

'alexpose.exe' loads image data to main memory and, if no error flag is set, it signals "start recording" to the daemon process. On success the command returns '0'. Otherwise, if the image data loading failed, a negative error code value is returned. For example:

- '-1' a wrong filename or conversion lookup table was specified
- '-5' an error occurs reading the image data
- '-6' the image size doesn't fit to the current geometry settings

As soon as the daemon signals an error state, indicating that the exposure of a previously loaded image failed, 'alexpose.exe' stops loading the image data and reports the error code with the return status.

### 7.1.3.4 almakelut [-v] <aim file> <density readings file> <input lut file> <output lut file>

The command 'almakelut' is used to calculate new densitometric calibration curves. The internal format of the ARRILASER is 10 bits per color channel with code values ranging from 0 to 1023. 'almakelut' is restricted to calibration of negative film. 'Almakelut' will usually be utilized for the recorder calibration as described in *chapter 6.2*.

To activate the new calibration curve at the film recorder, the 'output lut file' has to be downloaded by the 'alsetlut' command.

Note: For more information on conversion lookup tables see *chapter 6.3*.
A description of the daemon error states can be found in *chapter 8.2.17*.
All values returned by almakelut.exe are listed in *chapter 8.2.2*.

The input parameters to 'almakelut' are:

***Aim file***
describes the intended relation between digital code values in the internal 10 bit format and the densities on film.

The ASCII-file has the following format:

A 'BASE' line characterizes the base density for RGB. All three figures are set to 0.
A line with one of the key words 'LINEAR' or 'SMOOTH' defines the interpolation method between key points.
Key points are defined in lines with four entries, the 10 bit code value and the related status M densities on film for RGB.
Comment lines start with a '#'.
Aim file may be edited according to your needs.
Recommended file extension: '*.aim'

The following example is included in 'c:\al\luts\carlos.aim'

```
# CARLOS Aim file
#
BASE    0.0     0.0     0.0
LINEAR
#
0       0.0     0.0     0.0
1023    1.890   2.046   2.046
```

***Density readings file***
It is assumed that a set of gray patches was recorded, utilizing the 'input lutfile' as the film calibration curve. The density readings file contains the digital code values for each gray patch and the respective status M densities for RGB that have been reached on film. The code values and density readings have to be entered by the operator.

Recommended file extension: '*.dens'
The ASCII-file has the following format:
A 'BASE' line characterizes the base densities of the film stock.
'NSTEPS' is the number of gray steps used.
Normal lines contain the digital code values and the measured RGB densities.
Comment lines start with a '#'.

See also the following example.

```
# Density readings file
#
NSTEPS 21
#
# Enter density of unexposed film below
# in the form red, green, blue:
BASE    0.14     0.63     0.71
# Enter densitometer readings below
# CV    D_red    D_green  D_blue
#
0       0.14     0.63     0.71
51      0.24     0.75     0.88
102     0.36     0.88     0.99
…
1023    2.32     2.84     2.91
```

***Input lut file***
is the 'old' film calibration lut. The gray patches for the current calibration step were recorded with this lut. The table lists the relation between 10 bit code values and 16 bit digital exposure.
Lut files are generated automatically and should not be edited by the operator.
Comment lines start with a '#'.
Recommended file extension: '*.lut'

The ASCII-file has 1024 entries according to the following format:

```
# LUT file
# CV        exp_r       exp_g       exp_b
# 10 bit    16 bit      16 bit      16 bit
0           0           0           0
1           0           0           23
2           0           0           34
3           0           0           44
4           0           8           54
5           7           29          63
6           14          49          72
7           22          69          81
…           …           …           …
1022        19637       34871       27423
1023        19773       35042       27614
```

***Output lut file***
contains the result of the calibration achieved by almakelut.
For internal reasons the CV 0 value is always fixed to 0.
The file name is chosen by the user.
The ASCII-file has the same format as the input lut file.

### 7.1.3.5 alsetlut -l <calibration lut> alsetlut -m <redMaxExp> <greenMaxExp> <blueMaxExp>

'alsetlut.exe' sets the recorder calibration parameters of the ARRILASER film recorder.
The command has two different options:

1. '-l', to download a calibration lookup table.
   See *chapter 7.1.4.2* for a syntax description and a short usage of the calibration look-up-table.

2. '-m', to download max exposure values for the red, green and blue laser power.
   <redMaxExp>, <greenMaxExp>, <blueMaxExp> are scaling factors from 16 bit digital exposure values to physical exposure values in [$mWs/m^2$].

Find a detailed discussion of the ARRILASER calibration functions in *chapter 6.2*.

C-shell example using 'alsetlut.exe':

```
C% alsetlut -m 1700 800 40
alsetlut: maximum exposure values 1700 800 40
C% alsetlut -l c:\al\luts\startupexp.lut
...............................................
alsetlut: "c:\al\luts\startupexp.lut" loaded
```

The command checks and validates the input parameters. As soon as the daemon is ready, 'alsetlut.exe' sends the parameters to the Carmille control software and initiates a partial hardware reset at the film recorder.

Note: To avoid inconsistent hardware settings, call 'alstatus reseterror' after a parameter download error or an abnormal termination (CTRL C) of the 'alsetlut' command.

If the parameters have been successfully loaded, alsetlut. exe returns '0'. If an error occurs, the status variable has a negative value for example:

'-1' wrong command line parameter
'-2' parameter setup failed
because of a download error
or parameter setup not started,
because of a download error
during the last exposure cycle.
'-3' parameter setup not started,
the daemon signals an image data download error,
the last image failed to expose.
'-4' parameter setup not started,
the last image failed to expose
because of a recorder error
'-8' error, reading the calibration lookup table
'-11' daemon not ready

See also *chapter 8.2.5* for a complete return status list.

### 7.1.3.6 alsetstatus <parameter value>

The command 'alsetstatus.exe' is used to set up daemon status parameters.

Most of the parameters are directly sent to the internal control software of the film recorder as soon as they are verified and the daemon is ready to handle the command.

You can set the following parameters with 'alsetstatus.exe' at the film recorder.

- 'framecount nr'
  A frame counter is updated by the internal control software, which includes wind and autofeed operations. You can reset the frame count for example after changing film, to calculate used/available film in meter/feet.

  film in [meter] = frame count * 0.01896[m]
  film in [feet] = fram ecount * 0.0622[feet]

```
C% alsetstatus framecount 0
alsetstatus: framecount 0 set
```

- ‘reseterror’
  resets the Carmille control software after abnormal command terminations.
  Recommended after killing a ‘alsetlut -l <calibration lut>’ process, or if the alsetlut command fails during the lut download.

- ‘autored’, ‘autogreen’, ‘autoblue’
  affect the ARRILASER calibration functions.
  By default set to ‘1’, ‘autored’ activates the scaling of the maximum exposure value of the red channel according to the highest value in the calibration lookup table. Set to ‘0’ deactivates this feature. This is the same for the green and blue channel.

The following parameters affect the film recorder’s auto-calibration mode and logging options. These parameters are used for service purposes only:

- ‘expcheck’
- ‘colcheck’
- ‘attmove’
- ‘expsave’
- ‘scannerCheck’
- ‘offsetCheck’

A daemon parameter can be set by using ‘alsetstatus’:

- ‘daemonstate’
  set to ‘0’, the command resets the daemon’s state to ‘idle’. This call is necessary in custom error handling scripts. Recognizing a daemon error state by ‘alstatus daemonstate’ does not automatically reset the error state. This is an exception to other CLIF commands and you have to reset the daemon error state manually before resuming the job execution.

See also *chapter 7.4.3*.

The command ‘alsetstatus.exe’ addresses the daemon’s state. In case of an ‘error’ state it exits with an error code in the return variable. Otherwise it validates the command line parameters. When the setup of the parameter fails, it returns ‘-2’ signaling a command download error, or on success it returns ‘0’.

All values returned by ‘alsetstatus.exe’ are listed in *chapter 8.2.6*.

### 7.1.3.7 alstatus <parameter>

To obtain status information from the ARRILASER film recorder, you can call 'alstatus.exe' to query actual parameter settings.

The command 'alstatus all' prints a list of all available parameters and their actual settings to 'stdout' as shown in the next C-shell example.

```
C% alstatus all

daemonstate 0
recstate 0
xsize 4096
ysize 3112
xoffset 0
yoffset 0
pulldown 18960
pitch 600
xorigin 1797
yorigin 2514
redatt 4163
greenatt 3701
blueatt 3446
redmaxexp 2000.00
greenmaxexp 500.00
bluemaxexp 50.00
```

```
redscalexp 924.15
greenscalexp 269.58
bluescalexp 26.30
redmeasexp 924.87
greenmeasexp 270.47
bluemeasexp 26.37
redwatt 42.12
greenwatt 12.22
bluewatt 29.49
muecver 1103
pcver 1107
imagecount 40578
framecount 337
perfcount 1348
densfiltsate 0
lut c:\al\luts\startupexp.lut
image c:\Images\Aqua\0023
geometry fullap4k
```

To get a particular value call 'alstatus.exe' with the parameter name as argument.

The following C-shell example shows you how to grab the output for further usage.

```
C% set framecnt = 'alstatus framecount'
…
C% echo $framecnt
337
```

The command alstatus.exe will report:

- 'pitch', 'pulldown', 'xsize', 'ysize', 'xoffset', 'yoffset', 'xorigin', 'yorigin', 'geometry',
  the current geometry settings explained in *chapter 7.1.4.2* together with the name of the geometry format that was loaded last.

- 'image', the name of the image file recorded last.

- 'lut', 'redmaxexp', 'greenmaxexp', 'bluemaxexp', 'redscaledexp', 'greenscaledexp', 'bluescaledexp',
  current densitometric calibration parameters.
  the name of the calibration lut file that was loaded last,
  the maximum exposure values, set by 'alsetlut -m …'
  the scaled maximum exposure values.
  See also *chapter 7.1.3.5*.

- 'redatt', 'greenatt', 'blueatt', 'redmeasexp', 'green-measexp', 'bluemeasexp', 'redwatt', 'greenwatt', 'bluewatt',
  attenuator positions for each color channel,
  measured exposure values as current results of the autocalibration mode,
  measured laser power in each color channel.

- ‘imagecount’,
  total number of images recorded by the ARRILASER film recorder system

- ‘framecount’, ‘perfcount’,
  image counter including winds and autofeeds, set by ‘alsetstatus.exe’.
  perfcount returns the framecount in number of perforations.

- ‘pcver’, ‘muecver’,
  the version number of the Carmille Software and the micro-controller program running on the internal control computer.

- ‘daemonstate’,
  the current daemon state discussed in *chapter 7.4.2.*

- ‘recstate’,
  the current film recorder state.
  See also *chapter 7.4.1.*

- ´densfiltsate´,
  position of the additional filter for camera negative recording

See also *chapter 6.2.4.*

The return value of ‘alstatus.exe’ reviews the successful command execution or one of the error codes listed in *chapter 8.2.7.*

### 7.3.3.8 alwind <number>

The command ‘alwind <number>’ is used to shuttle film for a specific number of frames, forward or reverse.

```
C% alwind 60
alwind: fast forward 60 frames
```

Before starting to shuttle film, the command checks the film recorder’s state, to avoid film transport problems.

If the shuttle was successful, the value ‘0’ is returned in the status variable.

A ‘-4’ indicates one of the following film recorder errors:

| | |
|---|---|
| ‘32’ | film loops not correct |
| ‘33’ | film jam |
| ‘34’ | motor overload |
| ‘35’ | film guides not closed |
| ‘36’ | no film |
| ‘39’ | magazines unlocked |
| ‘40’ | camera not ready |
| ‘50’ | camera busy |

To recall the recorder error for an automated error handling, use ‘alstatus recerror’.

Find the complete return value list in *chapter 8.2.8*.

### 7.3.3.9 Tools

The CLIF software package includes some additional image tools like ‘atimginfo.exe’ to check the image file format or ‘atrename.exe’ to rename a sequence of image files.

For Cineon files ‘atchangefidoorientation.exe’ could be used to flip the image, simply rewriting the orientation flag in the file header.

See also *chapter 8.2.9*, *chapter 8.2.12* and *chapter 8.2.10* for a more detailed description of the commands.

## 7.1.4 CLIF Configuration Settings

This chapter lists all system environments and configuration files used by the CLIF software engine. For trouble shooting check the current environment definitions and the existence of the configuration files first.

### 7.1.4.1 System Environment

The CLIF software engine uses system environment variables to initialize setup parameters, specify configuration files and to predefine optional input parameters

Find a list of used environment variables in *chapter 8.2.13*.

Working on windows command prompt level, use the 'Control Panel' - 'System Properties' to customize the settings.

Using the Hamilton C-shell, global default values are predefined in the login script 'c:\cshell\login.csh'. Within a C-shell, you can rewrite global environment variables with the 'setenv' shell command.

See the following C-shell example of how to get and set the current value of a system environment variable. The new setting is local to this C-shell window. Calling 'setenv' without an argument lists all settings defined in the current shell.

```
C% setenv AL_TEST_MODE
AL_TEST_MODE 0
C% setenv AL_TEST_MODE 1
C% setenv AL_TEST_MODE
  AL_TEST_MODE 1
C%
```

**Path Setting**
The system path points to the 'c:\al\clif' directory, where all CLIF commands are located by default installation.

Using a custom CLIF directory structure, adapt the path variable with the 'Control Panel' - 'System Properties' - 'Environment'.

**Daemon Startup Files**
During startup, the daemon process looks for two configuration files named by the environment variables 'AL_ALSTATUS_FILE' and 'AL_REC_MSG_FILE'.

Per default
'AL_ALSTATUS_FILE' is set to 'c:\al\config\alstatus.cfg'
'AL_REC_MSG_FILE' is set to 'c:\al\config\alrecmsg.cfg'

See also *chapter 7.1.4.2*.

**Serial Port Initialization**
The serial line connection is used to exchange command and status information with the CARMILLE software running on the ICC. To access a serial port, the daemon process needs to know the active port number. When, for example, the system variable 'AL_SERIAL_PORT_NR' is set to '1' the daemon sends control data to COM1.

The serial device driver must be running.
(Control Panel, Devices: Serial started)

To run the CLIF software engine in an evaluation mode, you can deactivate the serial port communication by setting 'AL_SERIAL_PORT' to '0'.
'AL_SERIAL_PORT' set to '1' activates the serial port communication.

Per default
'AL_SERIAL_PORT_NR' is set to '1'
'AL_SERIAL_PORT' is set to '1'.

**Image Data Transfer Initialization**
To setup the image data transfer to the IDI interface card, the daemon checks the IDI-firmware from 'AL_LCA_FILE'.

The DLL file to access the IDI driver is named by 'AL_IDI_DLL'. If 'AL_IDI_DLL' is set to '0', the CLIF software engine skips the DLL calls and runs in an evaluation mode.

Per default
'AL_LCA_FILE' is set to 'c:\al\config\arrilca.rbt'
'AL_IDI_DLL' is set to 'c:\al\clif\carldll.dll'.

**Execution Mode**
If the system variable 'AL_TEST_MODE' is not defined or set to '0' the CLIF commands run in normal execution mode. Otherwise the commands run in test mode, printing a test mode message to 'stdout', always exiting with '0' as return status value.

A system variable which does not directly affect the execution mode is 'AL_DEBUG_REC_STATE'. Set to '1', it enables a more detailed monitoring of the film recorder functionality.

Per default
'AL_TEST_MODE' is set to '0'
'AL_DEBUG_REC_STATE' is set to '0'.

See also *chapter 7.1.5.1*.

**Preview Mode**
If the system variable 'AL_PREVIEW' is defined as '1', preview images are generated during exposure. Besides the time needed to write the previews to disk, normal operation remains unaffected. The names of the preview images are deduced from the value of the system variable 'AL_PREVIEW_NAME', wherein the specifiers '%s' and '%d' are replaced by the actual filename or command number, respectively. A value of 'c:\preview\preview_of_%s.tif' writes a preview image named:
'c:\preview\preview_of_scene03_0001.tif',
if the image name was 'scene03_0001'.

The type of the file is taken from the extension given in 'AL_PREVIEW_NAME' and can be '.tif' or '.jpg'.

If the value of 'AL_PREVIEW' is '1' or '8', 8 bit preview images are written. TIFF preview also supports a value of '16' for 16 bit preview images. The contents of the preview image are the cineon code values of the exposed image, either divided by 4 in 8 bit mode or multiplied by 64 in 16 bit mode.

**Predefined Command Line Arguments**
Some environment variables specify default values for optional input parameters.

'AL_FILM_FORMAT_FILE' names the geometry database for the 'alsetgeometry.exe' command.

The command 'alexpose.exe' needs a conversion lookup table as optional input parameter for all supported image formats, except those which match the internal 10 bit log Cineon standard. Per default the command uses the environment variable definitions, depending on the file format of the given image.

Per default
'AL_FILM_FORMAT_FILE' is set to
'c:\al\config\filmformats.cfg'
'AL_PICT_LUT_FILE' is set to 'c:\al\config\video.lut'
'AL_SGI_LUT_FILE' is set to 'c:\al\config\ video.lut'
'AL_TIFF_LUT_FILE' is set to 'c:\al\config\ video.lut'
'AL_DPX_LUT_FILE' is set to 'c:\al\config\ video.lut'
'AL_TGA_LUT_FILE' is set to 'c:\al\config\ video.lut'
'AL_YUV_LUT_FILE' is set to 'c:\al\config\ video.lut'.

See also *chapter 6.3*
See also *chapter 7.2.3.1* for conversion luts by using image processing.

### 7.1.4.2 Configuration Files

Per default all configuration files are located in the 'c:\al\config' or 'c:\al\luts' directory.

**alfilmformats.cfg**

There is a geometry format database containing all the information for positioning and sizing the image on film. The file 'c:\al\config\alfilmformats.cfg' contains already a predefined list of most useful formats. You can extend the database according to individual needs or you can define a custom geometry format definition file.To specify a geometry database for the 'alsetgeometry.exe' command, use the filename as optional input parameter. Otherwise the environment setting 'AL_FILM_FORMAT_FILE' is used as geometry database.

Syntax example for a format definition in the geometry database. You can use '#' at the beginning of a line to mark comments.

```
# -------------------------------------
Format:    1.37_4k
xSize:     3656
ySize:     2664
xOffset:   440
yOffset:   224
xOrigin:   1797
yOrigin:   2514
pullDown:  18960
pitch:     600
# -------------------------------------
```

**Geometry parameter description:**

'Format' name of the format, may be any custom selected name.

'xSize' horizontal and vertical size of the image in pixel.

'ySize'

'xOffset' upper left corner position of the active image

'yOffset' in pixel, relative to the full aperture image area (24.576 mm x 18.672 mm).

'xOrigin' position of the full aperture image area,

'yOrigin' relative to the center of the reference pin in microns.

These parameters are fixed.

'pullDown' inter-frame positioning on the film. For 4 perf formats this is always a fixed parameter of 18960 micron. Do not change.

'pitch' pixel size, scaled in microns x 100. Only a selected number of values are allowed.

See *chapter 7.3* for a detailed description.

The 'alfilmformats_ipmax.cfg' contains all maximum possible film formats, which need to be used for inter positive recording with overlapping frames [see *chapter 6.2.5*].

**alstatus.cfg**
This file is used to save daemon parameter as initialization setup for the daemon process. The file is automatically generated and should not be edited. The daemon updates the file, if 'AL_ALSTATUS_FILE' is set to a filename with read/write access.

Initialization parameters stored in the file are

- name and parameters of the geometry format loaded last
- name of the calibration lookup table loaded last
- name of the last recorded image file

**alrecmsg.cfg**
Before the daemon starts a recording cycle on the film recorder, it asks for the actual recorder state. When the film recorder is not ready to start the next exposure, the daemon repeats the request until the recorder is ready or the tolerance value for a specific error message is reached.

The ARRILASER film recorder has internal feedback mechanisms to measure and control parameters like laser power. The 'alrecmsg.cfg' file can be used to control the feedback loop, defining tolerance values for recorder messages.

It defines how often a specific recorder message may occur within one exposure cycle before the daemon switches into a recorder error state. The file 'alrecmsg.cfg' is structured according to the rule:
<message id>  <tolerance level for alexpose >   <tolerance level for alwind >  #comment

recorder messages are i.e.:

| message id | tolerance alexpose | comment alwind |
|---|---|---|
| 16 | 60 | - # maximum illumination red out of range |
| 17 | 60 | - # maximum illumination green out of range |
| 18 | 60 | - # maximum illumination blue out of range |
| 64 | 0 | - # pixel clock red failure |
| 65 | 0 | - # pixel clock green failure |
| 66 | 0 | - # pixel clock blue failure |
| 67 | 60 | - # critical scanner speed |
| 68 | 0 | - # scanner speed out of range |

## 7.1.5 Using Shell Scripts

To automate shooting sequences CLIF commands can be grouped to batch or script files. This section explains how to deal with scripts, based on the standard scripts located in ‘c:\al\stdscripts’.

### 7.1.5.1 Runtime Levels

Using scripts, you have the possibility to define runtime levels. A script can run in normal execution mode, while a second one is tested in another shell.

All CLIF commands check the ‘AL_TEST_MODE’ environment variable before doing anything else. If ‘AL_TEST_MODE’ is set and has a value not equal to ‘0’, the command returns with a test mode message on stdout and a ‘0’ return value for ‘successful execution’.

The standard scripts ‘shootsingle.csh’ and ‘shootseq.csh’ use positive ‘AL_TEST_MODE’ values to specify test mode levels. So it is possible to check script syntax, validate the geometry name and verify directory and image file names.See also *chapter 8.2.14* and *chapter 8.2.15* for a more detailed description of the shell scripts.

### 7.1.5.2 Standard Scripts

It is recommended to open two C-shells at a time. The first window is used for commands and scripts. The second window is used for logging.

To record one of the aqua images 10 times, use ‘shootsingle.csh’.

Switch to the ‘c:\al\stdscripts’ directory and call ‘shootsingle’ without argument, to get an actual usage message.

```
C% cd c:\al\stdscripts
C% shootsingle
usage shootsingle [-t|-s] picture geometry
repetition
  -t    restart sequence on error
  -s    skip frame on error
  AL_TEST_MODE:
  0     normal execution mode
  >0    check geometry name, directory and frame
C% setenv AL_TEST_MODE 0
C% shootsingle c:\images\aqua\0001 fullap4k 10
>> test.log
```

The command shootsingle '>> test.log' redirects stdout and appends the output to a file called 'test.log' in the current directory.

In the second shell 'cd' to the same path. Type in the command 'tail -f test.log', to monitor the script run.

```
C% cd c:\al\stdscripts
C% tail -f test.log
Wed Jan 26 2000 12:22:25.46 shootsingle c:\Images\Aqua\0001 started

IMAGE c:\Images\Aqua\0001 1 LOADED
  successfully exposed "c:\Images\Aqua\0001"

IMAGE c:\Images\Aqua\0001 2 LOADED
  successfully exposed "c:\Images\Aqua\0001"

IMAGE c:\Images\Aqua\0001 3 LOADED
  successfully exposed "c:\Images\Aqua\0001"

IMAGE c:\Images\Aqua\0001 4 LOADED
  successfully exposed "c:\Images\Aqua\0001"

IMAGE c:\Images\Aqua\0001 5 LOADED
  successfully exposed "c:\Images\Aqua\0001"

IMAGE c:\Images\Aqua\0001 6 LOADED
```

Use ‘shootseq.csh’ to record an image sequence. Again, ‘shootseq’ without argument prints a short usage message.

```
C% shootseq
usage: shootseq [-r|w|n|t|s] folder geometry
startframe endframe [numberformat]
  numberformat defaults to %04d
  Options:
  -r remove files after shooting
  -w wait for files to become the final size
     (first file must exist!)
  -n wait for next frame to come
  -t restart sequence on error
  -s skip frame on error
  AL_TEST_MODE:
  0  normal execution mode
  1  check geometry name, directory and
     first frame if -w option is set
  2  check each single frame, stop on error
  3  check each single frame,
     report but ignore errors
C%
C% shootseq.csh -t c:\images\aqua fullap4k 1 23
>>& test.log
```

The optional parameter [numberformat] is used to specify filenames containing a number format string.

The default ‘%04d’ names a sequence of image files, with a counter as filename, written in 4 digits with leading zeros.

Because <startframe> in the ‘shootseq’ command of the example is ‘1’ and <endframe> is ‘23’, the script starts with an image called ‘0001’ and stops the recording with file ‘0023’.

If the images are not according to the default filenames, [numberformat] may be any combination of text and a formatted number as shown in the following examples:

1. use ‘img%d.sgi’ as [numberformat] to name the following sequence
   ‘img1.sgi’, ‘img2.sgi’, ‘img3.sgi’…’ img763.sgi’

2. use ‘name.%03d’ to specify the sequence
   ‘name.000’, ‘name.001’, ‘name.002’… ‘name.999’

## 7.1.6 Application Programming Interface

### 7.1.6.1 Shared Memory Loader

Instead of an image file, the CLIF software engine also accepts image data written into shared memory as recording input. The data in shared memory has to adhere to the packed Cineon 10 bit log standard. Shared memory objects are indicated by the prefix SHM:\. For example the SHM objet myshmobj will be exposed by the command :

```
Alexpose SHM:\myshmobj
```

There are source code examples explaining the shared memory interface and the packing of 10 bit RGB values in 32 bit words according to the Cineon standard available from customer support.

### 7.1.6.2 API

The implementation of the CLIF commands is based on a DLL, which represents the ARRILASER Film Recorder interface. This API is accessible for custom developments. The DLL interface provides all functions to initialize and calibrate the Film Recorder, and all functions to set or get current Film Recorder status parameters.

Please contact your technical support for the Application Programming Interface - User Guide Appendix.

# 7.2 Image Processing Software Engine

The ARRILASER software is able to modify image content on the fly during exposure by means of the image processing system. In order to take full advantage of its capabilities, the reader should be familiar with basic operation tasks of the ARRILASER.

## 7.2.1 Basic Concepts

Integrated into the CLIF software engine, the image processing system is implemented as a set of command line executables, which can be used in control scripts in the same way as other CLIF commands. Once image processing has been started and configured, existing recording scripts can be used unchanged while taking full advantage of the image processing capabilities.

The image processing runs as a second daemon process in parallel to the master daemon process 'aldaemond'. As without image processing, 'aldaemond' handles communication and data transfer to the film recorder, while the image data is loaded into memory by the 'alexpose' command. With the image processing daemon running as a third process, loading, processing and recording of images are all done in parallel.

### 7.2.1.1 Image Data Flow

Without image processing turned on, image data is loaded into the host computer memory frame by frame, transferred by DMA to the Image Data Interface and finally sent to the film recorder via fibre optic link. A dual data buffer allows one process ('alexpose') to decode and read a frame to memory, while the previous frame is still being send to the recorder. Image processing established a second double buffer, and a daemon process taking over the control of the data flow. So the 'alexpose' command stores the image data into one of the input buffers of the image processing daemon, where this process takes over control, processes the image data, and places it into one of the input buffers of the 'aldaemon' process.

The control and image data exchange is based on the windows shared memory concept, which allows different tasks to access the same memory. All inter-process communication is achieved by windows event mechanisms.

### 7.2.1.2 Example: A Video to Film Conversion

The example-job is to convert video images of 720 x 576 pixels size to a 1.66 2K format of 1828 x 1100 pixels, and to expose these using a 2K geometry.

First, the relevant part of the image is selected, which will be exposed later on. In this example, the image part has a size of 720 x 462 pixels, and is located 57 pixels below the top line.

The image processing system is instructed to crop down the image to the selected part. This is done by writing a configuration file, which first specifies the crop operation and the necessary parameters with the keywords 'xOffset', 'yOffset', 'xSize' and 'ySize'.

In general, each operation is expressed as a node, and a configuration file consists of a list of nodes which are executed in the same order as the appear in the file.

```
#
# image processing configuration file
# c:\al\ipconfig\video_to_film.cfg
# for video to film conversion
#
node:      crop
  xOffset: 0
  yOffset: 57
  xSize:   720
  ySize:   462
…
```

The image now has the correct aspect ratio. Next, it needs to be magnified to the desired output size. This is done by adding a scale node to the configuration file. In this example cubic interpolation is used, expressed by the interpolation parameter.

```
…
node:             scale
  newXSize:       1828
  newYSize:       1100
  interpolation: cubic
…
```

The ‘newXSize’ and ‘newYSize’ parameters specify the image size after scaling.

Note: The keywords, parameters and arguments are never case sensitive.

As the last processing step, the scaled image has to be sharpened a little to compensate the blur introduced by the cubic scaling. Sharpening is equivalent to convoluting the image with an appropriate kernel. This is expressed by the more general convolution node, whose argument specifies the kernel to be used. The kernel matrix itself is taken from the default kernel library file ‘c:\al\ipconfig\kernels\alkernels.cfg’, defined by ALIP_KERNEL_FILE.

```
…
node:   conv
  kernel:  sharpen_medium_intermediate
#
# end of image processing configuration file
#
```

This kernel corresponds to an unsharp masking operation with a radius of approximately 1.5 and a strength of 1.125.

Now that the configuration file has been finished, the image processing system has to be set up to transform every exposed image. This is accomplished by first starting the system itself, configuring it, and then exposing images as usual. After the sequence has been exposed, the image processing system is either turned off or reconfigured to use another configuration (see following page).

```
…
aldaemon start                    # starts aldaemon
ipdaemon start                    # starts the image processing system
ipcfg c:\al\video_to_film.cfg     # configures the image processing system
alsetgeometry  1.66_real2k        # sets the recorder geometry
alexpose img_0001.sgi             # exposes the images
alexpose img_0002.sgi
…
alexpose img_1000.sgi             # expose last image in sequence
ipdaemon stop                     # either turn off image processing
(ipcfg another_config_file.cfg)   # or reconfiguring it    )
…
```

To make things easier, an exposure script analogue to the 'shootseq.csh' script is included with the CLIF software distribution. It is named 'shootseqip.csh' and located in 'c:\al\stdscripts'. See also *chapter 8.3.5 System Variables*.

Besides an easier usage, the script provides certain levels of error handling.

```
# exposes the images img_00001.sgi to img_01000.sgi from the directory
# c:\images\video, using image processing with the configuration file
# c:\al\ipconfig\video_to_film.cfg
c:/al/stdscripts/shootseqip.csh –t c:\images\video 1.66_real2k  1 1000
c:/al/ipconfig/video_to_film.cfg img_%05d.sgi
```

## 7.2.2 Using the Image Processing System

### 7.2.2.1 Image Processing CLIF Commands

Chapter 7.3.1 explained the structure of the software engine and its integration into the CLIF system. In the following sections all image processing commands are discussed in detail.

For a short command description see *chapter 8.3*.

**ipdaemon <start/stop>**

The command 'ipdaemon.exe' starts or stops the image pro-cessing daemon process called 'ipdaemond.exe'. It expects the daemon executable to reside in the same directory as itself. As a prerequisite, the main control process 'aldaemon' has to be started before 'ipdaemon' is launched.

***C-shell example using aldaemon.exe:***

```
C% aldaemon start
aldaemon: daemon started
C% ipdaemon start
ipdaemon: daemon started
C% ipdaemon start
ipdaemon: daemon already running
C% ipdaemon stop
ipdaemon: daemon stopped
```

Calling 'ipdaemon start', the command first tests if 'aldaemon' is already running. If not, an error is generated and the command returns with error code '-10'. Otherwise, the command checks if the image processing daemon itself is already running, and, in this case, returns with an informal message 'ipdaemon already running' and return code '0'. The configuration of the currently running 'ipdaemon' process remains untouched. Otherwise, the command waits until all queued images are exposed, and then launches the image processing daemon 'ipdaemond.exe'. The command then waits until it receives an 'initialization done' or 'initialization failed' from the daemon process.

Calling 'ipdaemon stop', the command sends a 'stop execution' event to the daemon and waits until it gets a 'daemon stopped' or 'daemon failed to stop' signal. The result is written to 'stdout' and coded to one of the following return status values.

'0' daemon started or stopped

'-1' a wrong command line parameter was typed in

'-10' aldaemon not running

'-11' ipdaemon failed to start/stop

'-12' system error.
For example the system runs out of memory or the interprocess communication failed

Note: A CTRL-C event is used to stop both the aldaemon as well as the ipdaemon process immediately.

**ipcfg <configfile>**
After the image-processing daemon has been started, the command 'ipcfg.exe' is used to configure it by providing a node list in the configuration file. In case either the image-processing daemon or aldaemon are not running, the command returns with an error code. If not, it waits until all queued images have been processed and exposed. Then, the image processing system is reconfigured according to the instructions found in the configuration file.

***C-shell example using ipcfg.exe:***

```
C% aldaemon start
aldaemon: daemon started
C% ipdaemon start
ipdaemon:  daemon started
C% ipcfg c:\al\ipconfig\mycfg.cfg
ipcfg: 'c:\al\ipconfig\ mycfg.cfg' ipdaemon configured
```

Again the result is written to 'stdout' and coded to one of the following return status values.

'0' ipdaemon successfully configured

'-1' a wrong command line parameter was typed in

'-10' aldaemon not running

'-11' ipdaemon failed to configure.
Either the configuration file does not exists,
is syntactically incorrect
or the ipdaemon is not running at all.

'-12' system error.
For example the system runs out of memory
or the inter-process communication failed.

To view the current configuration of the ipdaemon, the command ‘ipcfg –show’ can be used.

```
C% ipcfg —show
ipdaemond: ip configuration: c:\al\ipconfig\video_to_film.cfg
ipdaemond: node: crop { xOffset=0; yOffset=0; xSize=720; ySize=576;}
ipdaemond: node: scale{ newXsize=1828; newYsize=1371; interpolation=cubic;}
ipdaemond: node: conv { kernel=usm_16_1;}
```

It produces a compact output with each node and its parameters displayed in a single line.

Note: Optional node arguments, which may not have been specified in the configuration file, are given with their explicit values.

### 7.2.2.2 Image Processing Utility Commands

The quality of processed images strongly depends on the correct data representation, and on correct conversions between logarithmic and linear data representations. Therefore two utilities to generate and check LUT files are part of the image processing software.
See chapter 7.2..3.1 for a more detailed description.

**iplutconvert**
This utility converts existing loader LUTs to LUT pairs suitable for the image processing system.

**ipmakelut**
This utility can be used to generate the required input and output LUTs.

### 7.2.2.3 Image Processing Configuration Files

In the previous section, it has been demonstrated that the image processing system is controlled by configuration files and a first example has been shown. In this chapter the syntax used to write configuration files will be explained in detail. An IP configuration file specifies a list of processing nodes, which are executed in sequential order. Each node is introduced by the keyword ‘node’, followed by a colon and the node type identifier. If the node has parameters, these are specified line by line after the node definition. The only node without any parameters is the deinterlace node. Some node parameters have default values, which can be omitted. The parameter list is therefore specified in the form
argumentname: argumentvalue.

Parameters are separated from each other by either a line break or a semicolon. Argument values are allowed to be integers, floats or strings, depending on the node they belong to.

Note String arguments are not enclosed by quotation marks.

Several examples of configuration files are provided with the software. They can be found in the directory 'c:\al\ipconfig'.

```
The number of nodes in a configuration file is not limited. # pseudo image processing configuration file
node: node1
  argumentname1: argumentvalue1
  argumentname2: argumentvalue2
  …
node: node2
  argumentmame1: argumentvalue1
  …
…
```

### 7.2.2.4 Processing Nodes

This chapter explains all available nodes and their parameters in a systematic way. It is mainly intended as a reference. The nodes are explained in alphabetical order.

**CMS node (optional)**

The CMS node creates a 3D lookup table from the ICC profile specified as monitor and recorder profile.
The monitor profile is taken as input profile, the recorder profile as output profile.

An optional gamut compression can be activated by specifying one of the presets defined in the soft clip configuration file. See *chapter 7.2.2.5* for a description of the softclip file.

Also, the rendering intent can be influenced by specifying either 'absolute', 'relative', 'perceptual' or 'saturation'.

See a more detailed description on the usage of CMS under *chapter 6.4*.

**Node type identifier and node arguments**

The Color Management node is identified by the keyword 'CMS'.

| Argument | Type | Default | Description |
|---|---|---|---|
| monitor profile | string | - | ICC profile to be used as monitor profile |
| recorder profile | string | - | ICC profile to be used as recorder profile |
| soft clip | string | - | soft clip parameters to be used (optional) |
| intent | string | - | rendering intent to be used (optional) |

*Example:*

```
# example configuration file showing
# the use of the Color Management node
# with default settings, as used in ALICE

node: CMS
  monitorprofile: hdmonitor.icm
  recorderprofile: arrilaser.icm

# example configuration file showing
# the use of the Color Management node
# with soft clip

node: CMS
  monitorprofile: hdmonitor.icm
  recorderprofile: arrilaser.icm
  soft clip: weak
```

## Convolution Node

Performs a convolution of the image with the kernel given. The values of the convolution kernel have to be specified in the kernel library file. See *chapter 7.2.2.5* A detailed discussion of convolution kernels can be found in *chapter 7.2.3.2* <Filter Kernels>.

### *Node type identifier and node arguments*

The convolution node is identified by the keyword ‘conv’.

| Argument | Type | Default Value | Description |
|---|---|---|---|
| Kernel | string | - | convolution kernel to be used for all color channels |
| kernel.red | string | - | convolution kernel to be used for red color channel |
| kernel.green | string | - | convolution kernel to be used for green color channel |
| kernel.blue | string | - | convolution kernel to be used for blue color channel |

Note: When using separate kernels for the different colors, each color needs to be defined. If no effect in one color is wanted, a kernel without any effect needs to be specified.

### *Example*

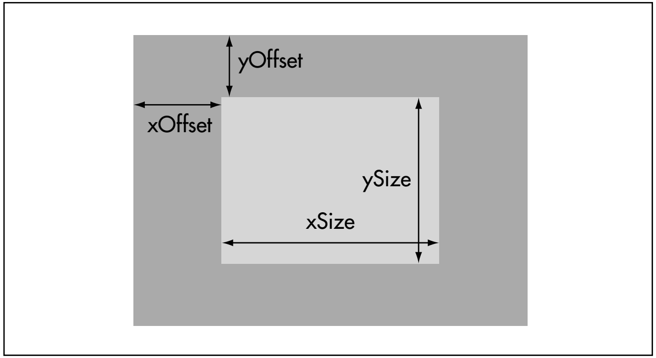
```
# example configuration file showing
# the use of the convolution node
# to sharpen the image with a kernel
# of small size and medium strength
node: conv
  kernel: sharpen_small_intermediate
```

## Crop Node

Selects a rectangular part of the image for further processing. Data outside the selected region is omitted.

***Node type identifier and node arguments***

The crop node is identified by the keyword ‘crop’.




The graphics demonstrates the definitions of the positioning parameters:

| Argument | Type | Default Value | Description |
|---|---|---|---|
| xOffset | integer or string | 0 | x coordinate of upper left corner of the image region or<br>‘left‘: positions the image leftmost<br>‘center‘: centers the image within the height of the input image<br>‘right‘: positions the image rightmost |
| yOffset | integer or string | 0 | y coordinate of upper left corner of the image region or<br>‘top‘: positions the image on row 0<br>‘center‘: centers the image within the width of the input image<br>‘bottom‘: positions the image |
| xSize | integer | as large as possible | width of the image region |
| ySize | integer | as large as possible | height of the image region |

### *Examples*

```
# example configuration file showing
# the use of the crop node
# to extract a 2k 1.66 image from a 2k fullap
image
# using exact pixel coordinates
node: crop
  xOffset: 220   # (2048 – 1828)
  yOffset: 228   # (1556 – 1100)/2
  xSize: 1828
  ySize: 1100
```

```
# example configuration file showing
# the use of the crop node
# to extract a 2k 1.66 image from a 2k fullap
image
# using symbolic position specifiers
node: crop
  xOffset: right
  yOffset: center
  xSize: 1828
  ySize: 1100
```

## Deinterlace Node

The deinterlace node performs a simple deinterlacing on video images.

***Node type identifier and arguments***

The deinterlace node is identified by the keyword 'deinterlace'. It has no arguments.

***Example***

```
# example configuration file showing
# the use of the deinterlace node
node: deinterlace
  # no arguments required !
```

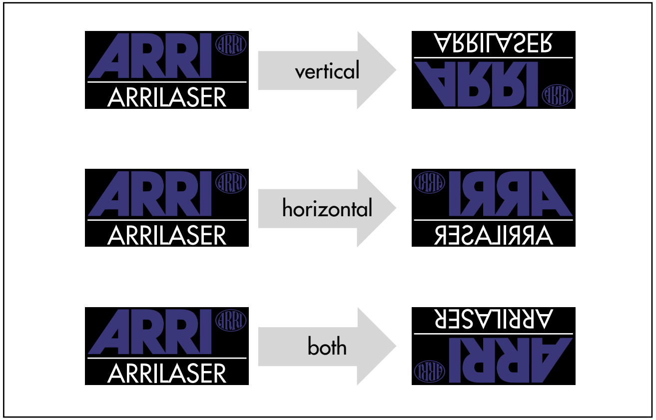
## Flip Node

The flip node changes the direction of the specified coordinates. Either x, y or both coordinate directions can be reversed. Note that flipping the X-coordinate mirrors the image at a vertical axis.

### *Node type identifier and arguments*

The flip node is identified by the keyword ‘flip’.

| Argument | Type | Default Value | Description |
|---|---|---|---|
| direction | string | - | specifies the direction:<br>vertical: mirrors the image at a horizontal axis (thus reverses vertical coordinates)<br>horizontal: mirrors the image at a vertical axis (thus reverses horizontal coordinates)<br>both: reverses both coordinates |




### *Example*

```
# example configuration file showing the use
# of the flip node to reverse horizontal order,
# e.g. for intermediate positive
node: flip
  direction: horizontal
```

## Interpositive LUT

The interpositive LUT node is intended to make intermediate positive recording easier by reversing the output LUT, so that the cineon code values are replaced by
1023 – <original code value> prior to recording. In terms of processing images, it is a pseudo node, since it leaves the image data untouched, and its position within the node list is irrelevant.

Note: Using the interpositive LUT node, the recorder calibration doesn’t need to be inverted to get a positive image on the intermediate film stock.

**Node type identifier and node arguments**

The interpositive LUT node is identified by the keyword ‘interposlut’.

The node has no arguments.

## Paste Node

Places the image within a larger image. If the entire shifted image does not fit into the (optionally) new image size, it is clipped.

***Node type identifier and node arguments***

The paste node is identified by the keyword 'paste'.

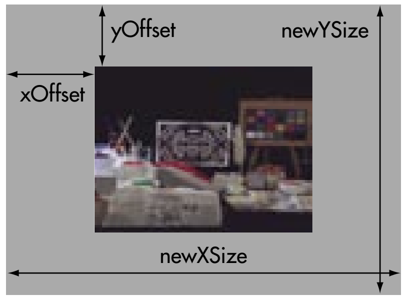
| Argument | Type | Default Value | Description |
|---|---|---|---|
| xOffset | integer or string | 0 | x coordinate, position of the upper left corner of the image within the larger image or<br>'left': positions the image leftmost<br>'center': centers the image within the width of the output image<br>'right': positions the image rightmost |
| yOffset | integer or string | 0 | y coordinate, position of the upper left corner of the image within the larger image or<br>'top': positions the image topmost<br>'center': centers the image within the height of the output image<br>'bottom': positions the image at the bottom of the output image |
| newXSize | integer | as large as possible | specifies the new width of the image |
| newYSize | integer | as large as possible | specifies the new height of the image |

| Argument | Type | Default Value | Description |
|---|---|---|---|
| fillcolor.red<br>fillcolor.green<br>fillcolor.blue | proportional value (integer or float) | 0 | specifies the color the outer border of the new image is filled with. As a proportional value, it relates to the total range of values covered by the input LUT. The color value is specified for each color channel separately. |

### *Example*

```
# example configuration file showing the use of
# the paste node to paste a given image on a
# mid-gray canvas of 4096 x 3112 at
# top left corner # position 200 / 220
node: paste
  xOffset: 200
  yOffset: 220
  newXSize: 4096
  newYSize: 3112
  fillcolor.red: 50%
  fillcolor.green: 50%
  fillcolor.blue: 50%
```

The definitions of the positioning parameters:



## Saturation Node

Enhances or decreases the color saturation of the input image. The factor determines the saturation enhancement or decrease.

### *Node type identifier and node arguments*

The scaling node is identified by the keyword 'saturation'.

| Argument | Type | Default Value | Description |
|---|---|---|---|
| factor | proportional value (integer) | 0 | specifies the enhancement (positive value) or desaturation (negative value) of the image |

### *Example*

```
# example configuration file showing the use of the separation node
# to compute a image desaturated by 50 %
node: saturation
  factor : -50%
```

## Scaling Node

Scales the image with an arbitrary factor in x and y. The scaling factor is derived from the size of the resulting image, which is specified as the nodes parameters.

***Node type identifier and node arguments***

The scaling node is identified by the keyword ‘scale’.

| Argument | Type | Default Value | Description |
|---|---|---|---|
| newXSize | integer | - | specifies the new width of the image |
| newYSize | integer | - | specifies the new height of the image |
| interpolation | string | - | specifies the interpolation algorithm:<br>NN: nearest neighbour<br>replicate: same as NN<br>linear: bilinear interpolation<br>cubic: bicubic interpolation |

***Example***

```
# example configuration file showing the use of the scale node
# to compute a 4k image using a bicubic interpolation algorithm
node: scale
  newXSize: 4096
  newYSize: 3112
  interpolation: cubic
```

## Separation Node

Calculates the weighted sum of the three color channels of an image and generates a black & white image. Used for recording of b&w separations from a color master, or render a b&w image out of a color image.

***Node type identifier and node arguments***

The color separation node is identified by the keyword 'separation'.

| Argument | Type | Default Value | Description |
|---|---|---|---|
| weight.red | float | 33.3333 % | specifies the weight factor for the red color channel |
| weight.green | float | 33.3333 % | specifies the weight factor for the green color channel |
| weight.blue | float | 33.3333 % | specifies the weight factor for the blue color channel |

***Example 1 : Selection of a single color channel***

```
# example configuration file showing the use of the color separation node to
# shoot the red color channel on black & white film stock
node: separation
  weight.red    : 1.0  100%
  weight.green  : 0.0    0%
  weight.blue   : 0.0    0%
```

### *Example 2 : Render the luminance of a RGB image*

```
# example configuration file showing the use of the color separation node to
# render the luminance of the given rgb image and output to color stock
node: separation
  weight.red    :  0.3
  weight.green  :  0.6
  weight.blue   :  0.1
```

**Unsharp masking (USM)**

The unsharp masking (USM) performs a sharpening of the image by adding a high pass filtered image with a zero mean value to the original image. This is done by calculating

$$(1 + s)I - s(B \quad I)$$

I is the original image, B is a smoothing kernel, and s is a positive strength factor.

Note: All kernels provided in the alkernel.cfg file (see *chapter 7.7.2.4 convolution node* for details) do exactly the same, but the calculation is done in the kernel and not at runtime.

The advantage of the USM node is that the strength factor can be chosen arbitrarily, while in the convolution node only discrete values of s can be achieved. The greater flexibility of the USM node has its price in increased computing time compared to the convolution node. It is important to note that the USM node needs smoothing kernels, not sharpening kernels as the convolution node does.

To avoid cluttering the alkernel.cfg file with smoothing filters, the most common smoothing filters have been built into the software, without the need to specify them in the alkernel.cfg file. They are named builtin.Bin3x3, builtin.Bin5x5 and builtin.Bin7x7, denoting binomial filters of size 3x3, 5x5 and 7x7, respectively.

### Node type identifier and node arguments

The unsharp masking node is identified by the keyword 'usm'.

| Argument | Type | Default Value | Description |
|---|---|---|---|
| Kernel | string | - | convolution kernel to be used for all color channels |
| kernel.red | string | - | convolution kernel to be used for red color channel |
| kernel.green | string | - | convolution kernel to be used for green color channel |
| kernel.blue | string | - | convolution kernel to be used for blue color channel |
| strength | float | - | strength of sharpening. 0 means no sharpening at all. |

### Example

```
# example configuration file showing
# the use of the usm node to achieve
# the same results as the
# predefined sharpen_bin_medium_weak
# kernel.
node: usm
  kernel: builtin.Bin5x5
  strength: 0.5
```

In the ALGUI the USM node is put together with the convolution node and can be chosen by the 'sharpen' button. Choosing USM for sharpening allows you to select a kernel size and a filter strength. Filter strength is defined as a percentage value. Reasonable values for filter strength are between 0% and 200%.

Note: Computing time might be longer than recording time. This can slow down your recording.

### 7.2.2.5 Library Files

**Kernel Library Files**

Convolution kernels are specified in kernel library files. The name of the default kernel library file is specified in the environment variable 'AL_KERNEL_FILE' and consistently in the ALGUI startup file 'Arri.txt'.The default location is 'c:\al\ipconfig\kernels\alkernels.cfg'. The kernel library file consists of a list of convolution kernels, each identified by a unique label. The kernel definition follows the general syntax,

```
kernel: kernelname
{
    mask[ysize][xsize]:    maskvalues
    scale:                 scalevalue
}
```

then the 'mask' keyword follows, and then the size of the kernel is specified, followed by the mask's values.
In addition, a scaling factor can be specified.
For the sake of processing speed, it shall be a power of two.

```
# Example entry in a kernel definition file
# showing the definition of the 3x3 sharpen
# kernel
#
#    -1/8    –1/8    –1/8
#    -1/8    2       -1/8
#    -1/8    –1/8    –1/8
#
kernel: sample3x3kernel {
     mask[3][3]:      -1      -1      -1
                      -1      16      -1
                      -1      -1      -1
     scale: 8
}
```

A set of sharpening kernels is provided with the software, and can be found in the file 'c:\al\ipconfig\kernels\alkernels.cfg'.

Their properties are discussed in detail in *chapter 7.2.3.2*.

**Softclip Configuration File**

Colors outside the recorder gamut cannot be recorded without changes, since they do not exist on film. By default, these colors are hard clipped into the recorder gamut. To smoothly clip these colors, a compression of the monitor gamut has to be done. The strength of the compression can be controlled by the parameters given in the soft clip configuration file.The fully qualified path and filename of the soft clip configuration file is specified in the environment variable 'ALIP_SOFTCLIP_FILE' and consistently in the ALGUI startup file 'Arri.txt'. The default location is 'c:\al\ipconfig\icc\alsoftclip.cfg'.

The syntax of the soft clip configuration file is the following:

```
###############################################
# ARRI Film & TV
#
###############################################

# example of an entry using the same settings
# for all colors
softclip:  all_the_same
  dL: 25%
  dC: 25%

# example of color specific entry
softclip: different
  dL: 25%
  dC: 25%
  dC.R 10%
     dL.M 10%
```

For each entry in the soft clip configuration file, the following parameters are valid:

| **soft clip** | **name of the setting, used as value of soft clip parameter of the CMS node. Example: 'mysoftclip'.** |
|---|---|
| DL | luminance difference, used for each color if not specified color specific |
| dC | chroma difference, used for each color if not specified color specific |
| dL.R | luminance difference for red |
| dL.G | luminance difference for green |
| dL.B | luminance difference for blue |
| dL.C | luminance difference for cyan |
| dL.M | luminance difference for magenta |
| dL.Y | luminance difference for yellow |
| dC.R | chroma difference for red |
| dC.G | chroma difference for green |
| dC.B | chroma difference for blue |
| dC.C | chroma difference for cyan |
| dC.M | chroma difference for magenta |
| dC.Y | chroma difference for yellow |

The color specific settings (dL.R , etc.) always take precedence over the color independent setting (dL), regardless of the order of the arguments. This means, there is no difference in specifying e.g. dL.R before or after dL.

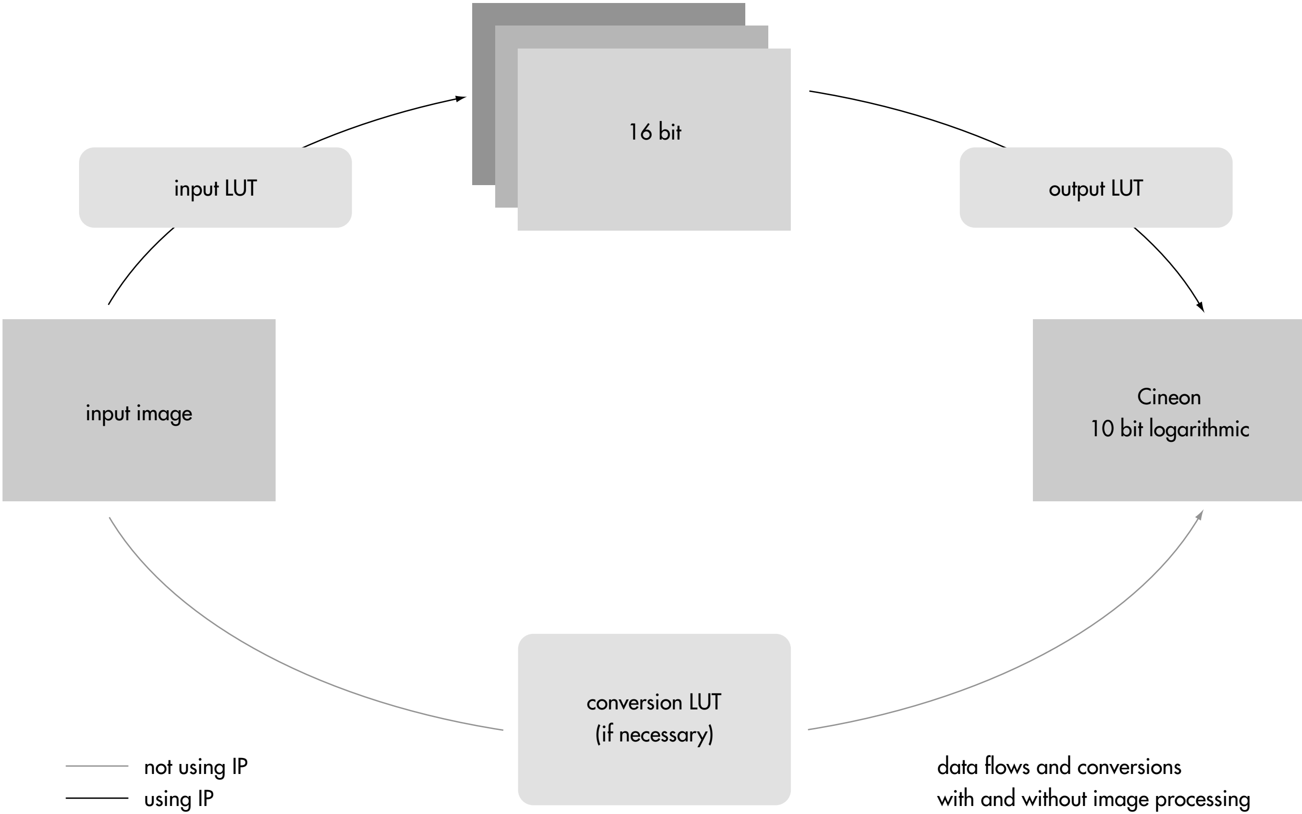
## Soft clip parameters demystified

Gamut compression can be achieved in general by reducing the chroma of colors, thus moving colors slightly towards the gray axis.

In the case of recording CRT monitor images to film, due to the fact that film gamut reaches its maximum chroma at lower levels of lightness than the monitor gamut, carefully reducing lightness also moves colors into the film gamut.

Best results are achieved by balancing chroma and lightness reduction. The soft clip parameters specify the amount of change in terms of the perceptual difference between the two gamut's, e.g. setting dC.R to 50% reduces red chroma by 50% of the difference between the pure red of the monitor and film gamut, respectively.

Both chroma and lightness change depending on hue, chroma and lightness, so that dark and unsaturated colors are affected less than bright, highly saturated colors. For colors at which the film chroma is greater than the monitor chroma, the chroma difference should be 0 or negative to gain gamut compression, otherwise gamut extension would be the effect. This is especially true for yellow.




data flows and conversions
with and without image processing

## 7.2.3 Understanding the image processing system

This chapter explains some details of the image processing system. It is divided in two main parts, LUT handling and kernel design. First, it is shown how image data is prepared to make best use of the calculation depth of the image processing system, and how it is converted to logarithmic representation after processing. In addition, the LUT generation utilities are discussed. The second part deals with constructing kernels for the convolution node. While the main focus is on sharpen filters, some properties of smoothing filters are discussed also. The kernels provided with the software are explained in detail.

Note: This chapter adresses the experienced user, who wants to gain a deeper understanding of the image processing system.
With the GUI the image processing can be used without reading this chapter.

### 7.2.3.1 Input and Output LUT´s

**Basics**

Without image processing, linear images such as TIFF or SGI images are converted to the 10 bit logarithmic data representation used by the film recorder by means of applying an appropriate conversion LUT to the image. Cineon images are not converted, since they already are logarithmic. The image processing system internally works with 16 bit values. All input data has to be converted to this 16 bit representation by applying the so-called 'input LUT' to the input image. After processing has been finished, the resulting image is converted to the Cineon representation by applying the output LUT. Input and Output LUT files are specified by a set of environment variables, and selected according to the type and bit depth of the image .

### Choosing input and output LUTs

#### *Linear images*

Linear images are best processed in linear space. The transformation to the 16 bit processing memory has to meet two essential conditions: First, to make the most use of the additional accuracy and second, to avoid clipping as good as possible. Clipping may occur by enlarging the contrast range of the image, for example while applying sharpening filters. To process an 8 bit image for example with an accuracy of 12 bits, a linear transformation would be used which places the resulting 4096 values symmetrically within the 16 bit range from 0 to 65535

| input value | 16 bit value |
|---|---|
| 0 | $(2^{16}-2^{12})/2 = 30720$ |
| 256 | $(2^{16}+2^{12})/2 = 34816$ |

After processing has been finished, the output LUT converts the 16 bit linear image to the logarithmic 10 bit format. The relationship between the input/output LUT pair and the conversion LUT used without image processing is established as

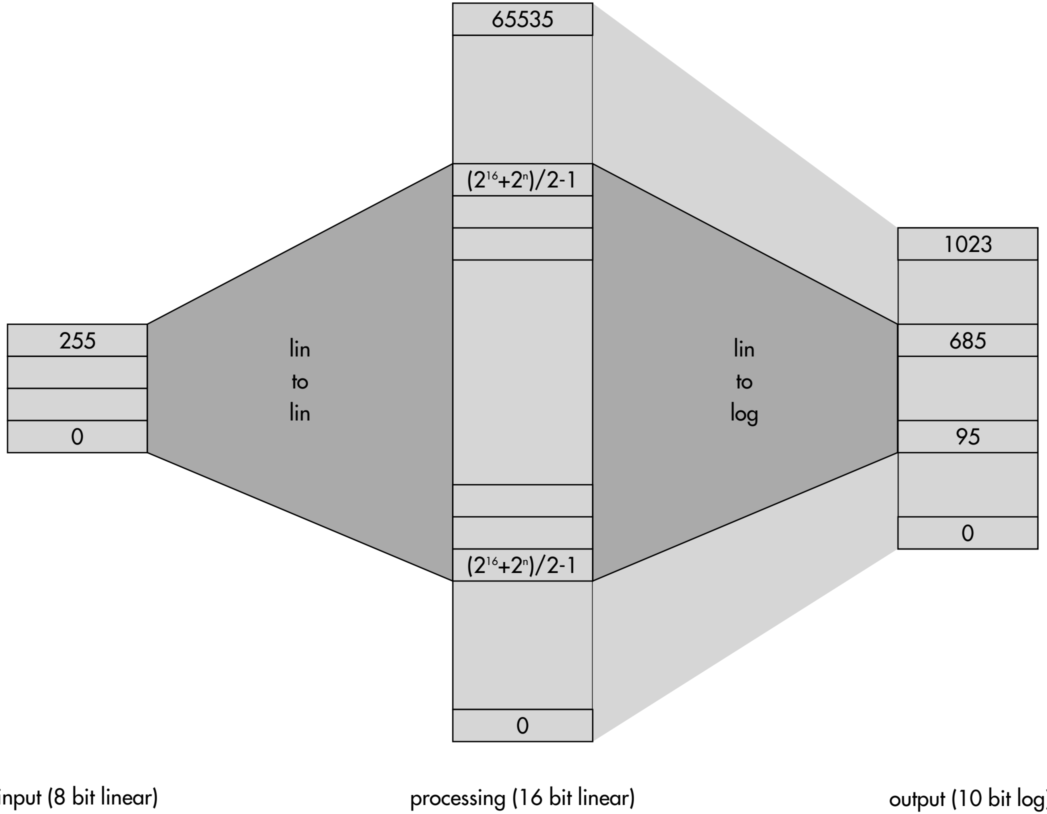
'OutputLUT(InputLut(g)) = ConversionLut(g),
or
OutputLut(g) = ConversionLut(InputLut-1(g))'

with 'InputLut-1' being the reverse of the 'input LUT'. The input value 'g' ranges from 0 to 255 in this example.
If interpolation or convolutions have been applied to the image, it is necessary to interpolate the output LUT in order avoid quantization losses.

#### *Logarithmic images*

In theory, interpolations and convolutions have to be done in linear space rather than in logarithmic representations. In practice, applying these filters to the logarithmic values is often done and also may result in better output image quality. If working directly with the logarithmic values, the procedure discussed in the previous section can be used for logarithmic images too.

data ranges for processing 8 bit images with n bit accuracy within an unsigned 16 bit data space



Otherwise, the input LUT linearizes the image, and the output LUT converts it back to log space. The relationship between input and output LUT is then
'outputLUT(inputLUT(g))= g',
implying that the output LUT is the reverse of the input LUT. The input LUT then has exponential characteristics, meaning that its gradient is low for small values. If not carefully chosen, the LUTs gradient may even become smaller than 1. Applying the input LUT is then not reversible any longer, resulting in quantization artifacts in the low densities.

***Copy Operations***

If only 'copy' nodes such as crop, flip and paste are used, the selection of the LUTs becomes less critical. Since these operations do not alter the brightness of any pixel, but only changes its position within the image, the input LUT can safely be selected as identity, and the output LUT as identical to the conversion LUT, which is normally used without image processing.

**LUT generating utilities**

The 'ipmakelut' utility can be used to generate input/output LUT pairs. It is able to generate linear to linear and linear to logarithmic conversion tables in an ASCII format, which can be read by the ARRILASER software. For both types of LUT's a pair of input/output values has to be specified, and, in case of logarithmic conversions, the gamma factor as well.

### ***Generating linear to logarithmic LUTs***

The command

ipmakelut –L|-CV –gamma <°> -val0 <$l_0$ $cv_0$> –val1 <$l_1$ $cv_1$>–range <$r_0$ $r_1$> –out <lutfile>

generates LUTs according to

$$CV = \frac{\log (gain_1 * lin + offset_1)}{0.002 / \gamma}$$

$$lin = gain_2 * 1^{00.002 * CV / \gamma} + offset$$

so that $CV(l_0) = cv_0$ and $CV(l_1) = cv_1$.

The '–L' switch causes the linear values to be tabled with code values running from r0 to r1, while the switch '–CV' causes the code values being tabled with the linear values running from r0 to r1.

For example, the C-shell commands

```
ipmakelut –L -gamma <gamma> -val0 30720 0 -val1 34815 1023 -range 0 1023
  -out input.lut
ipmakelut -CV -gamma <gamma> -val0 30720 0 -val1 34815 1023 -range 0 65535
  –clipval 0 1023 -out $out
```

generate an input/output LUT pair to process Cineon images in 12 bit linear representation.

### Generating linear to linear LUTs

Specifying '–linear' instead of '–gamma <γ>' causes the relationship between CVs and linear values to become linear instead of logarithmic. Thus the command can be used to generate linear to linear conversion tables as well.

So the C-shell commands

```
# example showing how to generate a LUT pair to process 8 bit images in 12 bit
# accuracy, and convert them to 10 bit logarithmic representation using an
# arbitrary gamma factor
ipmakelut –CV –linear –val0 0 30720 –val1 256 34816 –range 0 255 –out input.lut
ipmakelut –CV –gamma <gamma> -val0 30720 95 –val1 34816 685 –range 0 65535
  –clipval 0 1023 – out output.lut
```

generates a linear input LUT from 8 bit to 12 bit, and a logarithmic output LUT according to the value of gamma.

### LUT conversion utility

Sometimes it is handy to convert existing loader LUT files to pairs of input and output LUTs without fitting parameters to these LUTs. The 'iplutconvert' command reads in a loader LUT, and generates the image processing LUTs by linear transforming the input values to a 12 bit range within the 16 bit processing data range. The output LUT is calculated by linear interpolation of the given loader LUT.

Thus the command

```
iplutconvert video.lut c:\al\ipconfig\ipluts\
```

generates the image processing LUTs 'c:\al\ipconfig\ipluts\video_in.lut' and 'c:\al\ipconfig\video_out.lut'.

This command is used in the ALGUI, if image processing is activated, to generate a input/output LUT pair.

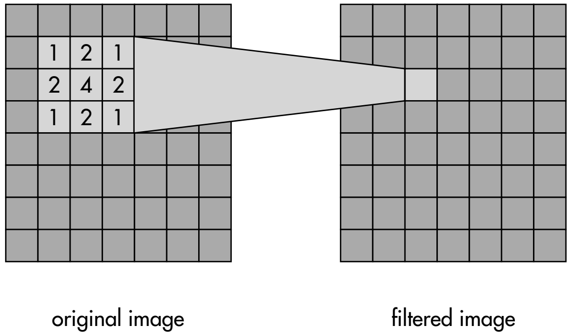
### 7.2.3.2 Filter Kernels

The convolution node is a powerful instrument to manipulate the contents of an image. Its most important use is as a sharpening filter, which increases edge contrast, hence resulting in a crisper image. This is done by convoluting the image with an appropriate convolution kernel, specified as the node's parameter. This chapter will first introduce the convolution operation and deal with smoothing filters as a basic application. It is then showed how sharpening filters are constructed from smoothing kernels.

#### Convolution

Convolution can be thought of as moving a small mask of weighting factors over the image, while adding up the values of all pixels within the mask area. Each pixel contributes to the result with the corresponding weighting factor given by the mask. Finally, the result is written to the center pixel. As the center pixel of a mask of even size is not well defined, we'll focus on rectangular masks of an odd size. As the new values are not written back to the original image before calculating the next pixel, but stored in a separate output image, the order in which the pixels of the resulting image are calculated is irrelevant. The graphic illustrates the convolution using a 3x3 mask.

convolution with a 3x3 mask



**Smoothing Filters**

Smoothing filters are the fundamentals of many other filter-types, as for example sharpening filters. Smoothing is accomplished by averaging the values of the pixels in a local neighborhood, and setting the value of the center pixel to this average value. The simplest approach is to evenly sum the pixels within a rectangular shaped mask, and to divide the result by the number of the pixels in the filter mask. This leads to the so called rectangular box filters, as tabled below.

$$R_{3x3} = \frac{1}{9}\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} \quad R_{5x5} = \frac{1}{25}\begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{pmatrix} \quad R_{7x7} = \frac{1}{49}\begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

and so on. With increasing filter size, the fact that these masks work on a rectangular neighborhood may not be well chosen for natural images. A better choice would be to use circular box filters, which approximate a circular shape on a rectangular grid. The smallest circular box filters are

$$C_{3x3} = \frac{1}{5}\begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{pmatrix} \quad C_{5x5} = \frac{1}{13}\begin{pmatrix} 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{pmatrix} \quad C_{5x5} = \frac{1}{21}\begin{pmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$

To better localize the filter, pixels near the mask center should be weighted more than pixels far outside at the masks border. To do so, Binomial masks are well suited. They are discrete approximations of a two dimensional Gaussian, which decreases slowly first and then quickly which increasing distance from the center pixel.

$$B_{3x3} = \frac{1}{16}\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} \quad B_{5x5} = \frac{1}{256}\begin{pmatrix} 1 & 4 & 6 & 4 & 1 \\ 4 & 16 & 24 & 16 & 4 \\ 16 & 24 & 36 & 24 & 16 \\ 4 & 16 & 24 & 16 & 4 \\ 1 & 4 & 6 & 4 & 1 \end{pmatrix} \quad \ldots$$

The advantages of Binomial filters are enhanced isotropy and a smoother frequency behavior, which is less sensitive to aliasing artefacts compared to box filters. On the other hand, computation of box filters is more efficient since no multiplication has to be carried out.

### Sharpen Filters

Smoothing and sharpening are complementary operations, and a previously performed smoothing operation can be almost completely reversed with an appropriate sharpening filter. While smoothing suppresses small structures, the aim of a sharpening filter is to intensify these. Subtracting a smoothed image from the original image can therefore be used for sharpening filters. Given a smoothing filter B, a sharpening filter S of strength s can be constructed as
S = (1+s) ID – sB

with ID denoting the identity mask $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$

The kind, and mainly the size of the smoothing kernel B controls the area the filter acts on, defining what is a 'fine' and what is a 'coarse' detail. The strength factor s determines how strong fine details are enhanced. For example, setting s to zero results in the original image, while s=1 leads to the so called 'fully sharpened image' which enhances the finest details by a factor of two.

To construct a filter suitable for the image processing system, s has to be chosen so that the filter coefficients are integer numbers. For example, from the box filters of the previous section, the following sharpening kernels can be found:

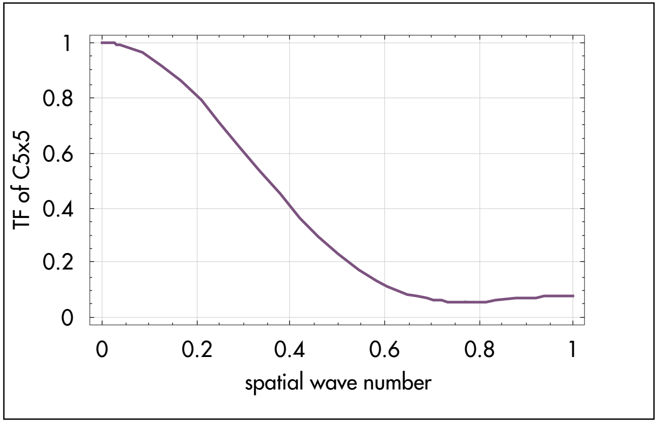
| Filters based on $C_{3x3}$ | Filters based on $R_{3x3}$ |
|---|---|
| $1.3125 * ID - 0.3125 * C_{3x3} = \frac{1}{16}\begin{pmatrix} 0 & -1 & 0 \\ -1 & 20 & -1 \\ 0 & -1 & 0 \end{pmatrix}$ | $2.5625 * ID - 0.5625 * R_{3x3} = \frac{1}{16}\begin{pmatrix} -1 & -1 & -1 \\ -1 & 24 & -1 \\ -1 & -1 & -1 \end{pmatrix}$ |
| $1.625 * ID - 0.625 * C_{3x3} = \frac{1}{8}\begin{pmatrix} 0 & -1 & 0 \\ -1 & 12 & -1 \\ 0 & -1 & 0 \end{pmatrix}$ | $2.125 * ID - 1.125 * R_{3x3} = \frac{1}{8}\begin{pmatrix} -1 & -1 & -1 \\ -1 & 16 & -1 \\ -1 & -1 & -1 \end{pmatrix}$ |
| $2.55 * ID - 1.25 * C_{3x3} = \frac{1}{4}\begin{pmatrix} 0 & -1 & 0 \\ -1 & 8 & -1 \\ 0 & -1 & 0 \end{pmatrix}$ | $3.25 * ID - 2.25 * R_{3x3} = \frac{1}{4}\begin{pmatrix} -1 & -1 & -1 \\ -1 & 12 & -1 \\ -1 & -1 & -1 \end{pmatrix}$ |

**Judging Filters**

A large variety of sharpen filters can be constructed, and the main task is to select the right filter for the desired purpose. Predicting the effect of a filter just from the values of the filter matrix is very difficult. It is easier to look at the filter in a way that shows how its behavior depends on the spatial frequency in the image. For example, a smoothing filter shall preserve large structures while suppressing the very small ones.

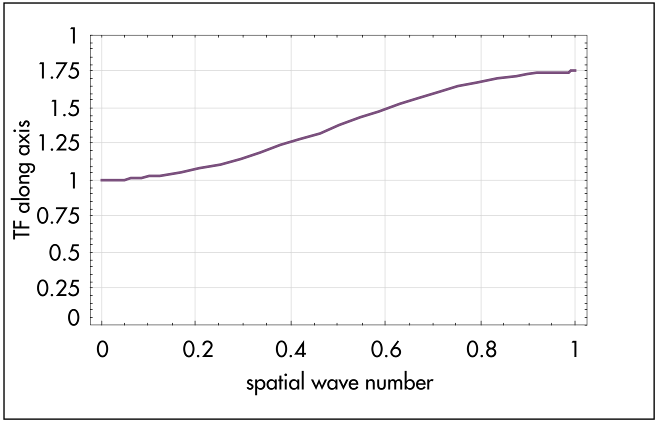
Such a representation of a filter is called its Transfer Function (TF). The values of the TF indicates how much structures of given sizes are increased or decreased by the filter. For example, if the TF has a value of 0.5 at 40 line pairs per millimeter, the contrast of four pixel wide structures is reduced to the half of their original value after applying the filter. In general, the TF is calculated for all structure sizes up to the finest detail which can be represented in the image. For a 4k geometry, this will by 80 line pairs per millimeter, and 40 line pairs per millimeter for 2k geometries.

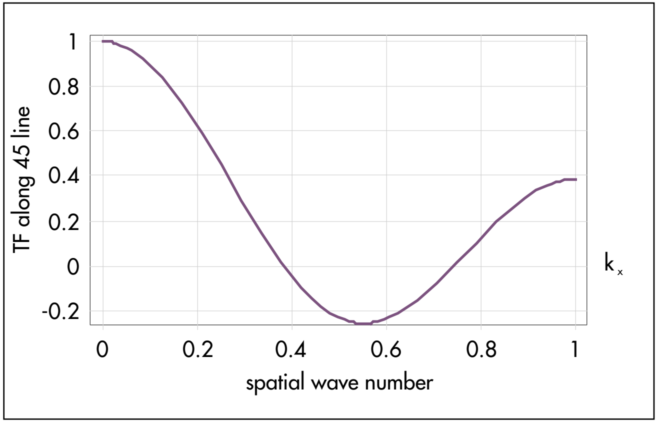
If we look at the TF of one of the smoothing filters introduced above, e.g. the C5x5 filter, we see that it starts with 1 and decreases to 0 at the high wave numbers. So the filter is depressing high wave numbers, or in other words, small details. This is what a smoothing filter is expected to do.




Now we see that subtracting a smoothed image from the original causes the TF to increase for fine details, since the TF of the resulting filter increases with wavelength, thus enhancing small details.

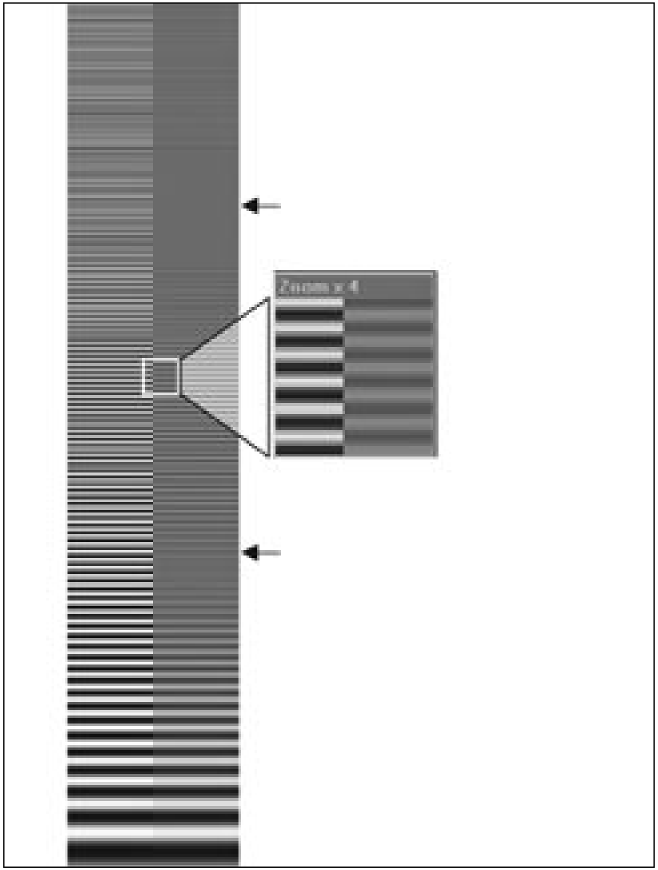
As an example, the TF of 1.0625 ID – 0.625 C5x5 is shown in the next graphics:




It is important to note that the filter may act different on structures of different directions, since the rectangular grid on which the image and the filter are represented have an inherent anisotropy. Therefore, it is important to look at the TF at least in two directions, along the axis and on a 45 degree line. The TF of the C5x5 filter along the 45 degree line indeed looks different from that along the axis:

It still decreases to zero, than becomes negative, and for very small structures positive again. A zero point of the TF means that structures of this size are damped completely. In between these points, where the TF is negative, bright and dark regions of the structure become interchanged.




To illustrate the behaviour of the filter, a pattern of decreasing detail size is shown together with the filtered result in the graphics.

Some filters show strong directional deviations, while others are nearly isotropic. The isotropy of a sharpen filter is fully determined by the isotropy of the underlying smoothing filter.

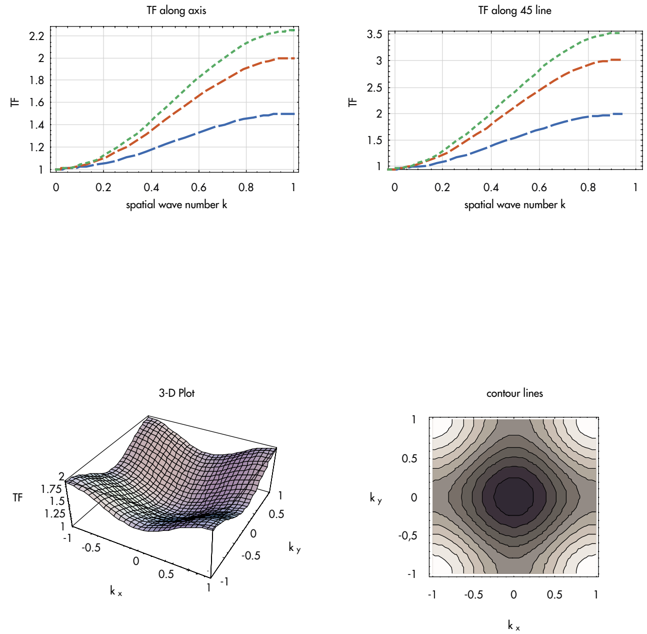
**Summary of sharpen filters**

This section summarizes the sharpen filters provided with the ARRILASER software. All filter definitions can be found in 'c:\al\ipconfig\kernels\alkernels.cfg'. The following table lists these filters together with their transfer functions and isotropy charts. For each filter family, the transfer function along the axis is shown as the top left graphics, and the transfer function in 45 degree direction is shown as top right graphics. Below, isotropy is characterized by the 3D plot and the contour plot of the weakest filter. Since isotropy does not depend on the filter strength, but on the underlying smoothing filter, it does not change within a filter family.

### *Filter set 1: Sharpen filters based on box filters*
Filters based on C3x3

| radius | strength | filter matrix |
|---|---|---|
| *sharpen_small_weak* (blue dashed line) | | |
| 1.0 | 0.625 | $\frac{1}{8}\begin{pmatrix} 0 & -1 & 0 \\ -1 & 12 & -1 \\ 0 & -1 & 0 \end{pmatrix}$ |
| *sharpen_small_intermediate* (orange dashed line) | | |
| 1.0 | 1.25 | $\frac{1}{4}\begin{pmatrix} 0 & -1 & 0 \\ -1 & 8 & -1 \\ 0 & -1 & 0 \end{pmatrix}$ |
| *sharpen_small_strong* (green dotted line) | | |
| 1.0 | 1.5625 | $\frac{1}{16}\begin{pmatrix} 0 & -5 & 0 \\ -5 & 36 & -5 \\ 0 & -5 & 0 \end{pmatrix}$ |

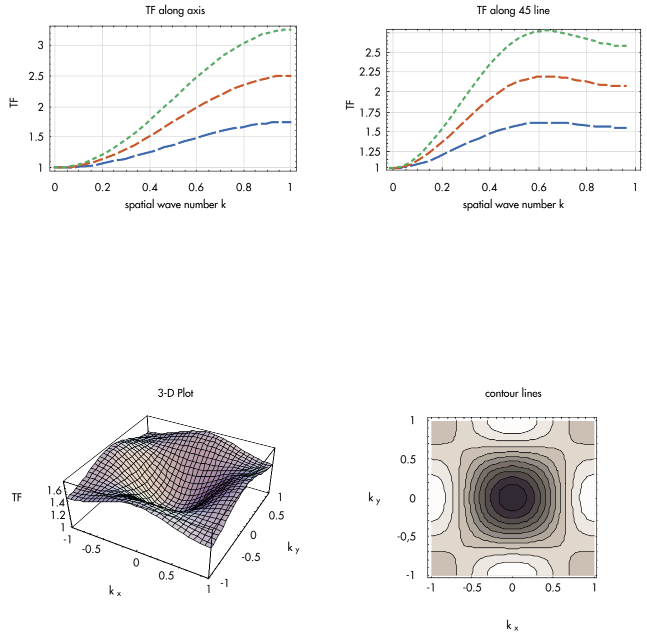
**Transfer functions and isotropy**



## Filters based on R3x3

| radius | strength | filter matrix |
|---|---|---|
| *sharpen_medium_weak* | | |
| 1.4 | 0.5625 | $\frac{1}{16}\begin{pmatrix} -1 & -1 & -1 \\ -1 & 24 & -1 \\ -1 & -1 & -1 \end{pmatrix}$ |
| *sharpen_medium_intermediate* | | |
| 1.4 | 1.125 | $\frac{1}{8}\begin{pmatrix} -1 & -1 & -1 \\ -1 & 16 & -1 \\ -1 & -1 & -1 \end{pmatrix}$ |
| *sharpen_medium_strong* | | |
| 1.4 | 1.6875 | $\frac{1}{16}\begin{pmatrix} -3 & -3 & -3 \\ -3 & 40 & -3 \\ -3 & -3 & -3 \end{pmatrix}$ |

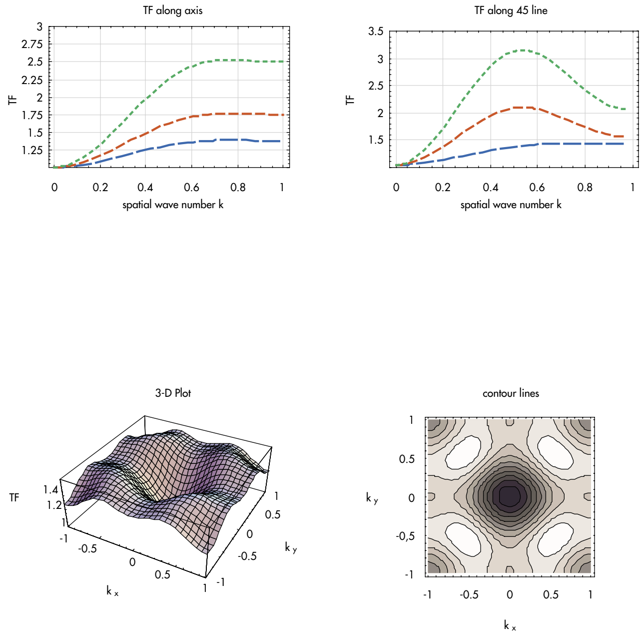
**Transfer functions and isotropy**



# Filters based on C5x5t

| radius | strength | filter matrix |
|---|---|---|
| *sharpen_large_weak* (blue, long dashes) | | |
| 2.0 | 0.40625 | $\frac{1}{16}\begin{pmatrix} 0 & 0 & -1 & 0 & 0 \\ 0 & -1 & -1 & -1 & 0 \\ -1 & -1 & 28 & -1 & -1 \\ 0 & -1 & -1 & -1 & 0 \\ 0 & 0 & -1 & 0 & 0 \end{pmatrix}$ |
| *sharpen_large_intermediate* (red, medium dashes) | | |
| 2.0 | 0.8125 | $\frac{1}{16}\begin{pmatrix} 0 & 0 & -1 & 0 & 0 \\ 0 & -1 & -1 & -1 & 0 \\ -1 & -1 & 28 & -1 & -1 \\ 0 & -1 & -1 & -1 & 0 \\ 0 & 0 & -1 & 0 & 0 \end{pmatrix}$ |
| *sharpen_large_strong* (green, short dashes) | | |
| 2.0 | 1.625 | $\frac{1}{8}\begin{pmatrix} 0 & 0 & -1 & 0 & 0 \\ 0 & -1 & -1 & -1 & 0 \\ -1 & -1 & 20 & -1 & -1 \\ 0 & -1 & -1 & -1 & 0 \\ 0 & 0 & -1 & 0 & 0 \end{pmatrix}$ |

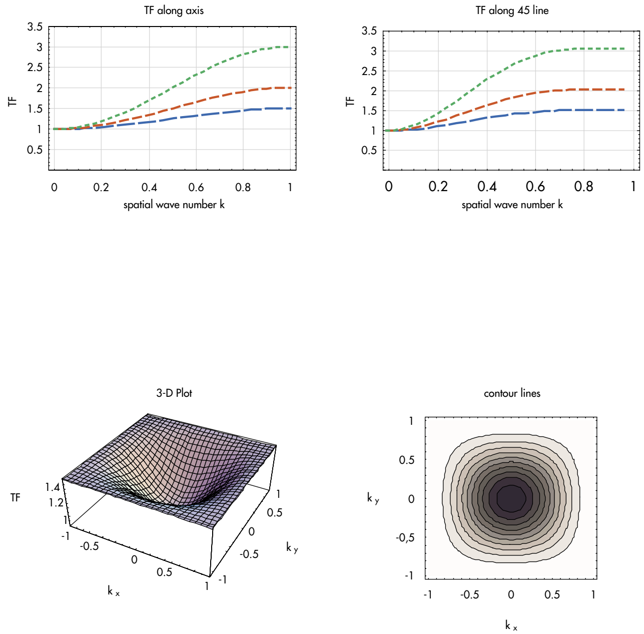
**Transfer functions and isotropy**



### *Filter set 2: Sharpen filters based on binomial Filters*
Filters based on 3x3 Binomial

| radius | strength | filter matrix |
|---|---|---|
| *sharpen_bin_small_weak* (blue dashed line) | | |
| 2.0 | 0.40625 | $\frac{1}{32}\begin{pmatrix} -1 & -2 & -1 \\ -1 & 44 & -2 \\ -1 & -2 & -1 \end{pmatrix}$ |
| *sharpen_bin_small_intermediate* (red dashed line) | | |
| 2.0 | 0.8125 | $\frac{1}{16}\begin{pmatrix} -1 & -2 & -1 \\ -1 & 28 & -2 \\ -1 & -2 & -1 \end{pmatrix}$ |
| *sharpen_bin_small_strong* (green dashed line) | | |
| 2.0 | 1.625 | $\frac{1}{8}\begin{pmatrix} -1 & -2 & -1 \\ -1 & 20 & -2 \\ -1 & -2 & -1 \end{pmatrix}$ |

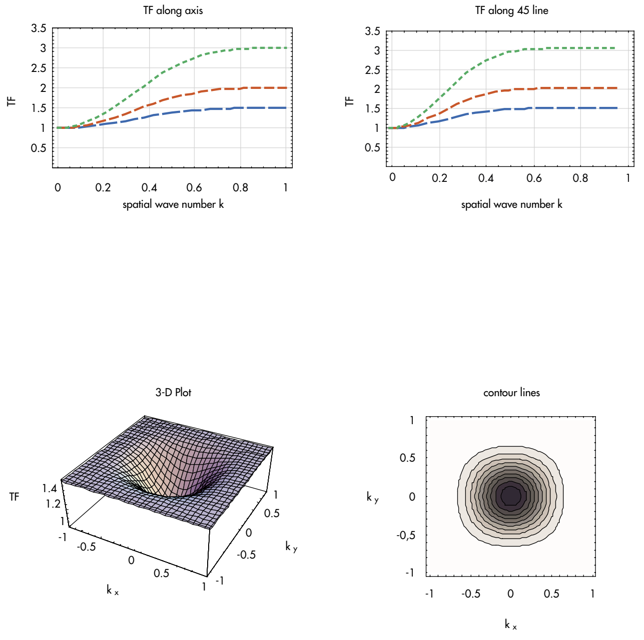
**Transfer functions and isotropy**



# Filters based on 5x5 Binomial

| radius | strength | filter matrix |
|---|---|---|
| *sharpen_bin_medium_weak* | | |
| 1.0 | 0.5 | $\frac{1}{512}\begin{pmatrix} -1 & -4 & -6 & -4 & -1 \\ -4 & -16 & -24 & -16 & -4 \\ -6 & -24 & 732 & -24 & -6 \\ -4 & -16 & -24 & -16 & -4 \\ -1 & -4 & -6 & -4 & -1 \end{pmatrix}$ |
| *sharpen_bin_medium_intermediate* | | |
| 1.0 | 1.0 | $\frac{1}{256}\begin{pmatrix} -1 & -4 & -6 & -4 & -1 \\ -4 & -16 & -24 & -16 & -4 \\ -6 & -24 & 476 & -24 & -6 \\ -4 & -16 & -24 & -16 & -4 \\ -1 & -4 & -6 & -4 & -1 \end{pmatrix}$ |
| *sharpen_bin_medium_strong* | | |
| 1.0 | 2.0 | $\frac{1}{128}\begin{pmatrix} -1 & -4 & -6 & -4 & -1 \\ -4 & -16 & -24 & -16 & -4 \\ -6 & -24 & 348 & -24 & -6 \\ -4 & -16 & -24 & -16 & -4 \\ -1 & -4 & -6 & -4 & -1 \end{pmatrix}$ |

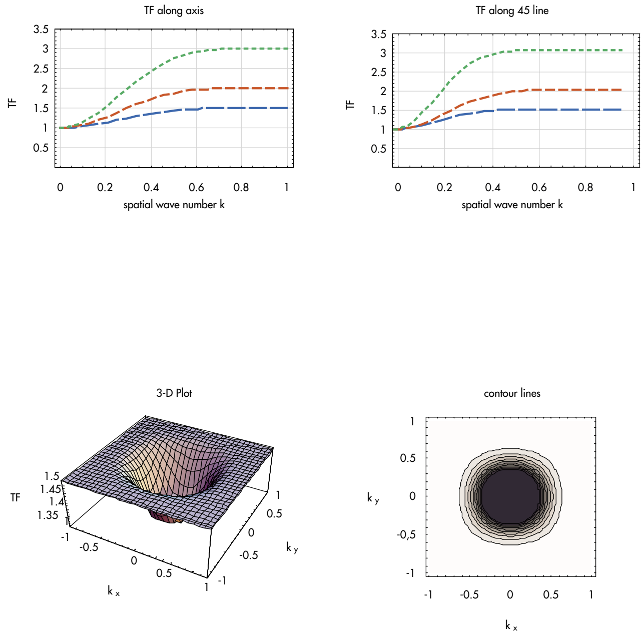
## Transfer functions and isotropy



## Filters based on 7x7 Binomial

| radius | strength | filter matrix |
| --- | --- | --- |
| *sharpen_bin_large_weak* (blue dashed line) | | |
| 1.2 | 0.5 | $\frac{1}{8192}\begin{pmatrix} -1 & -6 & -15 & -20 & -15 & -6 & -1 \\ -6 & -36 & -90 & -120 & -90 & -36 & -6 \\ -15 & -90 & -225 & -300 & -225 & -90 & -15 \\ -20 & -120 & -300 & 11888 & -300 & -120 & -20 \\ -15 & -90 & -225 & -300 & -225 & -90 & -15 \\ -6 & -36 & -90 & -120 & -90 & -36 & -6 \\ -1 & -6 & -15 & -20 & -15 & -6 & -1 \end{pmatrix}$ |
| *sharpen_bin_large_intermediate* (red dashed line) | | |
| 1.2 | 1.0 | $\frac{1}{4096}\begin{pmatrix} -1 & -6 & -15 & -20 & -15 & -6 & -1 \\ -6 & -36 & -90 & -120 & -90 & -36 & -6 \\ -15 & -90 & -225 & -300 & -225 & -90 & -15 \\ -20 & -120 & -300 & 7792 & -300 & -120 & -20 \\ -15 & -90 & -225 & -300 & -225 & -90 & -15 \\ -6 & -36 & -90 & -120 & -90 & -36 & -6 \\ -1 & -6 & -15 & -20 & -15 & -6 & -1 \end{pmatrix}$ |
| *sharpen_bin_large_strong* (green dashed line) | | |
| 1.2 | 2.0 | $\frac{1}{2048}\begin{pmatrix} -1 & -6 & -15 & -20 & -15 & -6 & -1 \\ -6 & -36 & -90 & -120 & -90 & -36 & -6 \\ -15 & -90 & -225 & -300 & -225 & -90 & -15 \\ -20 & -120 & -300 & 5744 & -300 & -120 & -20 \\ -15 & -90 & -225 & -300 & -225 & -90 & -15 \\ -6 & -36 & -90 & -120 & -90 & -36 & -6 \\ -1 & -6 & -15 & -20 & -15 & -6 & -1 \end{pmatrix}$ |

**Transfer functions and isotropy**



# 7.3 Multiple recording formats

The ARRILASER offers a variety of recording formats.
A recording format is used to define the physical size and position of an image on film.

## 7.3.1 Selecting a recording format within GUI or CLIF

In the GUI or CLIF software engine, the alsetgeometry command is used to choose from a list of predefined recording formats and image geometries.

The recording geometries are defined by the following arguments:

| | |
|---|---|
| name | is used by the GUI or CLIF command alsetgeometry.<br>Example: 'HD_acad_2K'. |
| xSize | Image width in pixel. Example: 1920. |
| ySize | Image height in pixel. Example: 1080. |
| xOffset: | Offset in pixels with reference to the left edge of the image window.<br>Example: 231 = 2151 - 1920.<br>The offset pixels are filled with zero by the IDI driver software (IDI: image data interface). |
| yOffset: | Offset in pixels with reference to the top or bottom edge of the image window.<br>Example: 277 = (1634 - 1080)/2.<br>The offset pixels are filled with zero by the IDI driver software (IDI: image data interface). |
| xOrigin: | Horizontal position of the image window in microns relative to the reference pin. Example :1797 |
| yOrigin: | Vertical position in microns relative to the reference pin. Example: 2514. |
| pulldown: | Distance of two adjacent images on film in microns.<br>Example: 18960 |
| pitch: | Size of a pixel in mirons * 100.<br>Side note: pixel are always square.<br>Example: 1142.5000. |

**Limitations**

The pitch size is firstly depended on the available lenses in the system. There is one lens, which generates a 4K pitch size (6µm) and one lens that generates a 2K pitch size (12 µm). Depending on the ARRILASER model either one or the other or both lenses are available in your system. Secondly the arguments pitch and pulldown in combination control internal parameters of the ARRILASER system. These parameters are the pixel clock and the speed profile of the linear motor, moving the film stage during recording. The list of available pitch and pulldown combinations is limited and key protected depending on the options of your system, see also *chapter 7.3.4.*

The film formats on the host side are generated by the 'Setup Geometry' menue in the ALGUI or in the 'c:\al\config\alfilmformats.cfg' file, when using the clif commands. Examples for geometry files are given below:

```
Format:    fullap4k
xSize:     4096
ySize:     3112
xOffset:   0
yOffset:   0
xOrigin:   1797
yOrigin:   2514
pullDown:  18960
pitch:     600.0000

Format:    4K4096x3072
xSize:     4096
ySize:     3072
xOffset:   0
yOffset:   20
xOrigin:   1797
yOrigin:   2514
pullDown:  18960
pitch:     600.0000
```

```
Format:    HDTV
xSize:     1920
ySize:     1080
xOffset:   231
yOffset:   277
xOrigin:   1797
yOrigin:   2514
pullDown:  18960
pitch:     1142.5
```

## 7.3.2 Film formats from the point of view of the Carmille software

From the point of view of the Carmille software a film format is defined by the following data items:

| | |
|---|---|
| maxXSize | horizontal size of the image window in pixels (from perf to perf) |
| maxYSize | vertical size of the image window in pixels (in film transport direction) |
| xOrigin | horizontal position in microns relative to the reference pin |
| yOrigin | vertical position relative to the reference pin |
| pitch | height and width of an individual (square) pixel in microns |
| pulldown | distance of two adjacent images on the film. |
| perf | number of perfs (could be derived from pull-down). |
| collpos | position of the movable collimators for pitches of 6 micron/12 micron (4K/2K position) |

Note: The perf data item is redundant (it is listed for convenience only), it could be derived from the pull-down.

A sample list of film formats as seen by the Carmille software is given in the following table:

| name | max Xsize | max Ysize | xOrigin | yOrigin | pitch | pull-down | perf | coll pos |
|---|---|---|---|---|---|---|---|---|
| 4k | 4096 | 3112 | 1797 | 2514 | 6.00000 | 18960 | 4 | 4K |
| 2k | 2048 | 1556 | 1797 | 2514 | 12.000000 | 18960 | 4 | 2K |
| 4k across acad | 4589 | 3487 | 1797 | 2514 | 5.355469 | 18960 | 4 | 4K |
| 2k across acad | 2294 | 1743 | 1797 | 2514 | 10.710938 | 18960 | 4 | 2K |
| HD S35 4k | 3840 | 2953 | 1860 | 2450 | 6.367188 | 18960 | 4 | 4K |
| HD S35 | 1920 | 1476 | 1860 | 2450 | 12.734375 | 18960 | 4 | 2K |
| HD ac 4k | 4302 | 3269 | 1797 | 2514 | 5.712500 | 18960 | 4 | 4K |
| HD ac 2k | 2151 | 1634 | 1797 | 2514 | 11.425000 | 18960 | 4 | 2K |
| 4k 3Perf | 4096 | 2334 | 1797 | 2478 | 6.000000 | 18960 | 3 | 4K |
| 2k 3Perf | 2048 | 1167 | 1797 | 2478 | 12.000000 | 14220 | 3 | 2K |
| 4k ac 3perf | 4589 | 2615 | 1797 | 2478 | 5.355469 | 14220 | 3 | 4K |
| 2k ac 3perf | 2294 | 1307 | 1797 | 2478 | 10.710938 | 14220 | 3 | 2K |
| HD S35 4k 3perf | 3840 | 2199 | 1860 | 2478 | 6.367188 | 14220 | 3 | 4K |
| HD S35 3perf | 1920 | 1100 | 1860 | 2478 | 12.734375 | 14220 | 3 | 2K |
| HD ac 4k 3perf | 4302 | 2451 | 1797 | 2478 | 5.712500 | 14220 | 3 | 4K |
| HD ac 2k 3perf | 2151 | 1226 | 1797 | 2478 | 11.425000 | 14220 | 3 | 2K |

**Special High Speed Profiles**

Special high speed profiles offer the possibility to run the black part of a 1.85 or an HD image in a higher speed and thus save time compared to the fullap images. 1.85 and HD images will be recognized by their geometry (pitch and offset, size must be same or smaller, than the specified one) and a different profile will be loaded in the linear drive.

A sample list of film formats which run in higher speed:

All available formats are stored in the file 'c:\program files\arri\arrilaser\charts\profiles.rec'. An example file 'profiles.rec' is given below:

| name | max Xsize | max Ysize | xOrigin | yOrigin | pitch | pull-down | perf | coll pos |
|---|---|---|---|---|---|---|---|---|
| 4k_1.85 | 3656 | 1976 | 1797 | 2514 | 6.00000 | 18960 | 4 | 4K |
| 2k_1.85 | 1828 | 988 | 1797 | 2514 | 12.000000 | 18960 | 4 | 2K |
| 4k HD_acad | 3840 | 2160 | 1797 | 2514 | 5.7125 | 18960 | 4 | 4K |
| 2k_HD_ | 1920 | 1080 | 1797 | 2514 | 11.425000 | 18960 | 4 | 2K |

```
Table “ARRILASER sliding carriage profiles” 1000 “1.100”
{
“2K fullap “,0x85,12000000,2048,1556,1797,2514,18960,4,”2K”,0,2,90
“2K acad “,0x86,10710938,2294,1743,1797,2514,18960,4,”2K”,0,0,99
“2K HD „,0x87,11425000,1920,1080,1797,2514,18960,4,“2K“,1,0,144
„2K HD S35 „,0x88,12734375,1920,1476,1860,2450,18960,4,“2K“,0,0,85
“2K 1.85 „,0x89,12000000,1828,988,1797,2514,18960,4,“2K“,1,0,142
„2K HD acad “,0xD1,11425000,2151,1634,1797,2514,18960,4,”2K”,0,0,94
“2K fullap “,0xA5,12000000,2048,1167,1797,2478,14220,3,”2K”,0,0,90
“2K acad “,0xA6,10710938,2294,1307,1797,2478,14220,3,”2K”,0,0,99
“2K HD S35 “,0xA8,12734375,1920,1100,1860,2478,14220,3,”2K”,0,0,85
“2K HD acad “,0xA7,11425000,2151,1226,1797,2478,14220,3,”2K”,0,0,94
“4K fullap “,0x95,6000000,4096,3112,1797,2514,18960,4,”4K”,0,1,169
“4K acad “,0x91,5355469,4589,3487,1797,2514,18960,4,”4K”,0,0,189
“4K HD „,0x92,5712500,3840,2160,1797,2514,18960,4,“4K“,1,0,218
„4K HD S35 „,0x93,6367188,3840,2952,1860,2450,18960,4,“4K“,0,0,159
“4K 1.85 „,0x94,6000000,3656,1976,1797,2514,18960,4,“4K“,1,0,207
„4K HD acad “,0xD3,5712500,4302,3268,1797,2514,18960,4,”4K”,0,0,177
“4K fullap “,0xB5,6000000,4096,2334,1797,2478,14220,3,”4K”,0,0,169
“4K acad “,0xB1,5355469,4589,2615,1797,2478,14220,3,”4K”,0,0,189
“4K HD S35 “,0xB3,6367188,3840,2199,1860,2487,14220,3,”4K”,0,0,159
“4K HD acad “,0xB2,5712500,4302,2451,1797,2478,14220,3,”4K”,0,0,177
}
```

The file also contains the entry number of the corresponding sliding carriage profile (second column).

### 7.3.3 Understanding the actions when loading a geometry at the host computer

Loading a geometry with the 'alsetgeometry' command or starting the aldaemon on the host computer (in CLIF starting the aldaemon means sending the last geometry active) leads to the following actions in Carmille:

- Prevalidate the loaded geometry settings.
  If validation fails, issue of an error code.
  Validation includes checking of the licence keys.

- Check whether the geometry has been loaded before.
  If yes, don't load the geometry again, but only clear the line buffers (this takes several seconds).

- Select the corresponding film-format on the carmille side.
  The combined primary key for selecting the profile is the combination of pitch and pull-down.
  In other words: the profile selected for driving the sliding carriage is only defined by the combination of pitch and pull-down and by nothing else.
  If no profile is found, issue of an error code.

- Select a base calibration (either 2K or 4K) for the geometry.

- Check whether the pitch of the loaded geometry is within a ±15 percent window of the pitch of the base calibration. If not, issue an error code.

- Calculate the delay counter settings from the settings of the selected base calibration.

- Validate the new delay counter settings.
  If the allowed ranges are exceeded,
  issue of an error code.

- Download the new parameters to the electronics of the ARRILASER.

- Adjust the exposure settings such that the theoretical exposure is identical to the max exposures loaded.

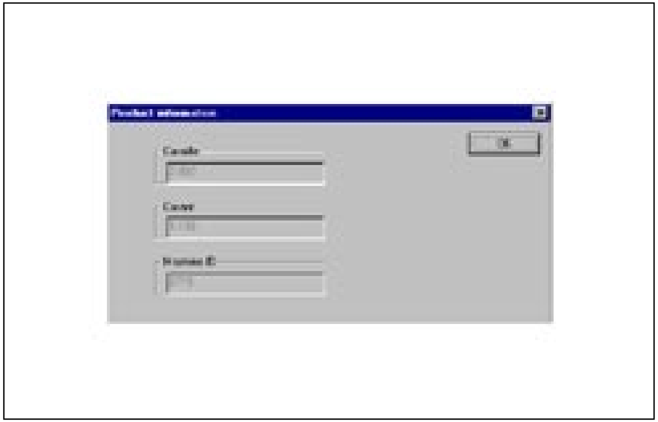
To execute the steps above, a time of 30 seconds up to about a minute is needed.

## 7.3.4 Licence keys

The multi-format feature of the CLIF/ Carmille software is protected by software licence keys. Several licence keys protect a set of formats.

Licensing of the different modules is handled by a software-key system, which also allows time limited licenses. Those licenses are machine specific and check the serial number on the EERam of the microcontroller board. In the versions window you can see the licensed modules and the machine number as well as the licensed machine number (must be the same). The license information is stored in the license.key file, which is located under 'c:\Program Files\ARRI\ARRILASER\charts'. After updating the license file Carmille needs to be restarted.

To find out which profiles are licensed, you can check in the drop down menu in the calibrate\alignment window.



The licensing is connected to the network card of the computer, when the network card has been changed a new license file is necessary. If no network card exists, licensing will be connected to the CPU.

The licence keys are generated by ARRI Munich. For generation of the keys the system key must be known. The system key can be read in the versions window when Carmille is running:

The following options are grouped into sets of licence keys: 4K, 2K , HD, acad, 3perf.
The HD option includes S35 HD and HD across academy.
The options User1 and User2 are custom film-formats.

| name | max Xsize | max Ysize | pitch | pull-down | 4K | 2K | HD | acad | 3 perf | User1 | User2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4k fullap | 4096 | 3112 | 6.00000 | 18960 | x | | | | | | |
| 4K_1.85 | 3656 | 1976 | 6.00000 | 18960 | x | | | | | | |
| 2k fullap | 2048 | 1556 | 12.000000 | 18960 | | x | | | | | |
| 2K_1.85 | 1828 | 988 | 12.000000 | 18960 | | x | | | | | |
| 4k across acad | 4589 | 3487 | 5.355469 | 18960 | x | | | x | | | |
| 2k across acad | 2294 | 1743 | 10.710938 | 18960 | | x | | x | | | |
| HD S35 4k | 3840 | 2953 | 6.367188 | 18960 | x | | x | | | | |
| HD S35 | 1920 | 1476 | 12.734375 | 18960 | | x | x | | | | |
| HD ac 4k | 4302 | 3269 | 5.712500 | 18960 | x | | x | | | | |
| HD_4k | 3840 | 2160 | 5.712500 | 18960 | x | | x | | | | |
| HD ac 2k | 2151 | 1634 | 11.425000 | 18960 | | x | x | | | | |
| HD_2k | 1920 | 1080 | 11.425000 | 18960 | | x | x | | | | |
| 4k 3perf | 4096 | 2334 | 6.000000 | 14220 | x | | | | x | | |
| 2k 3perf | 2048 | 1167 | 12.000000 | 14220 | | x | | | x | | |
| 4k ac 3perf | 4589 | 2615 | 5.355469 | 14220 | x | | | x | x | | |
| 2k ac 3perf | 2294 | 1307 | 10.710938 | 14220 | | x | | x | x | | |
| HD S35 4k 3perf | 3840 | 2199 | 6.367188 | 14220 | x | | x | | x | | |
| HD S35 3perf | 1920 | 1100 | 12.734375 | 14220 | | x | x | | x | | |
| HD ac 4k 3perf | 4302 | 2451 | 5.712500 | 14220 | x | | x | | x | | |
| HD ac 2k 3perf | 2151 | 1226 | 11.425000 | 14220 | | x | x | | x | | |

A specific format may be used if you purchased the ticked option, e.g. for ”2k ac 3perf” you need to buy the options 2k, native academy, and 3perf.

In order to purchase option formats, please contact your local sales agent.

# 7.4 Diagnostics and Error Handling

## 7.4.1 Available Logfiles

### 7.4.1.1 GUI

Job-Logfile: Contains the information that the GUI gives about one specific Job. As long as the jobname stays the same the output of the file will be added to the end of the file. These files are located under 'c:\algui\config\logs'.

Shootlog.log: contains the information about each start and finish of a job. It gives a quick overview on which jobs where recorded. Each recording is added to the end of that log. That´s why it is recommended to delete or rename that file once in a while. This file is located under 'c:\algui\config\logs'.

Lutlog.log: Logs every LUT that is downloaded to the recorder, for a quick overview over the calibration issues. This file is located under 'c:\algui\config\logs'.

In these Logfiles errors are classified by the return values of the al-commands [*see chapter 8.2.17*]

### 7.4.1.2 CLIF

Alcycle<dd>.dat: Logs every command of the clif output with a command ID. The command-id allows exact synchronisation of the logging-output between CLIF and Carmille. Each day a separate log-file is created. These files are overwritten in a monthly basis. It doesn´t matter, whether the command was launched by the GUI or by the c-shell. The files are located in the 'AL_LOGFILE_DIR' directory (default in 'c:\al\logs').

The log files are structured according to the rule:
<date> <cmdID> <severity> <cmdName>: <message string>
where <cmdID> counts all CLIF commands starting by '1' from each aldaemon start command.

Severity indicates MSG for all regular output of the al-commands, in error case it indicates one line as ERR and all other connected output lines with WAR. WAR also indicates cases where an error occured that was not severe enough to let the al-command return with an error status.

In that logfile the returnvalues of the al.commands are indicated as well as the exact description of the error by the recorder messages coming from the carmille program [*see chapter 8.2.16*]

### 7.4.1.3 Carmille

All carmille logfiles are located in the directory c:\Program Files\Arri\Arrilaser\logfiles.

cycle<dd>.dat: Logs every communication with the Clif and all error messages coming from the recorder. alcycle-files and cycle-files can be connected by the command ID.

exposu<dd>.dat: These logfiles are written permanently. They only write the power measurement of the file shutter. These files are important for laser instability issues. The files will be overwritten after one month.

scanner<dd>.dat: These logfiles are only written when activated in the carmille program. They only write the scanner frequency. These files are important for scanner instability issues.

longterm-logging: For long-term analysis the files, ‘scanner.dat’ and ‘exposure.dat’ are written. These files are never erased. The single lines of the files contain the same information as the files ‘scanner<dd>.dat’ and ‘exposure<dd>.dat’, but the entries are written only every 12 hours and at each restart of Carmille. This allows a long-term tracking of laser and scanner stability.

Note: In case of any error reporting to ARRILASER service staff, please always send ‘alcycle<dd>.dat’ ,‘cycle<dd>.dat’ and exposu<dd>.dat to ease error tracking.

### 7.4.2 Logfile Parsing for the C-Shell Scripting

The standard scripts shootsingle.csh or shootseq.csh add timestamps to a file called 'c:/al/logs/script.log' which mark start, end and the status of each script run. Check this file for status of each script to identify problems during execution or edit the standard scripts to customize the script logging.

Using the standard scripts without modifications, you have to backup and delete the file 'c:/al/logs/script.log' from time to time.

CLIF commands print a status report to 'stdout' and exit with an adequate return value. To analyze and supervise a script run in a more detailed way, redirect the output to a logfile. To analyze the log file you may use the 'grep' shell command in various ways like in the following example.

C-shell example to count the number of lines matching a string pattern in a file:

```
% grep -c 'successfully exposed' test.log
23
```

To monitor the film recorder state, there are two ways to get recorder status information:

1. Call 'alstatus recstate' within a script.
   [see *chapter 6.2.7*]

2. Interpret the daemon messages printed to 'stdout'.

Before starting the exposure cycle, the daemon requests the film recorder state. As long as the film recorder is not ready to start the next cycle and the error tolerance limits are not reached, the daemon repeats the request and the film recorder messages are printed to 'stdout'.

Analyzing the film recorder messages over a longer time period is a preventive measure to detect film recorder hardware instabilities.

### 7.4.3 Understanding Error States, when writing own scripts

This section explains how to handle error states reported by the daemon process. Starting the execution, a CLIF command checks the daemon's state. If the daemon signals an 'error' state, the command returns the reason for the error in the state variable. The reason could be:

**Daemon Error States**

- command download error '-2'
  error on the serial line transmission

- image download error '-3'
  the data transfer on the fibre link failed

- recorder error '-4'
  the laser recorder has stopped.
  Film out or a more serious problem occurred.

- system error '-12'
  fatal error, for example memory allocation failed

Before an executable returns to the command prompt, it sets the daemon state back to 'idle' [see *chapter 7.1.1.3*]. This means that from the perspective of a CLIF command, the error is fixed with an error message to 'stdout' and an error code in the return value.

The error handling is up to the caller and the next CLIF command can continue the job execution.

If the error handling is done by scripts, it is possible to distinguish between the two error situations:

- recoverable error
  there might be a corrupted image on film, but the recording could go on if the job is restarted.
  A command download error could indicate that the last image has not been recorded because the recorder did not receive the expose command.
  An image download error indicates that the transmission of the last image data per DMA transfer was not completed within a specific period of time.
  The image on film is corrupted.

- non-recoverable error
  A recorder error will be non-recoverable. It is necessary to react personally, changing film or technical service may be required.
  When a system error is encountered, it is necessary to restart the daemon process.
  A system reboot is recommended.

When using a script to automate the recording of an image sequence, it is important to wait until the last image is successfully recorded before exiting the current script and starting the next one.

The command ‘alstatus daemonstate’ will always return to the prompt level, printing the current daemon state to ‘stdout’. As long as the daemon is running, it is in one of the following states:

- ‘idle’, alstatus.exe prints ‘0’ to stdout
- ‘recording’, alstatus.exe prints ‘1’ to ‘stdout’
- ‘executing’ a command, alstatus.exe prints ‘2’ to stdout
- blocked by an ‘error’, alstatus.exe prints the negative error code to stdout

It is important to note, that in case of an error ‘alstatus daemonstate’ would not reset the daemon state to ‘idle’. Now the script detects the daemon error state and it is up to the script control to reset the daemon state with a call to ‘alsetstatus daemonstate 0’, after reporting the error and calling an operator to address the error.

C-shell script example, waiting for the last image to be successfully exposed:

```
…
set state = ‘alstatus daemonstate‘
while ( $state > 0 )
  sleep 5
  set state = ‘alstatus daemonstate‘
end
if ( $state < 0 )then
  # error handling:
  …
  # reset daemon error state:
  alsetstatus daemonstate 0
endif
…
```

# 8 Reference

## 8.1 GUI-File Structure

The GUI will use the ARRILASER (=AL) -executables located in the 'c:\al\clif'-folder. All other GUI specific files are located in the 'c:\algui'-folder. In the 'Arri.txt'-file (located under 'c:\Documents and Settings\\username') the file structure is defined and can be changed if necessary:

| | |
|---|---|
| CALDIR | directory of calibration files |
| LUTDIR | directory of conversion (loader) lut files |
| FORMATDIR | directory of geometry settings |
| JOBDIR | default directory for job-files |
| QUEUEDIR | default directory for queue-files |
| LOGDIR | dirctory for logfiles |
| SCRIPTDIR | directory for jobscripts |
| GEOMETRYTABLE | path of the file containing the geometry resolutions |
| ALIP_KERNEL_FILE | path of the file containing the convolution kernels |
| ALIP_SOFTCLIP_FILE | path of the file containing the softclip configurations |
| IPCONFIGDIR | directory of image processing configuration files |
| AL_BEEP | activates/deactivates a beep on every successful loaded image |

The following variables are set in the login.csh file under 'c:\cshell\login.csh':

| | |
|---|---|
| AL_SLATE_JARFILE | java applet for the slate generation |
| AL_SLATE_BGDFILE | path of the background file for the internal slate |
| ALLAUNCH_WAITTIME | |

With the default Arri.txt file the following structure is valid:

### 8.1.1 Applet

- 'Algui.jar': JAVA-applet to control the GUI.
- 'ArrirecSlate.jar': JAVA-applet to generate the recorder slate.
- 'ArrirecSlate.jpg': Background image for the recorder slate.
- 'Images': Contains all images included in the Java applet.

### 8.1.2 Config

- 'Cal': All files related to recorder calibration. The '*.cal' files have to be located in this directory in order to appear in the calibration window on the 'Job-Input'-page.
- 'Formats': All created geometry files. The '*.cfg' files have to be located in this directory in order to appear in the geometry window on the 'Job-Input'-page.
- 'Jobs': Location for saved jobs ('*.job'), queues ('*.que) and control jobs ('*.ctl'). They can also be saved in subdirectories.
- 'Logs': Logfiles automatically generated on recording of jobs, holding the information that is printed out in the 'shoot status' window. A 'shootlog.log' file logs every start and finish, including status of a job, for a quick overview on the order of recorded jobs. A 'lutlog.log"-file records every downloaded lut for a quick overview on calibration issues.
- 'Luts': All loader look-up-tables. The '*.lut' files have to be located in this directory in order to appear in the loader window on the 'Job-Input'-page.

### 8.1.3 Install
Contains all necessary files for the installation of the GUI.

### 8.1.4 Jobscripts
Contains the c-shell script file of a saved job. In order to run a job from within a Hamilton c-shell, type in the name of the script and choose '0' for runmode or '1' for testmode.

### 8.1.5 Stdscripts
Basic scripts called by the jobscripts. These scripts should not be edited.

### 8.1.6 Additional Files
- 'Alexec.dll': DLL-file to run the al- commands from within the JAVA-applet. Located under 'c:\al\clif'.

- 'Arri.txt': Text file to specify the location of the directories. This file is parsed when starting up the JAVA applet. The JAVA console window will give you information on errors while parsing this file. Needs to be under 'c:\Documents and Settings\username'.

# 8.2 CLIF

CLIF commands follow the naming convention 'al*.exe'.

Options available for all commands are:
'al* -h' gives a short help to standard out
'al* -vers' prints the current version to standard out (stout).

Each 'al*.exe' command exits with a return status in '%errorlevel%' for the windows command prompt level, or in the '$status' variable of the C-shell environment.

The environment variable 'AL_TEST_MODE' set to '1' forces all commands to print a test mode message to standard out and to return immediately with '0' in the status variable.

## 8.2.1 aldaemon.exe

| | |
|---|---|
| Command: | aldaemon.exe <command> |
| Description: | starts or stops the master daemon process called aldaemond.exe.<br>The daemon is responsible for the status, control and memory management accessed by most of the CLIF commands. |
| Arguments: | <command> start/stop |
| Return value: | 0 daemon started/stopped, or daemon already running/stopped<br>-1 wrong command line parameter<br>-11 daemon failed to start/stop<br>-12 system error |

## 8.2.2 alexpose.exe

| | | |
|---|---|---|
| Command: | alexpose.exe <image> [<conversion lut>]<br>alexpose.exe <image> [<input lut><output lut>] | |
| Description: | 'alexpose' loads image data to be exposed with the ARRILASER film recorder to main memory.<br>If successful alexpose returns '0'.<br>If the image data loading failed, or if the daemon reports an error state,<br>the command returns a negative error code value. | |
| Arguments: | <image> | image filename |
| | [<conversion lut>] | optional filename, to specify a lookup table for an image data conversion to the internal 10 bit log space.<br>If a lookup table is required but not specified as input parameter, alexpose.exe uses definitions of environment variables AL_PICT_LUT_FILE, AL_SGI_LUT_FILE, AL_TIFF_LUT_FILE, AL_DPX_LUT_FILE, according to the file format of the given image file. |
| | [<input lut> <output lut>] | optional filenames, to specify the lookup tables for image data conversion when image processing is active. The lut files represent image data to 16 bit linear and 16 bit linear to 10 bit log space conversions. If the lookup tables are required but not specified as input parameter, the environment variable ALIP_SGI8_IN_LUT_FILE, ALIP_SGI8_OUT_LUT_FILE,…, according to the file format and bit depth of the given image, are used. |

| Return value: | | |
|---|---|---|
| | 0 | image data successfully loaded |
| | -1 | wrong command line parameter |
| | -2 | command download error, the previous image failed to expose |
| | -3 | image data download error, the previous image failed to expose |
| | -4 | recorder error, the previous image failed to expose |
| | -5 | reading image data failed |
| | -6 | unexpected image parameter |
| | -10 | daemon not running |
| | -11 | daemon not ready |
| | -12 | system error |

## 8.2.3 almakelut.exe

| | |
|---|---|
| Command: | almakelut.exe [-v] <aim file><density readings file><input lut file> <output lut file> |
| Description: | calculates a new densitometric calibration lut called <output lut file> from an <input lut file>, using the <density readings file> of a calibration wedge and the aim curves in <aim file>. |
| Arguments: | <aim file> aim density curves for the recorder<br><input lut file> calibration lut which was used to expose the calibration wedge<br><density readings file> table of densities vs. code values of the calibration wedge<br><output lut file> new calibration lut, result of almakelut |
| Options: | -v verbose mode |
| Return value: | 0 lut was successfully created<br><0 error |

## 8.2.4 alsetgeometry.exe

| | |
|---|---|
| Command: | alsetgeometry.exe <film format> [<format definition file>] |
| Description: | checks the existence of the format definition file and looks for an entry of the specified film format. It reads and verifies the geometry parameters, sets up the values on the ARRILASER film recorder. |
| Arguments: | <film format> film format name listed in the format definition file<br><format definition file> optional input parameter to specify a format definition file. The default is set by the environment variable AL_FILM_FORMAT_FILE. |
| Return value: | 0 successful geometry setting<br>-1 wrong command line parameter<br>-2 command download error, parameter set up failed or parameter set up not started because the last image failed to expose.<br>-3 parameter set up not started, daemon signals image data download error, the last image failed to expose<br>-4 geometry parameter set up not started, daemon signals recorder error, the last image failed to expose<br>-8 geometry parameter out of range<br>-10 daemon not running<br>-11 daemon not ready<br>-12 system error |

## 8.2.5 alsetlut.exe

| | |
|---|---|
| Command: | alsetlut.exe -m <redMaxExp> <greenMaxExp> <blueMaxExp><br>alsetlut .exe -l <calibration lut> |
| Description: | sets densitometric calibration parameters on the ARRILASER film recorder.<br>The '-m' option defines the maximum exposure values.<br>The '-l' option specifies the calibration lookup table. |
| Arguments: | <redMaxExp> maximum exposure value for red [mWs/m$^2$]<br><greenMaxExp> maximum exposure value for green [mWs/m$^2$]<br><blueMaxExp> maximum exposure value for blue [mWs/m$^2$]<br><calibration lut> lut filename<br>See *chapter 6.2* Recorder Calibration |
| Return value: | 0 parameters successfully set<br>-1 wrong command line parameter<br>-2 command download error,<br>parameter set up failed or parameter set up not started because the last image failed to expose.<br>-3 parameter set up not started,<br>daemon signals image data download error, the last image failed to expose<br>-4 parameter set up not started,<br>daemon signals recorder error, the last image failed to expose<br>-8 error reading the lookup table<br>-10 daemon not running<br>-11 daemon not ready<br>-12 system error |

### 8.2.6 alsetstatus.exe

| | | |
|---|---|---|
| Command: | alsetstatus.exe <status > | |
| Description: | set status values | |
| Arguments: | <daemonstate 0> | resets the daemon error state to IDLE. |
| | <reseterror> | resets the carmille, recommended after abnormal command terminations |
| | <framecount nr> | sets the framecount to nr |
| | <autored 0/1> | turn the film recorder's scaling of the calibration lut off/on |
| | <autogreen 0/1> | " |
| | <autoblue 0/1> | " |
| | <expcheck 0/1> | for service purposes only the parameter affect the film recorder |
| | autocalibration mode | |
| | <expsave 0/1> | " |
| | <attcheck 0/1> | " |
| | <colcheck 0/1> | " |
| | <scannercheck 0/1> " | |
| | <offsetcheck 0/1> " | |

Reference

| | | |
|---|---|---|
| Return value: | 0 | command was successful |
| | -1 | wrong command line parameter or parameter out of range |
| | -2 | command download error,<br>parameter set up failed or parameter set up not started because the last image failed to expose. |
| | -3 | parameter set up not started, daemon signals image data download error, the last image failed to expose |
| | -4 | calibration parameter set up failed,<br>daemon signals recorder error, the last image failed to expose |
| | -10 | daemon not running |
| | -11 | daemon not ready |
| | -12 | system error |

## 8.2.7 alstatus.exe

| | | |
|---|---|---|
| Command: alstatus.exe <status variable> | | |
| Description: print current system status values to 'stdout'. | | |
| Arguments:<br><status variable> | Description | Output (stdout) |
| -h | returns a short help | list of all arguments |
| pitch | scaled pixel size | pitch in [1/100 microns] |
| pulldown | inter-frame positioning on the film | pulldown [microns] |
| xsize | image width | xsize [pixels] |
| ysize | image height | ysize [pixels] |
| xoffset | x-offset of image | number of pixels<br>within the image window, |
| yoffset | y-offset of image within the image window | number of lines |
| xorigin | x coordinate of upper left corner of image, | xorigin [microns] |

| Arguments:<br><status variable> | Description | Output (stdout) |
|---|---|---|
| yorigin | y coordinate of upper left corner of image, | yorigins [microns] |
| geometry | currently set geometry format name,<br>see also geometry data base | name |
| daemonstate | state of the aldaemon | 0: idle<br>1: recording<br>2: executing a command<br>-2: command download error<br>-3: image download error<br>-4: recorder error<br>-12: system error |
| recstate | ARRILASER film recorder state<br>returned by the internal control computer | 0: idle,<br><0: number of errors<br>>0: position of the filmstage |
| recerror <n> | prints the recorder error <n> | find a complete error list in:<br><*chapter 8.2.16* Recorder Messages> |
| redmaxexp | maximum exposure value for red | redmaxexp [mWs/m$^2$] |
| greenmaxexp | maximum exposure value for green | greenmaxexp [mWs/m$^2$] |

| Arguments: <status variable> | Description | Output (stdout) |
|---|---|---|
| bluemaxexp | maximum exposure value for blue | bluemaxexp [mWs/m$^2$] |
| redmeasexp | measured exposure value for red | redmeasexp [mWs/m$^2$] |
| greenmeasexp | measured exposure value for green | greenmeasexp [mWs/m$^2$] |
| bluemeasexp | measured exposure value for blue | bluemeasexp [mWs/m$^2$] |
| redscaledexp | LUT-scaled max. exposure for red | redscaledexp [mWs/m$^2$] |
| greenscaledexp | LUT-scaled max. exposure for green | greenscaledexp [mWs/m$^2$] |
| bluescaledexp | LUT-scaled max. exposure for blue | bluescaledexp [mWs/m$^2$] |
| lut | currently loaded LUT file name | name |
| redatt | attenuator position for red | integer between 750 and 7500 |
| greenatt | attenuator position for green | integer between 750 and 7500 |
| blueatt | attenuator position for blue | integer between 750 and 7500 |
| imagecount | total number of exposed frames (not including autofeed and winding) | integer |

| Arguments:<br><status variable> | Description | Output (stdout) |
|---|---|---|
| framecount | number of frames<br>incl. autofeed and winding ,<br>can be set by user | integer |
| perfcount | number of perfs<br>incl. autofeed and winding | |
| pcver | software version of carmille | number |
| muecver | software version of the microcontroller | number |
| densfiltstate | position of additional filter<br>for camera negative recording | 0: filter out<br>1: filter in<br>2: filter moving<br>3: not implemented |

| | | |
|---|---|---|
| Return value: | 0 | the status was written to stdout |
| | -1 | wrong command line parameter |
| | -2 | command download error,<br>status request failed, or status request not started because the last image failed to expose |
| | -3 | status request not started,<br>daemon signals image data download error, the last image failed to expose |
| | -4 | status request not started,<br>daemon signals recorder error, the last image failed to expose |
| | -10 | daemon not running |
| | -11 | daemon not ready |
| | -12 | system error |

## 8.2.8 alwind.exe

| | |
|---|---|
| Command: | alwind.exe <number> |
| Description: | shuttle film |
| Arguments: | <number> number of frames to shuttle, positive value shuttle forwards, negative value shuttle backwards |
| Return value: | 0 film shuttled<br>-1 wrong command line parameter<br>-2 command download error,<br>shuttle failed or shuttle not started, because the last image failed to expose<br>-3 shuttle not started,<br>daemon signals image data download error, the last image failed to expose<br>-4 shuttle not started,<br>daemon signals recorder error, the last image failed to expose<br>-10 daemon not running<br>-11 daemon not ready<br>-12 system error |

## 8.2.9 atimginfo.exe

| | |
|---|---|
| Command: | atimginfo.exe <image> |
| Description: | print image format type and image size to standard out.<br>format type could be i.e.:<br>fido10, sgi8, sgi12, sgi16, dpx8, tiff8, tiff16, pict8, unknown<br>The image size is given in numbers of pixels in width and height.<br>*See also 10.1* <Supported File Formats> |
| Arguments: | <image> full filename |
| Return value: | 0 image file format supported<br>-1 error reading file header or unsupported image format |

C-shell example:

```
% atimginfo c:\images\aqua\0001
fido10 4096 3112
```

Reference

## 8.2.10 atchangefidoorientation.exe

| | |
|---|---|
| Command: | atchangefidoorientation.exe <image> <option> |
| Description: | rewrite the image orientation flag of a cineon file header |
| Arguments: | <image> full cineon filename<br><option> according to option, image orientation will be interpreted by the alexpose command as: |

| *option* | *line scan direction* | *page scan direction* |
|---|---|---|
| 0 | left to right | top to bottom |
| 1 | left to right | bottom to top |
| 2 | right to left | top to bottom |
| 3 | right to left | bottom to top |
| 4 | top to bottom | left to right |
| 5 | top to bottom | right to left |
| 6 | bottom to top | left to right |
| 7 | bottom to top | right to left |

| | | |
|---|---|---|
| Return value: | 0 | image orientation changed |
| | -1 | changing image orientation failed |

## 8.2.11 atcheckipgeo.exe

| | |
|---|---|
| Command: | atcheckipgeo.exe <ip config file> <image width> <image height> <geometry width> <geometry height> |
| Descrition : | checks whether an image of given geometry can be processed and exposed with the specified image processing configuration and recorder geometry. It is not necessary to start the image processing daemon to run the command. |
| Arguments: | <ip config file> : config file for image processing<br><image width>: desired image width<br><image height>: desired image height<br><geometry width>: width of recorder geometry<br><geometry height>: height of recorder geometry |
| Return value: | 0: image can be processed and exposed<br>-1: invalid command line arguments<br>-6: image cannot be processed and exposed with the given settings<br>-13: invalid config file |

## 8.2.12 atrename.exe

| | | |
|---|---|---|
| Command: | atrename.exe <old> [-s <#start> -e <#end>] <new> [-s <#start>] | |
| Description: | rename image or image sequence | |
| Arguments: | <old> | full input filename including format strings in Unix %d convention |
| | [-s <#start> -e <#end>] | start/end frame number |
| | <old> | full input filename including format strings in Unix %d convention |
| | <#start> | output start frame number |
| Return value: | 0 | image file format supported |
| | -1 | rename failed |

## 8.2.13 system variables

| *Variable* | *Description* |
|---|---|
| AL_DIR | dirctory for all clif related subdirectories |
| AL_CLIF_DIR | directory for cilf commands |
| AL_CONFIG_DIR | directory for config files |
| AL_LUT_DIR | directory for luts |
| AL_TEST_MODE | not defined or set to 0 means normal execution mode. All other values force the CLIF commands to return immediately with status 0 for successful execution |
| AL_SGI_LUT_FILE | lut filename used by alexpose.exe for the SGI to 10 bit log conversion |
| AL_DPX_LUT_FILE | lut filename used by alexpose.exe for the DPX to 10 bit log conversion |
| AL_PICT_LUT_FILE | lut filename used by alexpose.exe for the Softimage to 10 bit log conversion |
| AL_TIFF_LUT_FILE | lut filename used by alexpose.exe for the TIFF to 10 bit log conversion |
| AL_TGA_LUT_FILE | lut filename used by alexpose.exe for the Targa to 10 bit log conversion |
| AL_YUV_LUT_FILE | lut filename used by alexpose.exe for the Quantel YUV to 10 bit log conversion |

| *Variable* | *Description* |
|---|---|
| AL_HDTV_LUT_FILE | lut filename used by alexpose.exe for the 16bit YUV to 10 bit log conversionAL_YUV_ CONVERSION values 'fullrange' or 'videosafe' determine the YUV to RGB conversion |
| AL_FILM_FORMAT_FILE | geometry database filename including path |
| AL_ALSTATUS_FILE | configuration file saving actual status parameter for the daemons initialization. |
| AL_REC_MSG_FILE | configuration file setting tolerance values for recorder messages. |
| AL_DEBUG_REC_STATE | set to '1', prints every recorder message to stdout, not only every 5th status request within one exposure cycle. |
| AL_SERIAL_PORT | set to '0' means deactivate the serial port communication to the Internal Control Computer (ICC). Set to '1' activates the COM Port. |
| AL_SERIAL_PORT_NR | specify COM Port Number for communication to ICC |
| AL_LCA_FILE | IDI-firmware filename |
| AL_IDI_DLL | filename including path of the IDI driver DLL Set to '0', the daemon runs in evaluation mode without IDI driver software and IDI interface card. |
| AL_PREVIEW | not defined of set to '0' means normal execution mode. If set to one of the valid values ('1','8' or '16') causes preview images to be written before any exposure. |

| *Variable* | *Description* |
|---|---|
| AL_PREVIEW_NAME | Path and name of the preview images. |
| AL_LOGFILE_DIR | Log file directory |
| AL_CONSOLE_LOG | Not defined or set to '1' enables console output.<br>Set to '0' disables the console output. |
| AL_TIMING_LOG | when activated, measures the time between two successful exposes and writes it into the timing logfile aldaemon.log |
| AL_BEEP_EXPOSE | Activates or deactivates the beep function on each successfully recorded frame |

### 8.2.14 shootsingle.csh

| | |
|---|---|
| Command | shootsingle.csh [options] <image> <geometry> <repetition> |
| Description | standard script to shoot a single frame. The script distinguishes execution modes set by the environment variable AL_TEST_MODE.<br>AL_TEST_MODE set to 0 means normal recording mode<br>AL_TEST_MODE set to 1 checks geometry name and existence of image<br>The script control flow can be set by command line options |
| Arguments | <options><br>-t restart repetition on error<br>-s skip frame on error<br><image> name of the image file, including path<br><geometry> name of the geometry format<br><repetition> number of repetitions |

## 8.2.15 shootseq.csh

| | |
|---|---|
| Command | shootseq.csh [<options>] <folder> <geometry> <startframe> <endframe> [numberformat] |
| Description | standard script to shoot an image sequence. The script distinguish execution modes set by the environment variable AL_TEST_MODE:<br>0 normal recording mode<br>1 check geometry name, directory, and first frame<br>2 check each single frame, stop on error<br>3 check each single frame, report errors and go on testing<br>The script control flow can be set by command line options. |
| Arguments | <options><br>-r remove files after shooting<br>-w wait for files to become the final size. the first file of the sequence must exist as size reference, the files may not be compressed<br>-n to be sure that the current file is completely rendered, wait for next file.<br>-t restart sequence on error<br>-s skip frame on error<br><folder> directory of image sequence<br><geometry> geometry format name<br><startframe> number of first frame<br><endframe> number of last frame<br><numberformat> follows the Unix %d convention, default is %04d (i.e. 0001, 0002, …) |

## 8.2.16 Recorder Messages (Return values from the carmille program)

| Message ID | Description |
|---|---|
| 0 | waiting for new image or frame feed |
| 1 | waiting for regular or modified end of image exposure or end of frame (camera slider in intermediate stop) |
| 2 | waiting for camera to be 'up' |
| 3 | waiting for stage at return point (for take-up of film) |
| 4 | waiting for camera to be 'down' |
| 5 | waiting for stage to be in start position |
| 7 | autocalibration |
| 8 | recorder not ready |
| 16 | maximum illumination red out of range |
| 17 | maximum illumination green out of range |

| Message ID | Description |
|---|---|
| 18 | maximum illumination blue out of range |
| 32 | film loops not correct |
| 33 | film jam |
| 34 | camera motor overload |
| 35 | film guides not closed |
| 36 | no film |
| 38 | cover open |
| 40 | camera not ready |
| 63 | missing end of image flag |
| 64 | no pixelclock red |
| 65 | no pixelclock green |
| 66 | no pixelclock blue |

| Message ID | Description |
|---|---|
| 67 | warning, scanner speed critical |
| 68 | error, scanner speed out of range |
| 69 | error, scanner off |
| 70 | communication to muec disturbed |
| 71 | communication to muec disturbed |
| 72 | recorder offline |
| 80 | recorder laptop disk IO error |
| 82 | timeout moving collimator |
| 91 | invalid line len |
| 92 | invalid row len |
| 93 | invalid x origin |
| 94 | invalid y origin |

| Message ID | Description |
|---|---|
| 95 | invalid pitch |
| 96 | invalid pulldown |
| 97 | invalid geometry |
| 99 | geometry out of tolerance |
| 100 | geometry does not fit to hardware limits |
| 101 | no density calibration loaded |
| 102 | no linear drive profiles loaded |
| 103 | scanner frequency not measured |
| 104 | profile locked |
| 105 | ETEL not ready |
| 106 | exposure failed |
| 127 | unknown recorder error |

## 8.2.17 Return Values

| Value | Meaning | Notes |
|---|---|---|
| 0 | command was successful | |
| -1 | wrong command line parameter | syntax error |
| -2 | command download error | disturbed connection between carmille and clif program for a longer period of time |
| -3 | image download error | problem on the IDI connection, result is a black or corrupted frame |
| -4 | recorder error | mechanic or electronic error, or laser power not on the right level |
| -5 | image loading error | image is corrupted or not there |
| -6 | wrong image parameter | image size does not fit to current recorder geometry |
| -8 | inconsistent data in configuration files | error in alfilmformats.cfg or error in lut file |
| -10 | daemon not running | |
| -11 | daemon not ready | wait until the daemon event queue is ready. |
| -12 | system error | |

# 8.3 Image Processing Reference

Image processing related CLIF commands follow the naming convention ‘ip*.exe’. Options available for all commands are:

| | |
|---|---|
| ‘ip* -h’ | gives a short help to standard out |
| ‘ip* -vers’ | prints the current version to standard out |

Each ‘ip*.exe’ command exits with a return status in ‘%errorlevel%’ for the windowscommand prompt level, or in the ‘$status’ variable of the C-shell environment.

The environment variable ‘AL_TEST_MODE’ set to ‘1’ forces all commands to print a test mode message to standard out and to return immediately with ‘0’ in the status variable.

## 8.3.1 ipdaemon.exe

| | |
|---|---|
| Command: | ipdaemon.exe <command> |
| Description: | starts or stops the image processing daemon process called ipdaemond.exe. After starting, the image processing system has to be configured with the ipfcg.exe command. |
| Arguments: | <command> start/stop |
| Return value: | 0 daemon started/stopped, or daemon already running/stopped<br>–1 wrong command line parameter<br>–10 aldaemon not running<br>–11 daemon failed to start/stop<br>–12 system error |

## 8.3.2 ipcfg.exe

| | |
|---|---|
| Command: | ipcfg.exe <configfile> or -show |
| Description: | configures the image processing system according to the given configuration file. |
| Arguments: | <configfile> configuration file to be used<br>-show lists the current configuration of the image processing system. The output is a valid configuration file, which also lists the values of all node parameter set to there default values. |
| Return value: | 0 command was successful<br>-1 wrong command line parameter or parameter out of range<br>-10 daemon not running<br>-11 daemon not ready<br>-12 system error |

## 8.3.3 iplutconvert.exe

| | | |
|---|---|---|
| Command: | iplutconvert.exe <conversion lut> <path to ipluts > | |
| Description: | convert an existing conversion lut to an input and output lut pair for image processing | |
| Arguments: | <conversion lut> | conversion lut to be converted |
| | <path to ipluts> | path to the folder, where the resulting input and output lut is saved |
| Return value: | 0 | command was successful |
| | -1 | wrong command line parameter or parameter out of range |
| | -12 | system error |

## 8.3.4 ipmakelut.exe

| | | |
|---|---|---|
| Command: | ipmakelut.exe -CV\|-L -gamma <gamma> -val0 <L0> <CV0> -val1 <L1> <CV1> -range <Rmin> <Rmax> -out <filename> | |
| Description: | generates a conversion lut in ASCII format readable for the ARRILASER | |
| Arguments: | -CV | table cineon code values |
| | -L | table linear values |
| | -val0,1 | specify two (Linear,CodeValue) pairs |
| | -range | table values from Rmin to Rmax |
| | -out | output file |
| | -clip | clip input values to given range |
| | -clipval | clip output values to given range |
| Return value: | 0 | command was successful |
| | -1 | wrong command line parameter or parameter out of range |
| | -12 | system error 8.3.5 system variables |
| Variable | Description | |
| AL_IPCFG_DIR | directory for image processing configuration files | |

| *Variable* | *Description* |
|---|---|
| AL_IPLUT_DIR | directory for image processing inout and outout luts |
| ALIP_SOFTCLIP_FILE | path of the file containing the softclip configurations |
| AL_ICC_DIR | directory for icc profiles for CMS |
| ALIP_THREADS | defines priorities between ALICE and image processing functions during recording |
| ALIP_KERNEL_FILE | path of the file containing the convolution kernels |
| ALIP_TIFF8_IN_LUT_FILE | input LUT filename used for 8 bit TIFF images |
| ALIP_TIFF8_OUT_LUT_FILE | output LUT filename used for 8 bit TIFF images |
| ALIP_TIFF12_IN_LUT_FILE | input LUT filename used for 12 bit TIFF images |
| ALIP_TIFF12_OUT_LUT_FILE | output LUT filename used for 12 bit TIFF images |
| ALIP_TIFF16_IN_LUT_FILE | input LUT filename used for 16 bit TIFF images |
| ALIP_TIFF16_OUT_LUT_FILE | output LUT filename used for 16 bit TIFF images |
| ALIP_SGI8_IN_LUT_FILE | input LUT filename used for 8 bit SGI images |
| ALIP_SGI8_OUT_LUT_FILE | output LUT filename used for 8 bit SGI images |

| *Variable* | *Description* |
|---|---|
| ALIP_SGI12_IN_LUT_FILE | input LUT filename used for 12 bit SGI images |
| ALIP_SGI12_OUT_LUT_FILE | output LUT filename used for 12 bit SGI images |
| ALIP_SGI16_IN_LUT_FILE | input LUT filename used for 16 bit SGI images |
| ALIP_SGI16_OUT_LUT_FILE | output LUT filename used for 16 bit SGI images |
| ALIP_PICT8_IN_LUT_FILE | input LUT filename used for 8 bit PICT images |
| ALIP_PICT8_OUT_LUT_FILE | output LUT filename used for 8 bit PICT images |
| ALIP_DPX8_IN_LUT_FILE | input LUT filename used for 8 bit DPX images |
| ALIP_DPX8_OUT_LUT_FILE | output LUT filename used for 8 bit DPX images |
| ALIP_DPX10_IN_LUT_FILE | input LUT filename used for 10 bit DPX images |
| ALIP_DPX10_OUT_LUT_FILE | output LUT filename used for 10 bit DPX images |
| ALIP_DPX16_IN_LUT_FILE | input LUT filename used for 16 bit DPX images |
| ALIP_DPX16_OUT_LUT_FILE | output LUT filename used for 16 bit DPX images |
| ALIP_TGA8_IN_LUT_FILE | input LUT filename used for 8 bit Targe images |

| *Variable* | *Description* |
| --- | --- |
| ALIP_TGA8_OUT_LUT_FILE | output LUT filename used for 8 bit Targa images |
| ALIP_YUV8_IN_LUT_FILE | input LUT filename used for Quantel YUV images |
| ALIP_YUV8_OUT_LUT_FILE | output LUT filename used for Quantel YUV images |
| ALIP_HDTV16_IN_LUT_FILE | input LUT filename used for 16 bit YUV images |
| ALIP_HDTV16_OUT_LUT_FILE | output LUT filename used for 16 bit YUV images |
| ALIP_FIDO_IN_LUT_FILE | input LUT filename used for CINEON images |
| ALIP_FIDO_OUT_LUT_FILE | output LUT filename used for CINEON images |

## 8.3.6 LUT's provided with the software

Input and Output LUTs suitable for the image processing system are part of the software distribution. They are located in 'c:\al\ipconfig\ipluts'.

In the ALGUI those luts are not used, but a temporary lut pair is always generated from the chosen conversion lut, using the 'iplutconvert' command.

| LUT pair | | description |
|---|---|---|
| cms08_in.lut | cms08_out.lut | corresponds to the loader cms08.lut |
| cms10_in.lut | cms10_out.lut | corresponds to the loader LUTcms10.lut |
| cms16_in.lut | cms16_out.lut | corresponds to the loader cms16.lut |
| video_in.lut | video_out.lut | corresponds to the loader LUT video.lut |
| videogamma_8bit_in.lut | videogamma_8bit_in.lut | suitable to process 8 bit images with the same gamma as video images |
| videogamma_12bit_in.lut | videogamma_12bit_in.lut | suitable to process 12 bit images with the same gamma as video images |
| videogamma_16bit_in.lut | videogamma_16bit_in.lut | suitable to process 16 bit images with the same gamma as video images |
| fido_in.lut | fido_out.lut | LUT for processing Cineon images in log-space |

## 8.3.7 shootseqip.csh

| | |
|---|---|
| Command | shootseq.csh [<options>] <folder> <geometry> <startframe><br><endframe> <numberformat> <ipconfigfile> |
| Description | standard script to shoot an image sequence. The script distinguish execution modes set by the environment variable AL_TEST_MODE:<br>0 normal recording mode<br>1 check geometry name, directory, and first frame<br>2 check each single frame, stop on error<br>3 check each single frame, report errors and go on testing<br>The script control flow can be set by command line options. |
| Arguments | <options><br>-r remove files after shooting<br>-w wait for files to become the final size.<br>the first file of the sequence must exist as size reference, the files may not be compressed<br>-n to be sure that the current file is completely rendered, wait for next file.<br>-t restart sequence on error<br>-s skip frame on error<br><folder> directory of image sequence<br><geometry> geometry format name<br><startframe> number of first frame<br><endframe> number of last frame<br><numberformat> follows the Unix %d convention, default is %04d (i.e. 0001, 0002, ...)<br><ipconfigfile> image processing configuration file |

## 8.3.8 shootsingleip.csh

| | |
|---|---|
| Command | shootsingle.csh [<options>] <image> <geometry> <repetition> <ipconfigfile> |
| Description | standard script to shoot a single frame. The script distinguish execution modes set by the environment variable AL_TEST_MODE:<br>0 normal recording mode<br>1 check geometry name and existence of the image<br>The script control flow can be set by command line options. |
| Arguments | <options><br>-t restart sequence on error<br>-s skip frame on error<br><image> name of the image file<br><geometry> geometry format name<br><repetition> number of repetitions<br><ipconfigfile> image processing configuration file |

## 8.3.9 Processing speed

This section gives an impression of the computation time needed for the various nodes. Note that processing times may vary in a multitasking and multiprocessor environment, and cannot be guaranteed. Before running a time critical job, it is strongly recommended to run a test job to determine the processing time actually needed.

**Computation time in seconds for basic operations**

| | | video 720 x 576 | 1k 1024 x 778 | HDTV 1920 x 1080 | 2k 2048 x 1556 | 4k 4096 x 3112 |
|---|---|---|---|---|---|---|
| crop to given size | | 0.03 | 0.07 | 0.15 | 0.18 | 0.7 |
| flip | X | 0.03 | 0.04 | 0.1 | 0.15 | 0.6 |
| | Y | 0.03 | 0.04 | 0.1 | 0.15 | 0.6 |
| | XY | 0.03 | 0.04 | 0.1 | 0.18 | 0.7 |
| conv | 3x3 kernel | 0.09 | 0.15 | 0.3 | 0.6 | 2.4 |
| | 5x5 kernel | 0.2 | 0.3 | 0.65 | 1.3 | 5.3 |
| | 7x7 kernel | 0.35 | 0.6 | 1.5 | 2.3 | 9.8 |
| conversion to cineon | | 0.03 | 0.05 | 0.13 | 0.17 | 0.7 |

| | | video -> HDTV | video -> 2k | HDTV->2k | HDTV->4k | 2k->4k |
|---|---|---|---|---|---|---|
| scale | replicate | 0.13 | 0.15 | 0.25 | 0.7 | 0.7 |
| | linear | 0.15 | 0.2 | 0.28 | 0.8 | 0.85 |
| | cubic | 0.3 | 0.45 | 0.7 | 1.6 | 1.9 |

# 9 Library Disclaimer

The TIFF loader uses free libraries provided by third party organizations.

There availability is gratefully acknowledged. The libraries are in detail:

1. libtiff by Sam Leffler / SGI
Copyright (c) 1988-1997 Sam Leffler
Copyright (c) 1991-1997 Silicon Graphics, Inc.

Permission to use, copy, modify, distribute, and sell this software and its documentation for any purpose is hereby granted without fee, provided that (I) the above copyright notices and this permission notice appear in all copies of the software and related documentation, and (II) the names of Sam Leffler and Silicon Graphics may not be used in any advertising or publicity relating to the software without the specific, prior written permission of Sam Leffler and Silicon Graphics.
ftp://ftp.sgi.com/graphics/tiff/

2. zlib by Jean-loup Gailly and Mark Adler
© 1995-1998 Jean-loup Gailly and Mark Adler
http://www.cdrom.com/pub/infozip/zlib/

3. libjpeg by T. G. Lane / Independent JPEG Group
© 1991-1998, Thomas G. Lane.
ftp://ftp.uu.net/graphics/jpeg/

# 10 Technical Data

## 10.1 Supported File Formats

Image file formats, currently supported by the CLIF software engine are:

- Cineon 10 bit log, interpreting the orientation flag
- TGA
- Softimage 8 bit
- SGI 8,12,16 bit, raw and run length coded
- DPX 8, 10 and 16 bit
- TIFF 8,16 bit
- YUV (16bit)
- Abekas YUV Format 8bit (NTSC and PAL)

You can validate the file format of a current image file with the command executable atimginfo.exe.
See [*chapter 8.2.9 atimginfo.exe*]

Instead of an image file, the CLIF software engine also accepts image data written into shared memory as recording input. The data in shared memory has to adhere to the packed Cineon 10 bit log standard [see *chapter 7.1.6*].

# 10.2 Supported Film Stocks

## 10.2.1 ARRILASER Speed Performance or ARRILASER 2K:

- KODAK VISION Color Intermediate Film 5242 (35mm acetate).

  KODAK Vision Color Intermediate Film 2242 (35mm ESTAR)

- Fuji F-CI 8502(35mm acetate, rem-jetted)

- Fuji F-CI 4502(35mm ESTAR, rem-jetted)

- Fine Grain Duplicating Panchromatic Negative Film EK 5234/5236

- Separation Material 2238

## 10.2.2 ARRILASER HD or other ARRILASER with Camera Negative Option

- Kodak Vision 2 100  5212

- Kodak 50 D Color Negative Film 5245

- Fuji 64D 8522

- Fuji 125 8532

- B&W Camera negative material with sensitivity between 50 and 125 ASA

# 10.3 Specifications

## 10.3.1 ARRILASER Speed Performance

| | | |
|---|---|---|
| frame size | 35mm full aperture, 4 perforation<br>Optional: 3 perforation | |
| nominal spot size | 6 µm<br>12.0 µm | (4K resolution)<br>(2K resolution) |
| image format | 4096 x 3112 pixels<br>2048 x 1556 pixels<br>optional:<br>HD-module, 3-perforation,native academy module | (4K resolution)<br>(2K resolution) |
| dynamic range | 2.046 status M density above Dmin on EXR 5242 | |
| MTF | 40% @ 40 lp/mm horizontal and vertical | |
| recording time | < 1.7 sec/frame in 1.85:1 2K<br>< 2.2 sec/frame in 2K fullap<br>< 2.9 sec/frame in 1.85:1 4K<br>< 3.8 sec/frame in 4K fullap | |
| film transport | 1000 foot and 2000 foot magazines,<br>supply and take-up separate | |

| | | |
|---|---|---|
| shuttle mode | 10 frames per second | |
| host computer | Windows XP platform | |
| network interface | Gigabit Ethernet, others upon request | |
| physical dimensions | size<br>weight | 115 x 115 x 65 cm<br>approx. 285 kg |
| electrical requirements | operating voltage<br>power consumption<br>frequency | 100-120 V / 200 - 240 V<br>< 800 W incl. host computer<br>50 Hz / 60 Hz |
| operating environment | room temperature<br>rel. humidity | 19 - 24° Celsius<br>20 – 75% non condensing |

## 10.3.2 ARRILASER 2K

| | | |
|---|---|---|
| frame size | 35mm full aperture, 4 perforation<br>Optional: 3 perforation | |
| nominal spot size | 12.0 μm | (2K resolution) |
| image format | 2048 x 1556 pixels<br>optional: HD-module, native academy module | (2K resolution) |
| dynamic range | 2.046 status M density above Dmin on EXR 5242 | |
| MTF | 40% @ 40 lp/mm horizontal and vertical | |
| recording time | < 1.7 sec/frame in 1.85:1 2K<br>< 2.2 sec/frame in 2K fullap | |
| film transport | 1000 foot and 2000 foot magazines,<br>supply and take-up separate | |
| shuttle mode | 10 frames per second | |
| host computer | Windows XP platform | |
| network interface | Gigabit Ethernet, others upon request | |

| | | |
|---|---|---|
| physical dimensions | size | 115 x 115 x 65 cm |
| | weight | approx. 285 kg |
| electrical requirements | operating voltage | 100-120 V / 200 - 240 V |
| | power consumption | < 800 W incl. host computer |
| | frequency | 50 Hz / 60 Hz |
| operating environment | room temperature | 19 - 24° Celsius |
| | rel. humidity | 20 – 75% non condensing |

## 10.3.2 ARRILASER HD

| | | |
|---|---|---|
| frame size | 35mm full aperture, 4 perforation<br>Optional: 3 perforation | |
| nominal spot size | 11.47 µm (HD resolution)<br>12.0 µm (2K resolution) | |
| image format | 1920 x 1683 pixels | (HD resolution) |
| | 2048 x 1556 | (2K resolution) |
| | optional: native academy module | |
| dynamic range | r=1.20;g=1.35;b=1.55 status M density above $D_{min}$<br>on Kodak Vision 2 100 | |
| MTF | 40% @ 40 lp/mm horizontal and vertical | |
| recording time | < 1.9 sec/frame in 1.77:1<br>< 2.2 sec/frame in 2K fullap | |
| film transport | 1000 foot magazines, supply and take-up separate | |
| shuttle mode | 10 frames per second | |
| host computer | Windows XP platform built in ARRILASER housing | |
| network interface | Gigabit Ethernet, others upon request | |

| | | |
|---|---|---|
| physical dimensions | size | 115 x 115 x 65 cm |
| | weight | approx. 285 kg |
| electrical requirements | operating voltage | 100-120 V / 200 - 240 V |
| | power consumption | < 800 W incl. host computer |
| | frequency | 50 Hz / 60 Hz |
| operating environment | room temperature | 19 - 24° Celsius |
| | rel. humidity | 20 – 75% non condensing |

# 10.4 Host Computer Configuration

Front end to the ARRILASER film recorder is a standard windows system called host computer. Based on the CLIF software engine, the host provides a user interface to the film recorder. Images to be recorded are 'served' by the file system to the CLIF software engine either through a network connection or from local sources on board the host computer: hard drive or CD. The host guarantees high speed transfer of image data to the film recorder hardware. To control the film recording cycle, the host is connected to the Internal Control Computer (ICC) of the ARRILASER film recorder through a serial interface.

On the ARRILASER HD the host computer is built in the ARRILASER housing and the software of the ICC is running on the host computer as well. The communication between the CLIF software and the Carmille software is done internally.

## 10.4.1 Hardware Configuration

**Standard Configuration**

The following table summarizes the standard configuration of the host computer shipped with the ARRILASER film recorder January 2005. According to fast changes in the computer market, newer models are tested and supported continuosly. For the most actual tested configuration, please contact your technical support.

| | |
|---|---|
| Case | 19″ Housing 4HE |
| Power Supply | 110 and 230 V 460 W |
| Processor | Intel Xeon PIV, Hyperthreading |
| Memory | 1024 Mbytes registered SDRAM ECC |
| Mainboard | Supermicro SUPER X5DA8 Dual XEON |
| Storage | 36 GB UW 146Z10 IBM Ultrastar<br>DVD-ROM LiteOn 16x / 48x |
| Storage Controller | Adaptec SCSI<br>on-board controller |
| Network Controller | Fast EthernetRJ-45 on-board<br>10/100/1000 Mbit (autodetect) |
| Graphics | ASUS V8170/T Geforce 4, 64MB DDR |
| Operating System | Microsoft® Windows XP Prof DSP, U.S. version, |

## 10.4.2 Software Configuration

**Standard**

- Windows XP (U.S. english) , ServicePack ???
- Hummingbird Network File System (NFS)

Note: To access NFS shares on SGI workstations running IRIX, make sure that pcnfs daemon is installed and running on the SGI. It is not installed by default on these systems.

- Hamilton C-shell

Note: Information about the Hamilton C shell plus the complete "Hamilton C-shell User's Guide" can be found on the web at www.hamiltonlabs.com.

- CLIF Version 3.7.1.20 (Command Line Interface) including image processing
- GUI (Graphical User Interface) V 3.49
- Optional: ALICE V 1.1
- Optional: CMS profiles and CMM
- API (Application Programming Interface)
- Carmille V 2201 for ARRILASER Speed Performance and ARRILASER 2K
- Carmille V 2800 for ARRILASER HD

### 10.4.2.1 CLIF Distribution

The following directory and file configuration is installed on the host computer when the ARRILASER is shipped.

```
clif\
  ALApi.dll
  aldaemon.exe
  aldaemond.exe
  alexec.dll
  alexpose.exe
  AliceBrowser.exe
  allaunch.exe
  almakelut.exe
  alsetgeometry.exe
  alsetlut.exe
  alsetstatus.exe
  alstatus.exe
  alwind.exe
  arricom.dll
  atcheckipgeo.exe
  atchfidoorientation.exe
  athdtvdiskinfo.exe
  atFido2Tiff.exe
  atimginfo.exe
  atmakeslate.exe
  atrename.exe
```

```
blat.exe
carldll.dll
  citestpattern.exe
  fsize.csh
  ipcfg.exe
  ipdeamon.exe
  ipdaemond.exe
  iplutcheck.exe
  iplutconvert.exe
  ipmakelut.exe
  LicenseDialog.exe

config\
  alfilmformats.cfg
  alfilmformats_ipmax.cfg
  alrecmsg.cfg
  alstatus.cfg
  arrilca.rbt
  video.lut
  conversion tables\
     12bit_luts.xls
     12to10log.lut
     16bit_luts.xls
     16to10bit.lut
     8bit_luts.xls
```

```
     cgi.lut
     gamma1.lut
     generic12.lut
     generic12full.lut
     generic16.lut
     linear.lut
     video.lut
ipconfig\
  iplut\*.lut
  kernels\*.cfg
  *.cfg
logs\
luts\
  carlos.aim
  dens_sample.dens

  startupexp.lut
  xls_sample.xls
queue_scripts\
  *.csh

  ARRI\
     *.csh

rec_scripts\
  *.csh
```

```
  send_lut.csh
  ARRI\
     *.csh

stdscripts\
  call_operator.csh
  create_wedge.csh
  expose_check.csh
  geometry_check.csh
  shootseq.csh
  shootsingle.csh
  shootseqip.csh
  shootsingleip.csh
```

## 10.4.2.2 GUI-Distribution

```
applet\
  algui.jar
  Arrirecslate.jar
  Arrirecslate.jpg
  Images\
     Addjob.png
     Algui.jpg
     Arri-logo.png
     Deletejo.png
     Editjob.png
     Newjob.png
     Pause.png
     Quequead.png
     Quequede.png
     Quequesa.png
     Start.png
     Stop.png
  Config\
     Cal\
     Formats\
     Jobs\
     Logs\
     Luts\
  Install\
     Alexec.dll
     Allaunch.exe
     ARRI.txt
     Atmakeslate.exe
     Blat.exe
     BlatReadme.txt
     j2re-1_4_2_05-windows-i586-p-iftw.exe
  Jobscripts\
     Default.csh
  Stdscripts\
     Alstatuscheck
     ArriControl.csh
     ArriMaster.csh
```

# 11 Technical Support

Note: If you have technical support from your local service agent, then we would like to ask you that in case of a technical problem to always contact your local service agent first.

## 11.1 Service Calls to ARRI Laserservice Munich

There will be a RMA-Number for every service call placed by you.

This especially includes:

- failures in ARRILASER software or hardware
- image analysis

## 11.1.1 Opening a Service Call

When you place a service call by phone or e-mail, you will get an RMA-number. To get an RMA-number the following information is necessary:

- the serial number of the respective ARRILASER
- a brief error description

The following information will make responding time much quicker:

- on the internal laptop/computer zip the logfiles:
  c:\program files\arri\ARRILASER\logfiles\exposuXX.dat
  and
  c:\program files\arri\ARRILASER\logfiles\cycleXX.dat
  (where XX is the day when the error occurred).

For a more detailed error analysis please also send the logfiles from a few days before and after.

- on the host PC open a C shell, type in
  `aldaemon start` and press <enter>
  and after the daemon has started, type in
  `alstatus all >> c:\al\logs\status.log`
  and press <enter>

  Now zip the logfiles
  c:\al\logs\alcycleXX.dat (where XX is the day when the error occurred)
  and
  c:\al\logs\status.log

For a more detailed error analysis please send us also the alcycleXX.dat logfiles from a few days before and after.

### 11.1.2 When a service call is open

Every phone call/e-mail regarding an open service call should mention the RMA-number.

### 11.1.3 Closing a service call

When the service call is finished, please close it. This is especially necessary if you place a service call and fix the problem on your own later. Therefore please write an e-mail with the subject: "RMA-Call 300XXX finished".

You don't have to close the call if:
- only an image analysis was made and this was o.k.
- after a parts exchange an image analysis was made and this was o.k.

### 11.1.4 Sending film for analysis purposes to Munich

If an image analysis is not related to an already opened service call an RMA-number has to be issued prior to sending the images. In any case the RMA-number has to be written on the envelope and inside on the film can. For sending film to Munich the following information is necessary:

- are the images developed or not
- what shoulded be looked at
- serial number of the ARRILASER
- Copy the c:\windows\carmille.ini-file from the internal laptop/computer and send it to us

# 11.2 Contact Details

Please contact your local ARRILASER service point or one of the following service centers:

**Europe**
Arnold & Richter Cine-Technik
TFE Laserservice /T. Altenried

Tel.: + 49 89 3809 2221
Fax: + 49 89 3809 1432
E-mail: laserservice@arri.de
Address: Türkenstraße 89, Munich 80799, Germany

**United States of America**
ARRI Inc., West Coast
Laserservice
Tel.: + 818 841 7070
Fax: + 818 848 4028
E-mail: laserservice@arri.com
Address: 600 North Victory Boulevard, CA 91502-1639

technical data are subject to change without notice

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