Advanced Thermal Solutions

DL001U-Q
ALTAIR User Manual

ALTAIR

User Manual

1. Contents

2. License Agreement

ALTAIR Version 5

ALTAIR LICENSE

The ALTAIR program is protected by copyright law and international treaties as well as by intellectual property laws and treaties. The ALTAIR program is licensed, it cannot be sold.

LICENSE AGREEMENT

You are allowed to install one (1) copy of ALTAIR on a computer.

THE MAIN RIGHTS AND LIMITATIONS

Limitations relating to reverse engineering, decompiling and disassembly.

You are not permitted to rebuild the program's logic, to decompile or disassemble it.

Component separation

The Altair program must be considered as an integrated product. Its components must not be separated for use on more than one computer.

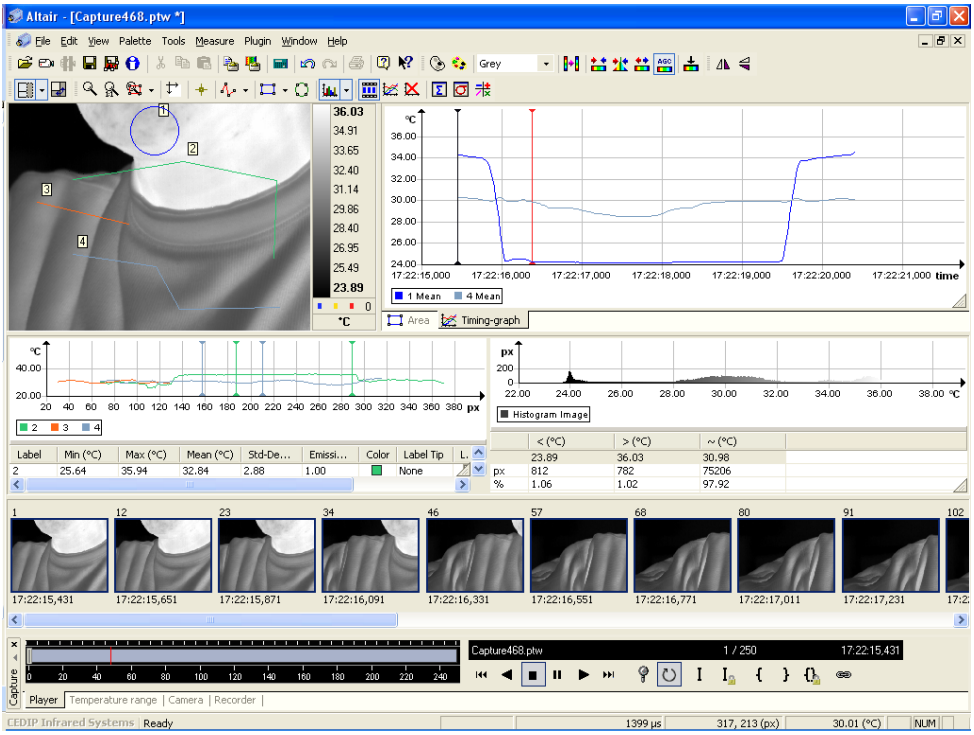
The Altair program is an integral part of the computer it is supplied with. It can only be used on this computer, except particular cases covered by agreement.

Rental

You are not allowed to rent or transfer the Altair program.

3. Altair General Presentation

Altair is a program dedicated to acquiring and processing images from FLIR SYSTEMS infrared cameras with 2D focal plane arrays. Thanks to its advanced technology, this program offers the ability to view films live and store them at a rate of 200 frames per second. In combination with other software components like Cirrus, this program can be used to manage picture taking specifications and image post-processing.



4. Using Help

Altair's help screens are provided to guide the user through the program's features. The help screens do not cover programs used in conjunction with Altair nor handling procedures. For information on these aspects, refer to FLIR SYSTEMS procedures for use.

There are two ways to access Altair:

- Using the **Help>Contents** command,
- By pressing the **<F1>** key.

You can call up the help items using one of the two methods described below:

- By clicking on  (the Help button), then on a screen element,
- By selecting the appropriate element and then pressing the **<F1>** key,
- By clicking on the Help button in a dialog box.

Balloon help

To display the name of a button or a toolbar, place the mouse pointer on the element. Balloon help will then be displayed.

5. Project Management

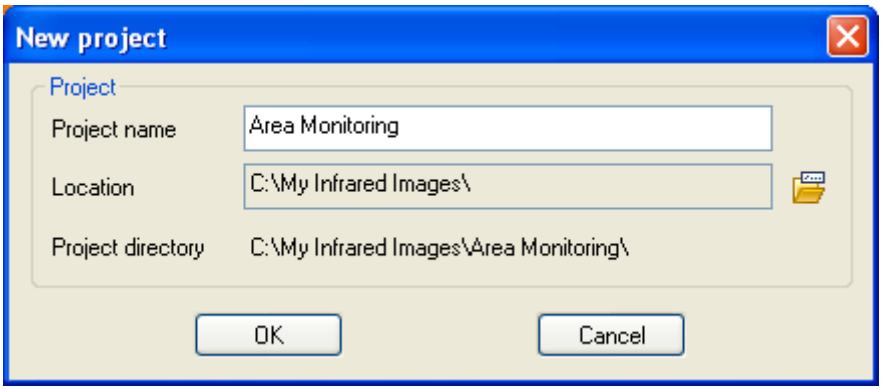
When it is first opened, Altair connects to the last project used.

When Altair is installed for the first time, it will move to the default folder created on installation.

Before acquiring any new images, you will have to create a new project directory. This operation will create the necessary folders for storing the data for your film and its related tools, thereby avoiding any mixing of files from different sources.

5.1. Creating a project

To create a project, select the **File>New project** menu. A dialog box prompts you to select the target folder and to choose a name for your project.



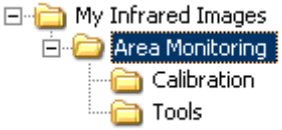
Use the  button to select or create the folder.

Enter the project name from the keyboard.

The new project's folder is created. It contains two other folders:

- "Calibration" intended to receive camera calibration files for this project, and
- "Tools" intended to receive the tools files for the project.

For example:



5.2. Opening a project

To open an existing project, select the **File>Open project** menu. A dialog box prompts you to choose the project to open.

6. Film Management

6.1. Viewing the scene as seen by the camera

To view the scene as seen by the camera, select the **File>Camera frame** menu or press [**Ctrl**] + [**L**] or click on the  button. The scene as seen by the camera will then be displayed live.

6.2. Opening a film or a image

To open a film or an image (an image is considered as a single frame film), then select the **File>Open frame** menu or press [**Ctrl**] + [**O**] or click on the  button.

6.3. Saving a film or a image

6.3.1. Saving the film with the current name

The **File>Save frame** menu (or [**CTRL**] + [**S**]) lets you update the film recording. If the film has not yet been saved, a window prompts you to specify where to save it and the name to be given to the film.

6.3.2. Saving the film under a new name

You can save your film under a new name, for example if you have made changes to it and do not wish to overwrite the original with it.

Choose the **File>Save frame as** menu (or press [**F12**]) and give your film a new name.

6.4. Playing a film

To play a film, you need to open it (refer to "Opening a film or an image ").

The play commands are available from the frame capture control panel. If the latter does not appear at the bottom of the screen, select the **View>Acquisition manager** menu.

Play the film forward. In "Pause" mode, displays the next frame. Play can also be started by pressing the [**Spacebar**] on the keyboard.

Play the film backward. In "Pause" mode, displays the previous frame.

Stop.

Pause. Click on this icon once again to resume play.

Back to the first an image in the film.

Go to the last an image in the film.

Plays film slower (up 1/8 of the original frame rate)

Plays film faster (up to 8x the original frame rate)

Opens a dialog box used to choose the frame to display.

Plays a film in a loop.

Marks the current a image as a "key frame".

Restricts play to "key frames".

Places a start of area of interest marker on the current frame.

Places an end of area of interest marker on the current frame.

Locks the player on the area of interest.

Creates a link so that the selected play criteria will be applied to all open films.

Play a sequence of images made by the best of each integration time.

7. Tool Management

7.1. Opening the tools file

The tools file can be opened by selecting the **File>Open tools** menu. The open function automatically moves to the project's "**Tools**" folder. From the tools files already saved, choose the one that you wish to apply to the frame. Tools files have a ***.tls** extensions.

7.2. Saving the tools file

7.2.1. Saving tools under the current name

You can save all of the tools created in your frame by calling up the **File>Save tools** menu. By default, the save is made to the project's "**Tools**" folder, under the same name as the current an image and with a **.tls** extension.

If you have already saved a set of tools with this an image, you will be prompted to choose a new name (refer to "**Saving the tools under a new name**").

7.2.2. Saving the tools under a new name

You should choose to save your tools set under a new name if you have already saved tools with the current an image or if you wish to choose a name other than that of the current an image for your tools. To do this, call up the **File> Save tools as** menu.

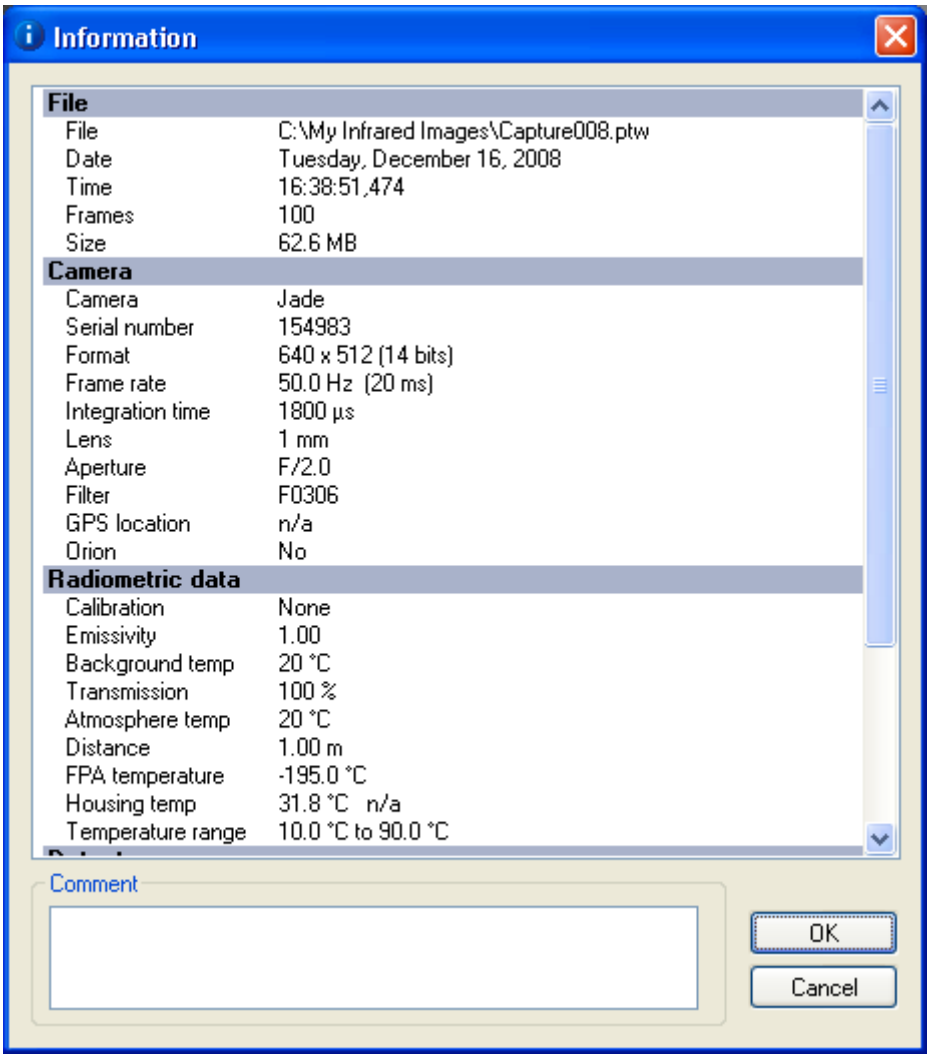
8. Viewing the General Properties of the Current Film

The properties of the current frame are stored as data that can be displayed at any time using the **File>Information** menu.

A window will then be displayed showing information on:

- Your film file (filename, date and time of acquisition, number of frames, file size)
- Your camera (camera name, serial number, frame format, frame rate, integration time, lens, aperture, filter, GPS location where applicable, orion)
- The radiometric data (calibration file address and name, emissivity, background temperature, transmission, atmospheric temperature, frame taking distance, camera housing temperature, temperature range)
- The detector (pixel size, active pixel width, cut on, cut off, NUC table number)
- Others (tool file address and name)

You can add free form comments in the data entry area at the bottom of the window.


Information
File
File C:\My Infrared Images\Capture008.ptw
Date Tuesday, December 16, 2008
Time 16:38:51,474
Frames 100
Size 62.6 MB
Camera
Camera Jade
Serial number 154983
Format 640 x 512 (14 bits)
Frame rate 50.0 Hz (20 ms)
Integration time 1800 µs
Lens 1 mm
Aperture F/2.0
Filter F0306
GPS location n/a
Orion No
Radiometric data
Calibration None
Emissivity 1.00
Background temp 20 °C
Transmission 100 %
Atmosphere temp 20 °C
Distance 1.00 m
FPA temperature -195.0 °C
Housing temp 31.8 °C n/a
Temperature range 10.0 °C to 90.0 °C
Comment
OK
Cancel

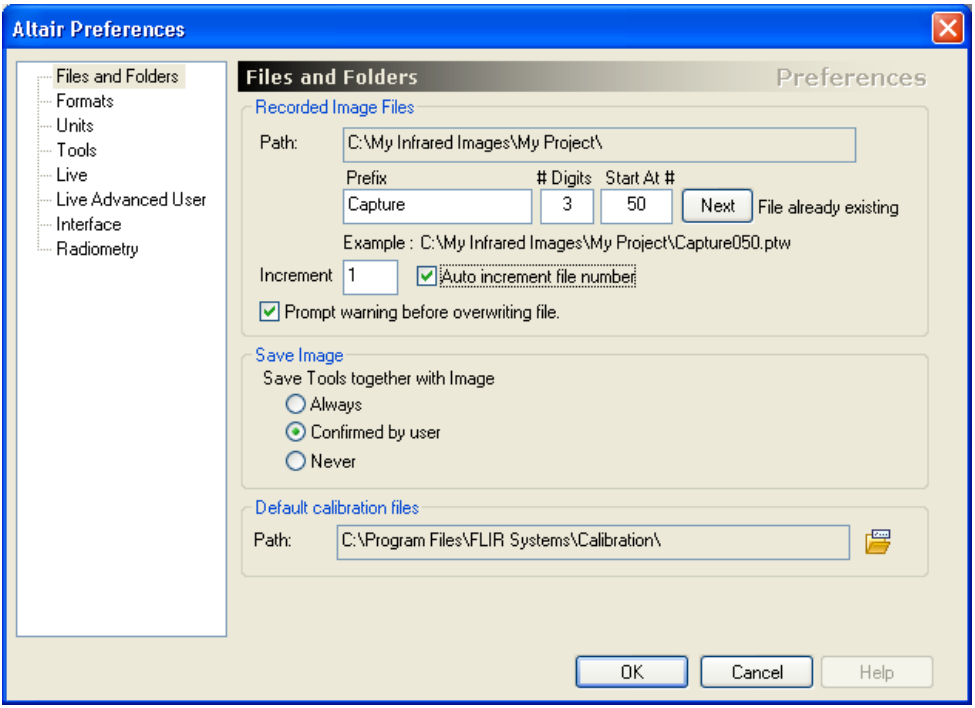
9. Displaying Altair Preferences

The **File>Preferences** menu lets you display the preferences for the current frame and change some of them.

Calling up preferences will display a window that shows data on the following items:

- Files and folders
- Formats
- Units
- Tools
- Live
- Live Advanced User
- Interface

9.1. "Files and Folders" preferences



The access path displayed is the one that you choose when you created the project. This cannot be changed from the **Preferences** menu.

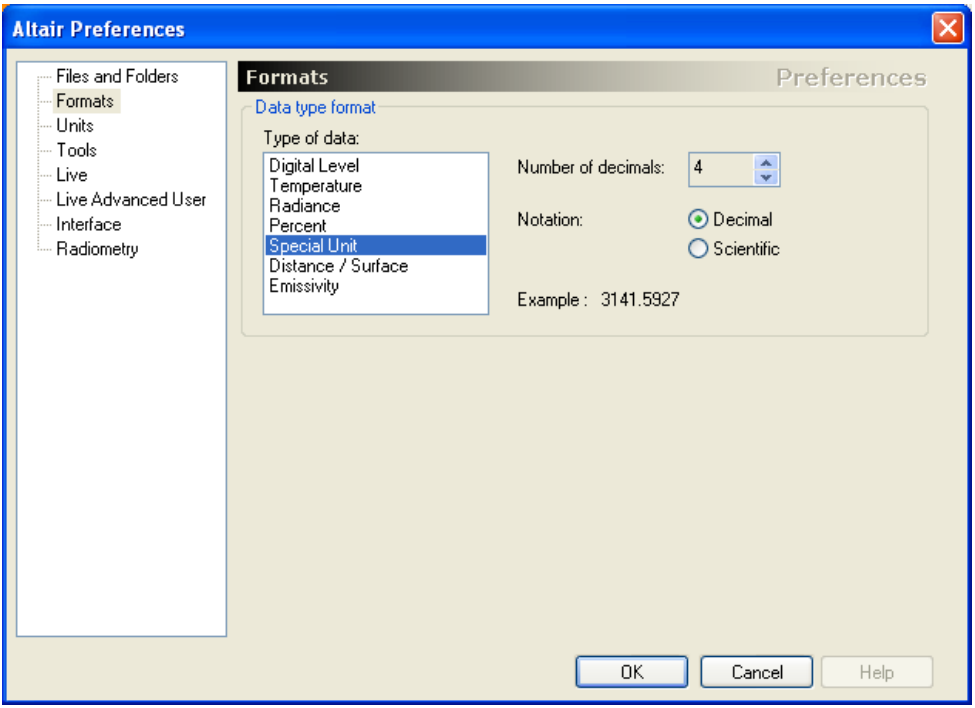
You can choose the name of your image files using three criteria:

- The prefix: chosen by the user
- The number of decimals (that will be assigned chronologically): from 1 to 6. If you choose "0", the value will be forced to "1". If you choose a number higher than "6", the value will be frozen on "6".
- Start (first frame number): from 1 to x. This choice can for example let you save your frames after files that were created during a previous session.

Tick the "Automatically increment file number" box to automatically save your frames with the next number.

If necessary, tick the "Warn before overwriting an existing file" box. This option is especially recommended if you do not choose to automatically increment the file number.

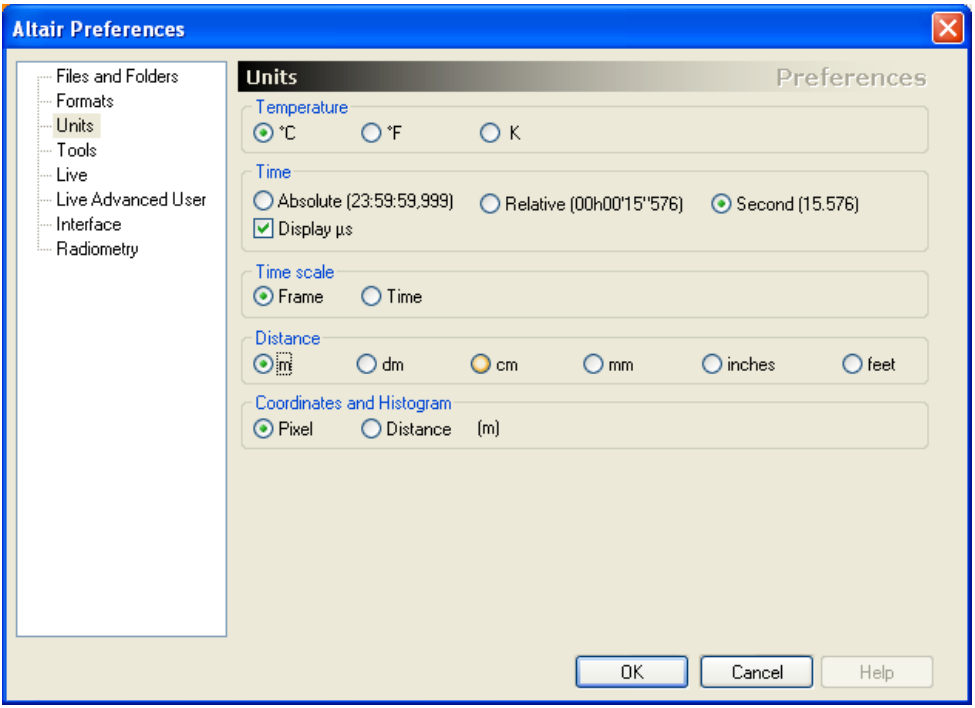
9.2. "Formats" preferences



This menu lets you choose data formats for the following units: Digital level, Temperature, Radiance, Percentage, Special unit, Distance/Surface and Emissivity

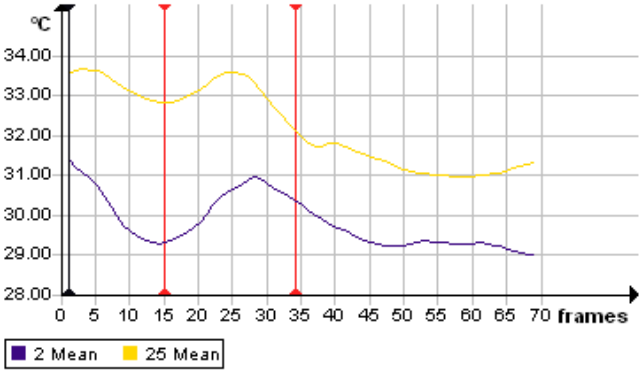
For each type of data, choose the number of decimals and the notation (decimal or scientific) to use. An example is displayed applying the chosen parameters.

9.3. "Units" preferences



This menu lets you choose the units to work with for the following data:

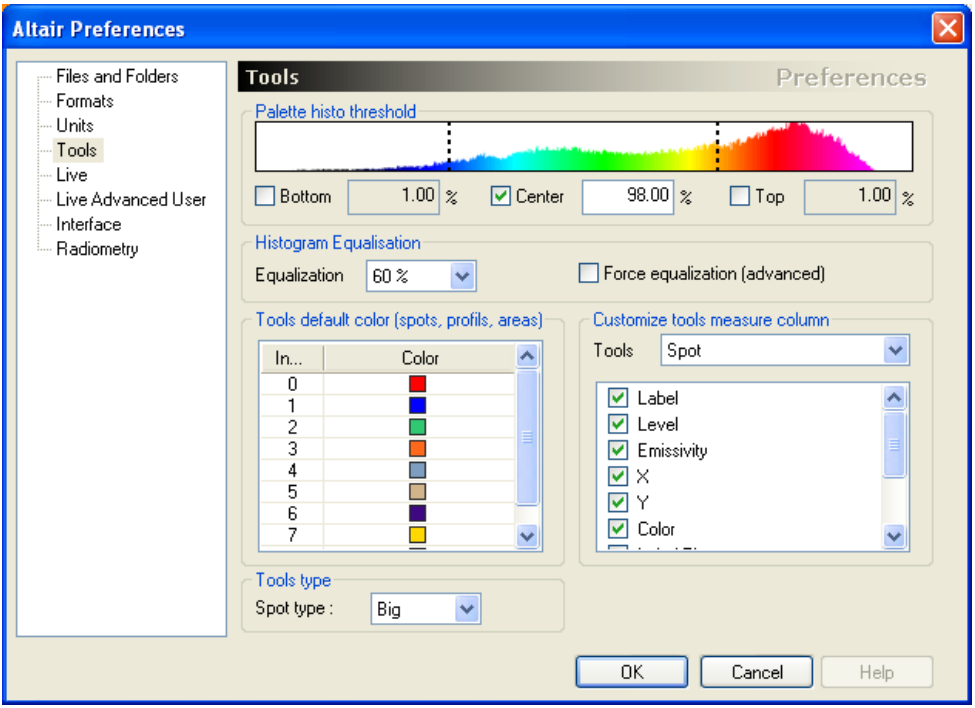
- Temperature: °C, °F, K.
- Time: Absolute. Time is measured from the start of the recording, in seconds.
  By default, the time is displayed in hundredths of a second. Tick the "Display µs" box to display three additional decimals.
- Time scale: Choose "Frame" to display the time graphs by reference to the frame number. Choose "Time" to display the time graphs by reference to elapsed time, as defined in the previous menu.



"Frame" reference

- Distance: Choose between m, dm, cm, mm, inches and feet. These units are used to display distances and surface areas if the "Coordinates and Histograms" option chosen is "Distance".
- Coordinates and Histograms: Choose "Pixel" to display distances and surface areas as a number of pixels. Choose "Distance" to display distances and surface areas in the unit chosen in the previous menu.

9.4. "Tools" preferences

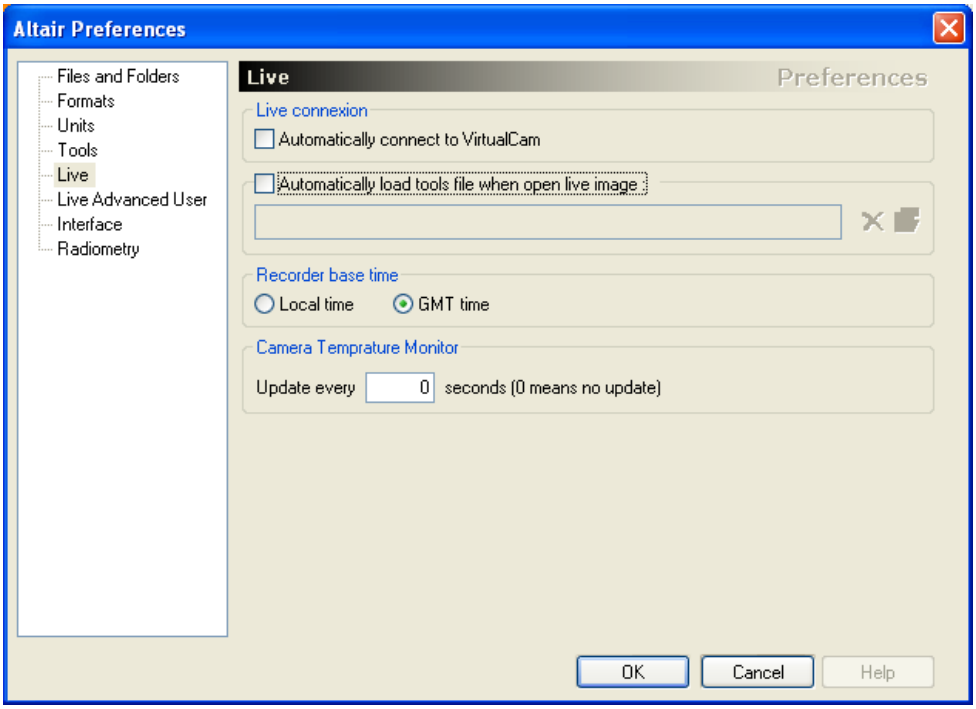


This menu lets you set:

- The palette histogram thresholds. By ticking one of the three boxes, choose whether to display pixels with a numerical value below the lower threshold, between the two thresholds or above the upper threshold. For each case, set a threshold.
  If you choose "center", the pixel value percentage retained will be centered on the entire temperature range.
- Tool colors. This menu lets you choose the colors assigned by default to the various tools and traces. Double-click on the color sample to open the palette, and then choose a color.

- Customizing the columns displayed for measurement values. For each of the tools (point, profile, area), tick the data you wish to see displayed in the measurement table.

9.5. "Live" preferences

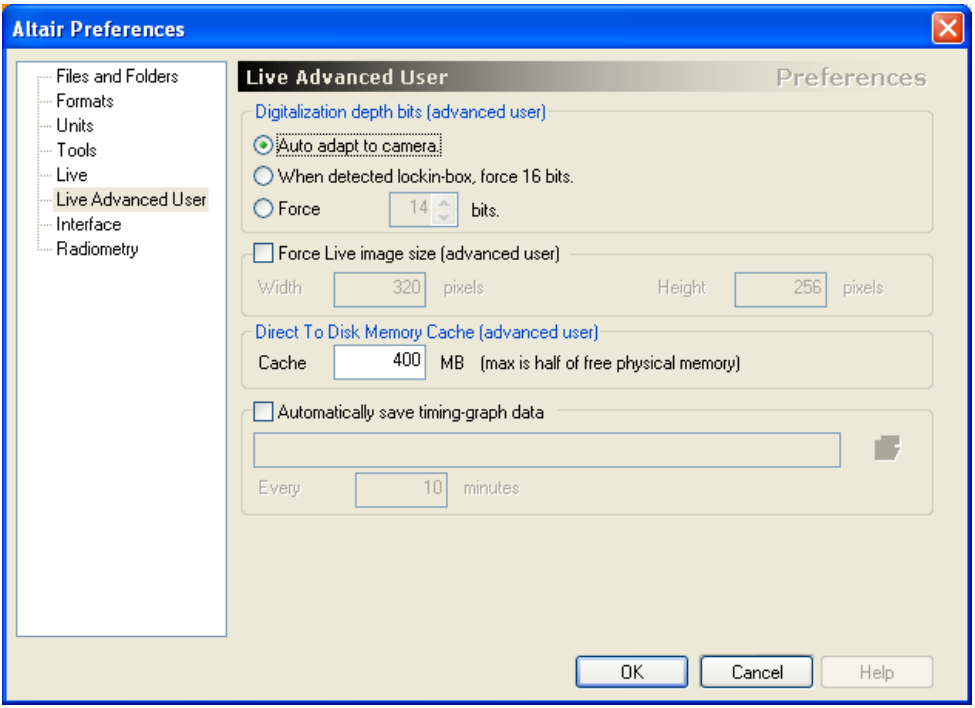


Tick the "Display the tools on the camera frame" to simultaneously open the image and the associated tools file. Then specify the access path and the name of the tools file.

Choose whether to use local time or Greenwich Mean Time (GMT).

You can choose the frequency for updating camera temperature.

9.6. "Live Advanced User" preferences



If necessary, choose whether to customize the encoding level (experienced users). By default, the "Automatic according to camera" option is ticked.

You can:

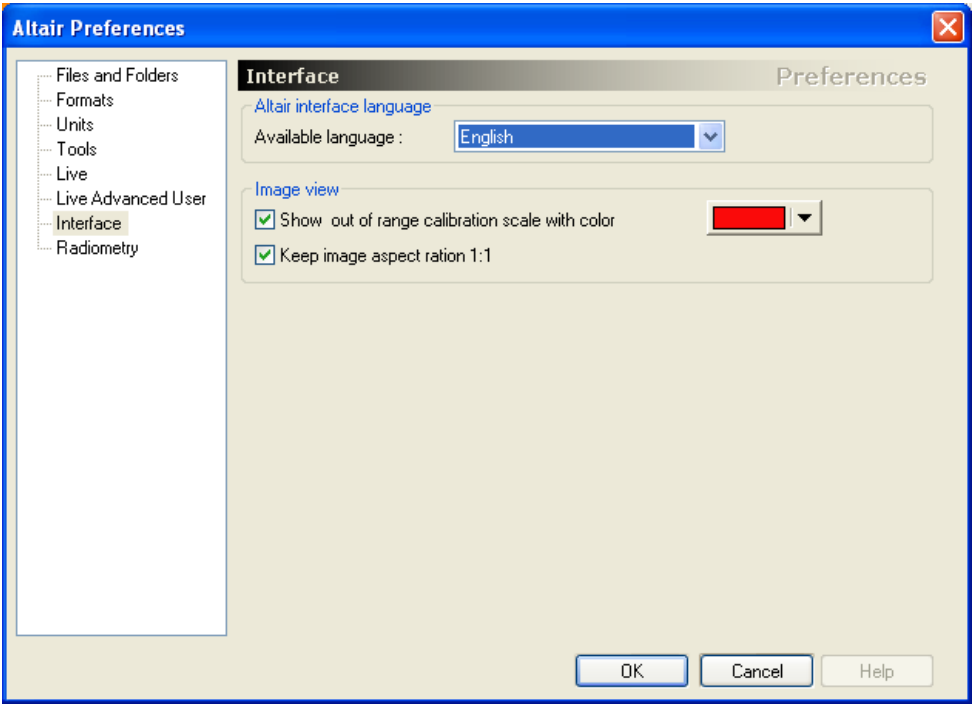
Force the image to be encoded in 16 bit format when using a demodulation box ("Lockin").

Force encoding with another value (to be chosen).

Tick the "Force camera size" box if necessary. Then enter the required size.

You can specify a cache file size when saving the frame directly to the hard disk drive. The cache size value cannot exceed half of the physical memory available.

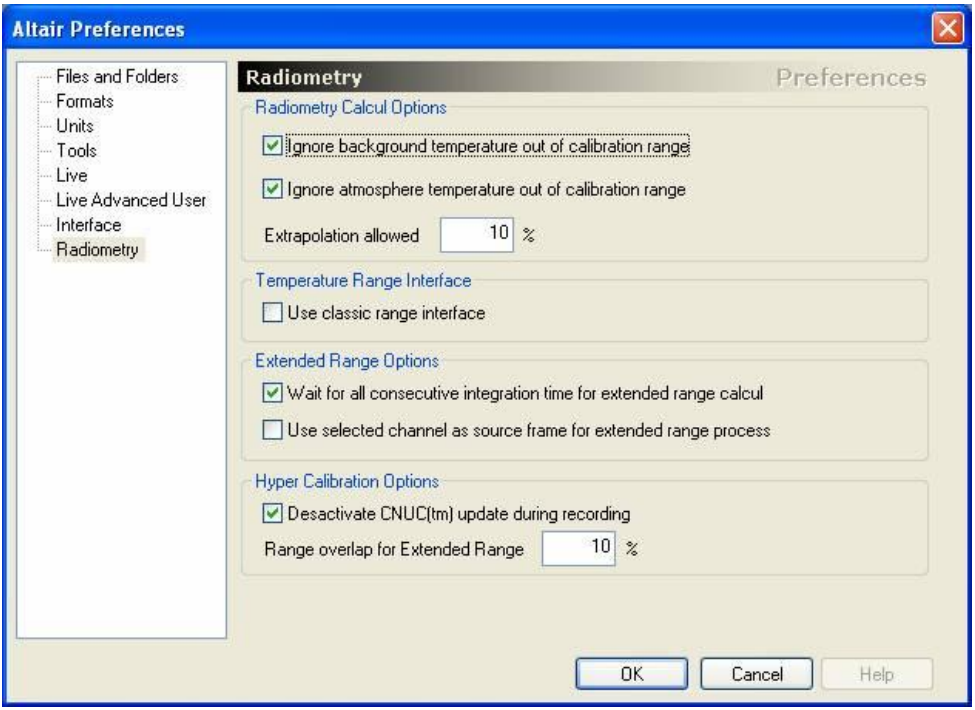
9.7. "Interface" preferences



This section let you:

- Change Altair language with an available one.
- Choose if you want to see when the scale is out of calibration range and with which color it is showed.
- Choose if you want to keep the image ratio.

9.8. "Radiometry" preferences



This section let you select radiometry calculation option:

In case of the ambient or the atmosphere temperatures are under the range, you could disregard the flux depending of these 2 types of temperature. You could adjust the threshold of extrapolation of the range of temperature.

This section let you select the temperature range interface: the new interface adapted to the hyper calibration feature or the previous interface.

This section let you select the extended range options:

It is recommended to **wait for all consecutive integration time** for the merge of images. In case of you uncross this option; the first image grabbed will be the references. This option is recommended.

The option which **use selected channel as a source frame** could allow having a priority of one range; and this range of temperature will be the range selected in the live image. This option is not recommended.

This section also let you select the hyper calibration options:

One could stop the automatic updating of the CNUC during a sequence acquisition to ensure not to drop frames. This option is recommended

The percentage of overlap is to ensure the continuity of the global range in extended range feature. 10% is recommended

10. Menus and Toolbars

Altair popup menus allow access to all of the functions available. The main functions are also accessible from the toolbars.

10.1. File menu

This menu is partially linked to the **Main** toolbar.

	New project	Creates the folders needed to save all of the project data (frames, tools, etc.)
	Open project	Opens a previously saved project
	**Camera**	Displays the scene seen by the camera (the camera must be running)
	**Freeze camera**	One click on this button freezes the image from the camera
	**Open frame**	Opens film(s) or image(s)
	**Save frame**	Saves the current image
	Save frame as	Saves the current image under a new name
	**Save all**	Saves all of the open images
	Open tools	Opens a previously saved tools file and applies it to the selected image

	**Save tools**	Saves the tools applied to the selected image
	Save tools as	Saves the tools applied to the selected image under a new name
	**Information**	Displays all of the image parameters
	Preferences	Displays Altair parameters
	Quit	Closes Altair. If changes have been made to the open files, a window prompts you to save these files.

This menu also displays the last four files opened.

10.2. Edit menu

Like the **File** menu, this menu is partially linked to the **Main** toolbar.

	**Cut**	Cuts the selected element and places it in the clipboard.
	**Copy**	Copies the selected element and places it in the clipboard.
	**Paste**	Pastes the contents of the clipboard.
	**Undo**	Undoes the last action done. If nothing was done, the button is shaded.
	**Redo**	Redoes the last action undone. If nothing was undone, the button is shaded.

Copy digital frame

Copies the digital data for the selected object into the clipboard. The data is stored in ASCII format for reuse in other applications. The following objects can be copied:

Frame

The entire frame is copied to the clipboard.

Cursors

Copies the data for all of the cursors created in the frame.

Profiles

Copies the data for all of the profiles created.

Areas

Copies the data for all of the areas created.

Histogram

Copies the data for all of the histograms created.

Graph

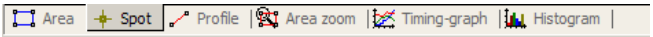
Copies the data from the time graph.

Selected tools

Copies only the data on the selected tools. The tools may be of different types.

Copy the graphic frame

Copies the selected objects in bitmap format into the clipboard. The objects are copied as they appear on-screen. Consequently, before they can be copied, they must be displayed on-screen using the following tabs:



The various options are available from the submenus:

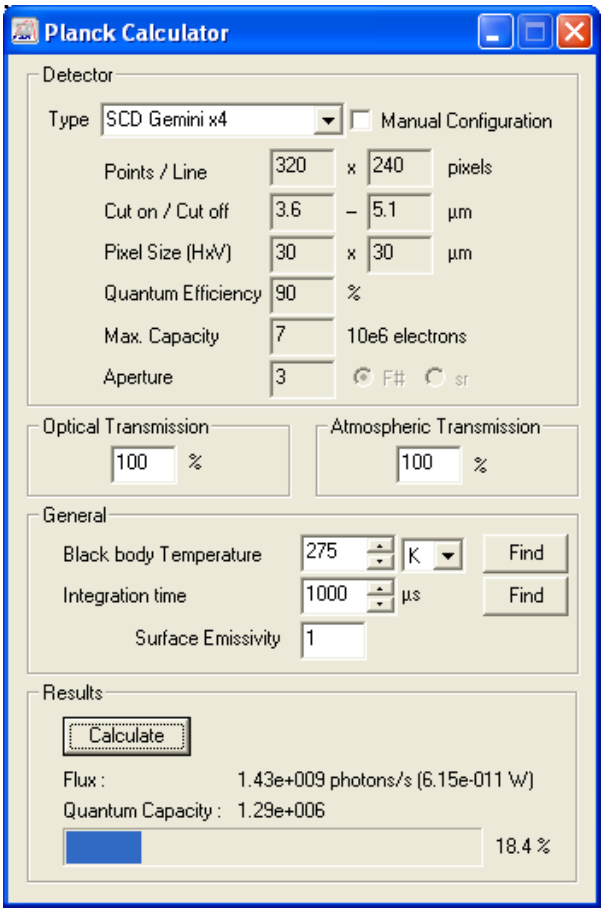
Copy graphic frame / Frame

Copies the infrared frame with no tools or palette.

Copy graphic frame / Frame & Palette

Copies the infrared frame with the palette display.

Copy graphic frame / Frame & Tools	Copies the infrared frame with the tools (cursors, areas, etc.).
Copy graphic frame / Frame & Palette & Tools	Copies the infrared frame with the tools and the palette display.
Copy graphic frame / Cursors	Copies the data for all of the measurement cursors.
Copy graphic frame / Profiles	Copies the data for all of the profiles.
Copy graphic frame / Areas	Copies the data for the drawn areas.
Copy graphic frame / Histogram	Copies the histogram.
Copy graphic frame / Graph	Copies the time graph.
Copy graphic frame / Multiple views	Copies the multiple views strip as displayed on-screen.
Copy graphic frame / Zoom area	Copies the selected zoom area.
Copy graphic frame / All views	Copies the entire work area.
 **Planck calculator**	One click on this button calls up a Planck's law radiometric calculation module.



One click on this button calls up CNUC Manager. (See Chapter 18 for details).

10.3. View menu

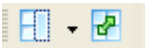
This menu's options are used to display or mask the different elements shown in the work area.

Main toolbar Displays or hides the Main toolbar

Palette toolbar Displays or hides the Palette toolbar

Tools toolbar Displays or hides the Tools toolbar

Layout toolbar Displays or hides the Layout toolbar



Capture manager Displays or hides the Capture manager

Status bar Displays or hides the Status bar

10.4. Palette menu

This menu is used to choose the data display mode based on the preset models. It is linked to the **Palette** toolbar.

Palette BW	Displays frames in grayscale.
Change palette	Replaces the current palette with the next one in the list: • Threshold • Grey • Rainbow • Steel • Lockin • Grey 16 • Rainbow 16 • Lockin 16 • Hot Metal • Cycle Shortcut: [**F4**] key.
IronBow 256 **Palette**	Offers a choice of palette from the above list.
Swap palette	Swaps the entire palette. Shortcut: [**Shift**] + [**F4**].
Min-Max palette	Adjusts the palette to the only useful amplitude. The lowest level is thereby assigned to the lowest data value in the frame and the highest level to the highest data value in the frame. Shortcut: [**Alt**] + [**X**].
Histo palette	Adjusts the palette to match a percentage of the population in the

histogram in the image. This percentage can be configured from the "Preferences" menu.

Shortcut: [**Alt**] + [**Y**].

"Full scale range" palette

Rescales the palette to cover the full scale range.

Shortcut: [**Backspace**].

Auto Gain Palette

Applies a Histogram palette to every image displayed.

Shortcut: [**Alt**] + [**A**].

Histogram Equalization

Applies a histogram equalization.

10.5. Tools menu

This menu is linked to the **Tools** toolbar.

Frame zoom

This menu lets you adjust the frame size. It offers the following choices:

Zoom

Activates the "zoom" function. The mouse pointer takes the shape of a magnifying glass when you move it around the frame. Click on that part of the frame you would like to see enlarged.

A x2 zoom factor is applied with each mouse click.

Zoom 1:1

Restores the normal image size.

Zoom in

Enlarges the image size (x 2) from its center.

Seven successive enlargements are possible.

Zoom out

Reduces the image size (x 2) from its center.

Adjust zoom to window

Adjusts the frame size to match that of the display area.

Zoom area

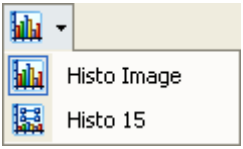
This function is only accessible if you have defined areas of interest. Submenus corresponding to each of the areas created let you choose the area you wish to enlarge.

The zoomed image of the selected area is displayed in the tab view. Each pixel is shown in line with the palette selected and with its value expressed in the selected units.

cm	3.54	3.57	3.60	3.63	3.66	3.69	3.72	3.75
0.42	34.76	34.85	34.89	35.08	35.15	35.14	34.98	34.76
0.45	34.44	34.67	34.85	35.00	35.15	35.08	35.02	34.92
0.48	33.91	34.46	34.69	34.86	34.99	35.09	35.09	35.07
0.51	32.34	33.94	34.39	34.74	34.87	35.05	35.11	35.04
0.54	29.75	32.34	33.92	34.50	34.69	34.91	35.05	35.05
0.57	26.52	29.65	32.24	33.84	34.43	34.66	34.96	35.05
0.60	25.20	26.41	29.27	32.01	33.67	34.43	34.73	34.95
0.63	24.78	25.11	26.21	29.01	31.58	33.45	34.43	34.76
	24.84	24.82	25.01	25.93	28.21	31.12	33.19	34.20

Timing-graph | Area | Spot | Area zoom

Cursor	Places a measurement point in the image
Single profile	Draws a measurement segment in the image
Multiple profile	Draws a multiple measurement segment in the image
Rectangle	Traces a rectangular area of interest in the image
Polygon	Traces an area of interest of any shape in the image
Circle	Traces a circular area of interest in the image
Histogram	Displays the histogram for the selected area. Note: Additional submenus are displayed for each of the areas of interest that are drawn. The area label is shown for each item.



Graph	Displays the dialog box for building a timing-graph.
Stop graph updating	Click on this button to inhibit timing-graph updating when you change the position of a tool in the image. This function avoids any wasted time when adjusting tools on a long film.

Multiple views	Displays a shortened film sequence.
Average	Produces and saves the average over time for a film: every pixel in the average frame takes as its value the average of all of the values of the same pixel in the film image. By default the filename proposed is that of the image with a **.ptm** extension.
RMS noise	Produces and saves a image where every pixel takes the noise value of a same pixel in the film frames. By default the filename proposed is that of the frame with a **.ptb** extension.
Arithmetical module	Displays the arithmetical module window.
Erase all tools	Erases all of the tools placed in the frame and their analysis window.

10.6. Measurement menu

Units

Digital level	Displays the data in logical levels (default parameter).
Temperature	Displays the data as a temperature. This menu is accessible if a calibration file has been linked to the frame.
Brightness	Displays the data as brightness (W/m²/sr). This menu is accessible if a calibration file has been linked to the frame.

Special unit	Displays the data using the scale included in the files.
Calibration special unit	Displays the data using the units defined by the user in a specific calibration file. This menu is accessible if a calibration file has been linked to the frame.
Radiometry	Opens the radiometry parameter window.

10.7. Additions menu

Altair can host additional functions by adding tools libraries. This menu groups all of the added functions, for example:

Frame mirroring

Vertical mirror image	Reverses the frame along the vertical axis
Horizontal mirror image	Reverses the frame along the horizontal axis

10.8. Window menu

 **Cascade**	Displays the windows in cascade
 **Tile**	Tiles the windows over the entire working area
Arrange icons	Reorganizes the minimized frame windows
Close	Closes the selected window. If changes have been made to the film, a message prompts you to save the changes.

Close all — Closes all of the open windows. If changes have been made to the films, a message prompts you to save the changes.

More windows... — Used to list all of the open files, even when there are more than just the nine listed in the Windows menu.

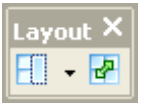
The Windows menu can display up to nine open files.

10.9. Help menu

About Altair — Opens a window showing the Altair version information and when it entered service.

Update serial number — When Altair is used for the first time, you are prompted to enter the program's serial number. This information is recorded and can be updated.

10.10. Layout toolbar



Multiple report view — This view presents all of the tool analyses on the same page. The analyses are added to this view by double-clicking on the triangle in the lower right hand corner of each analysis window.

Toggle view — Toggles between the tabs view and the multiple report view.

11. Tools

Altair offers advanced frame analysis tools. These tools share the common features described below:

11.1. Positioning a tool on the frame

Select the tool from the <**Tools**> menu or click on its icon it the "Tools" toolbar.

Move the mouse over the frame. The cursor takes a cross shape. Click on the desired position to start a tool trace. For tools other than points and segments, successively click on each point. To finish the trace, you can:

- Click on the starting point (closed shape),
- Click anywhere with the right mouse button,
- Double-click (open shape).

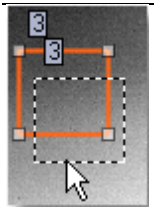
A right mouse click on the frame selects the last type of trace tool used. This makes it possible to quickly add a number of traces using different tools of the same shape.

11.2. Selecting a tool

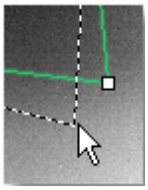
You can select a tool by clicking on its trace. Then the tool will be displayed in bold face and its label will be assigned a pale blue background.

11.3. Moving a tool

It is possible to change the dimension or the position of a tool.



To move a tool, click on a point along its contour, hold the click and move the mouse until the new location is reached. Release the mouse button.



To change the size of a tool, grab one of its handles and drag it towards the desired position (the handles appear when you pass over the tool with the mouse).

11.4. Parameters that are common to all tools

Each tool has its own parameters displayed at the top of the corresponding measurement table. The parameters below are common to all tools:

Label Each tool is numbered individually. By default, Altair assigns them a chronological number. It is however possible to change a tool's identification by double-clicking on its number in the data table (any alphanumeric sequence is valid).

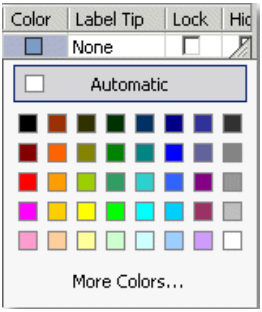
Warning: you may in this case obtain two tools with the same number.

Emissivity Specific emissivity level to be used in the calculations.

Warning, this value then replaces the value set in the radiometric data.

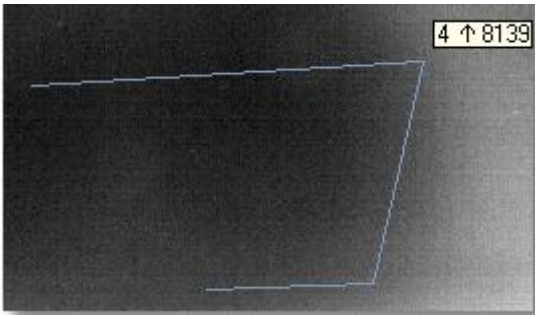
Color Double-click on the color sample to change it. A color selection window will then be displayed.

The tool color is updated in each of the views.



Label Tip To add or change any markings that appear in the tool representation, double-click on the marking in the data table and choose from the list displayed.

The figure below illustrates a tool where the selected marking shows the maximum value achieved on the profile.



Lock Ticking this box will disable the tool selection, thereby inhibiting changing and deleting it.

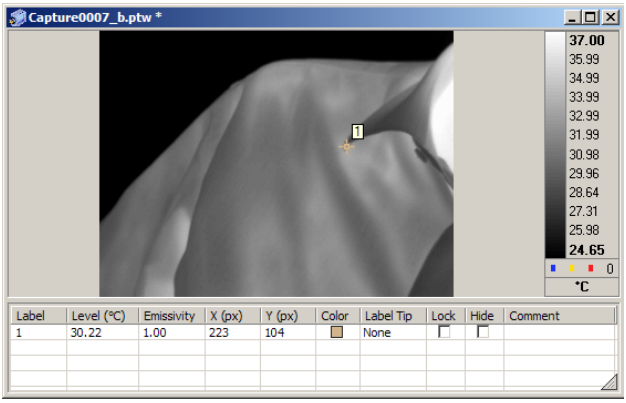
Hide Ticking this box will hide the tool on the frame. Use this function to reduce the calculation duration or to lighten up frame presentation.

Comment Double-click on this column to add a freeform text comment.

11.5. Cursor

Positions a measurement cursor on the frame. You can position up to 30 measurement cursors on the same frame.

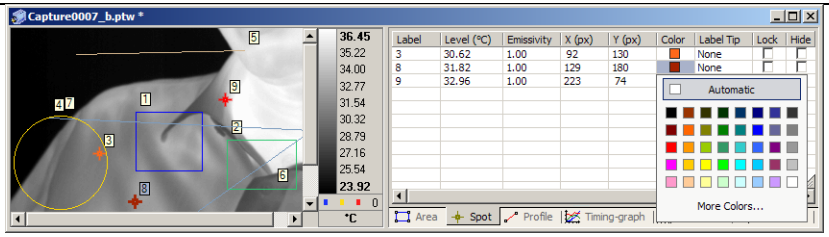
When this function is selected, the mouse pointer takes the shape of a thick cross as soon as it is located over the frame. To place a measurement point, click on the desired location in the frame.



You can at any time move the cursor using the mouse click/move method.

The cursor's X and Y coordinates are displayed in the additional data window. They can be displayed in pixels or in physical dimensions (m, dm, cm or mm). To choose this option, refer to the "Preferences" menu. The value of the measurement made using the cursor is displayed in the current measurement unit (temperature scale, isothermal value, brightness unit or digital level).

Different colors are assigned successively to each newly created element. You can change these colors by double-clicking on the corresponding color sample. Then choose a new color from the proposed palette.



11.6. Single profile

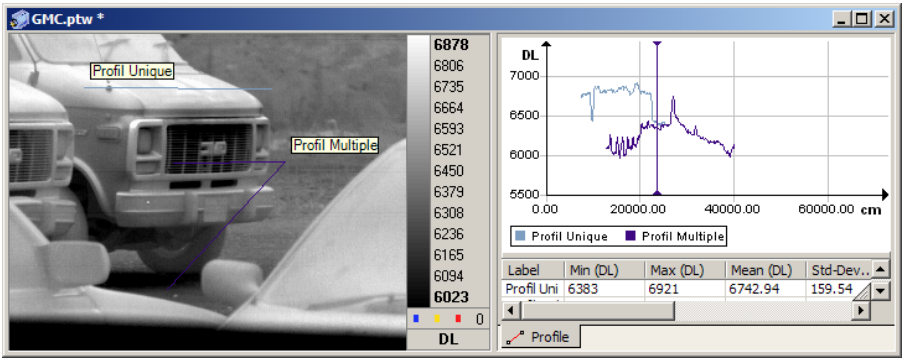
This function is used to position up to 30 profiles in the frame. A measurement will be made along each one.

To draw a profile in the frame, click to position the first end, move the cursor (a dotted line follows your motion), then click on the location of the other end. The dotted line is replaced by a colored line.

The data and the graph that correspond to the trace profile are displayed in the additional data window under the "profile" tab.

11.7. Multiple profile

To draw a multiple profile, click on the first end, then on each "break" in the multiple profile. Double-click on the last point to end the trace.



11.8. Area of interest

An area of interest is a surface, whether regular in shape or not, on which you would like to perform specific measurements.

These areas may be regular in shape (rectangle, circle) or irregular (polygons). Please note that for rectangle, all pixels within the rectangle are processed while, for polygons, only the upper and left edges' pixels are included into the region. The lower and right edges' pixels are not processed

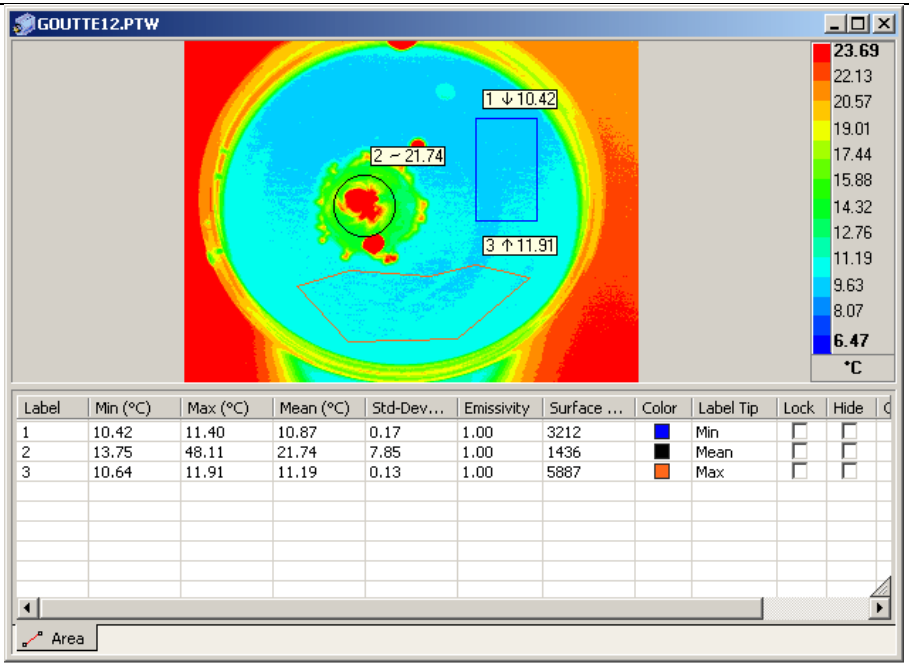
You can trace up to 30 areas in the same frame.

Each area can be made up of up to 100 sides.

A specific emissivity level can be defined for each of these areas.

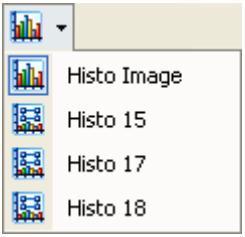
The results of the measurements made in each area are displayed in a table linked to the frame. These measurement cover the:

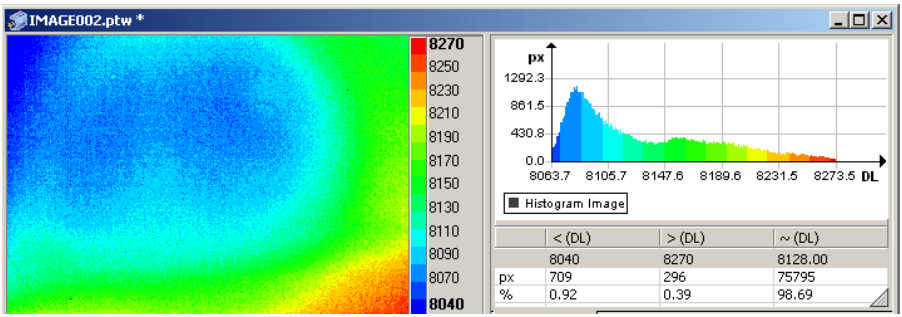
- Minimum value measured
- Maximum value measured
- Average value
- Standard deviation
- Surface area



11.9. Histogram

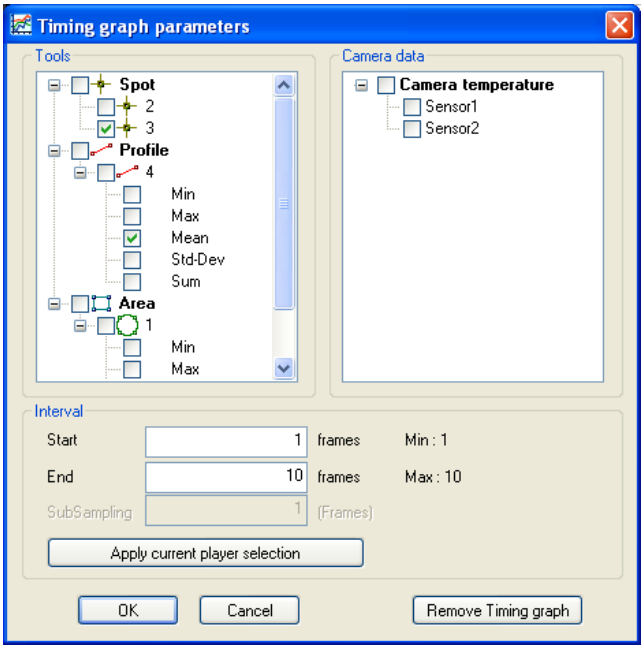
This function is used to calculate and to display a histogram image of frame data. A submenu offers you a choice of all of the existing areas of interest. The resulting graph is displayed in the "Histogram" view.





11.10. Timing-graph

This tool lets you trace a number of timing graphs. When this function is called up, the window below is displayed so that you can define graph parameters:



For each of the elements required, choose which parameters to use. You could identify the tool by the label name of the tool.

Choose the reference time interval (expressed in frames) for the trace. Click on "Apply current player selection" to use the same interval as that of the player.

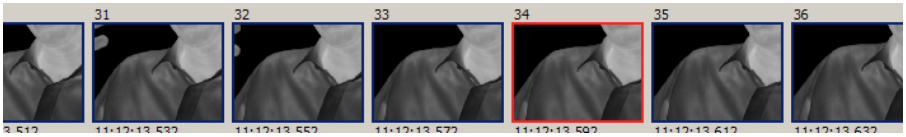
The “SubSampling” option allow to reduce the density of sampling displayed

The button “Remove timing graph” allow to remove all selections.

Click on "**OK**". The graph will be generated.

11.11. Multiple views

This mode displays the film in contact form. The number of frames is linked to the size of the display on-screen and the frames are spread out at regular intervals along the length of the film.

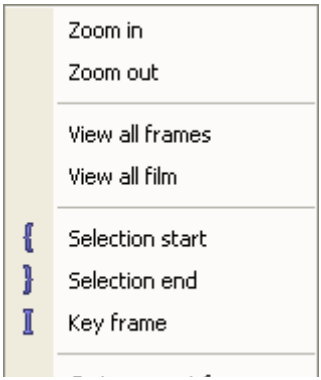


Every frame has its frame number as shown on the film.

Key frame are outlined in red.

Double-click on a frame to display it in the main view.

Click on a frame with the right mouse button to choose a display option:



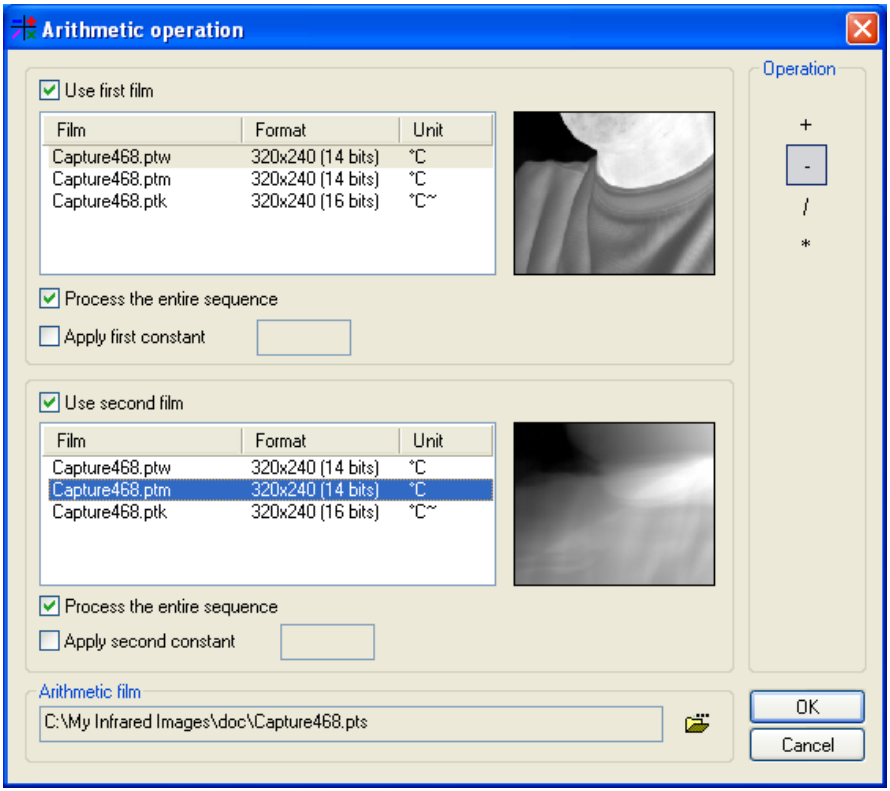
Zoom in	Reduces frame sampling. The frames displayed are separated by a wider interval. The function stops working when all of the frames fit the display area.
Zoom out	Increases frame sampling. The frames displayed are separated by a narrower interval. The function reaches its limit when all of the frames in the film are displayed.
Show all frames	Shows all of the frames in a film (a horizontal scroll bar is added at the bottom of the multiple view window).
Show entire film	The entire film is shown on-screen: the first and the last frame are displayed. Intermediate frames spread equally along the length of the film are displayed depending on the amount of space available on-screen.
Start	Moves the start of the film to the selected frame.
End	Moves the end of the film to the selected frame.
Frame	Designates the selected frame as the key frame.
Go to	Lets you select the current frame using its number.

11.12. Arithmetic module

The arithmetic module is a tool for performing basic arithmetic operations (+, -, x, /) on one or two frames. This function is used, for example, to obtain a negative frame by inverting the pixel values (the "1/x" function) or to remove noise by subtracting two frames.

To activate the arithmetic module:

- Click on the  button in the Tools menu or in the corresponding toolbar. The following window opens:



It shows two areas (first film and second film) which contain the list of films opened.

11.12.1. Apply an operation between two films

- Select the premier film, the arithmetic operation to apply and the second film (the selected films are shaded and the operation framed).
- Tick the "Process all film frames" box if you wish to apply the operation frame by frame from one film to the other.
- If necessary, change the name and location where the resulting film is saved. By default, the result of the operation is saved under the original film name followed by a **.pts** extension in the current project folder.

Click on [OK] to confirm.

11.12.2. Applying an operation on just one film

- Depending on the operation to apply, select

  – the first film, the operation and the second constant (e.g. "Capture0007_b.ptw", "+", "second constant: 25" to raise all values by 25°C), or

  – the first constant, the operation and the second film (e.g. "first constant: 1", "/", "Capture0007_b.ptw" to obtain an inverted frame display).

Click on [OK] to confirm.

12. Tool Handling

12.1. Using the clipboard

Use the Cut, Copy and Paste commands to copy a tool from one frame to another. You can also duplicate a tool in the same frame.

12.2. Tools files

Tools can be saved in a file. This means that the same group of tools can be applied to a number of frames. To save the tools, use the **File>Save tools** menu or **File>Save tools as** menu. The filename is built from the original frame's filename followed by a **.tls** extension. It is placed in the project folder that the frame belongs to.

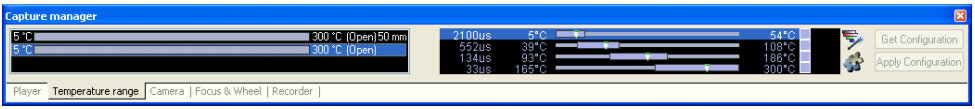
For example, a frame called **c:\project_1\frame.ptw** will have its tools saved in file **c:\project_1\tools\frame.tls**.

To apply a previously saved tool set to the current frame, use the **File>Open tools** menu.

13. Acquiring a Film

13.1. Choosing the temperature ranges

To configure the temperature range, select the "Temperature range" tab from the Capture manager.



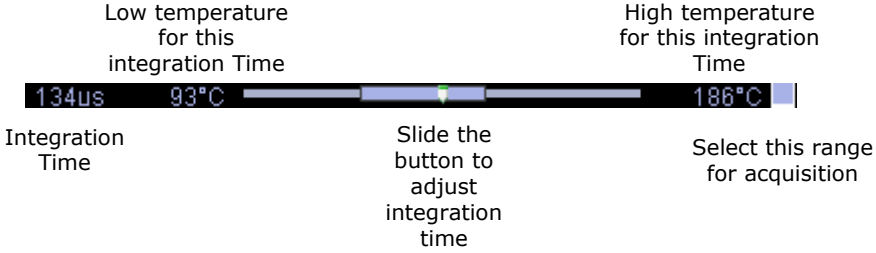
The left part of the window displays the configurations available on your camera. Each configuration is shown with its lower and upper total limits, as well as the optical filter used.

Only one configuration is valid at one time.

To select a configuration, click on its display. It will be highlighted in blue. Once selected, the camera is automatically set to this configuration.

Warning: Make sure you choose a range that matches the temperatures of the scene to be filmed. If not, your measurements will be wrong for they will be outside the limits of the calibration function

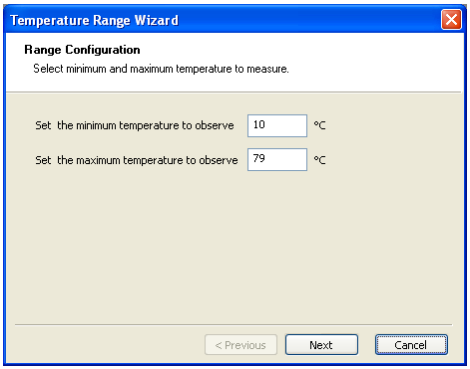
If the selected configuration is a Hypercal™ configuration, it is possible to adjust the different integration times inside this configuration.



Use the slider bar to adjust the integration time. The lower and higher temperature for the selected integration time is displayed.

Check the box to select this range for acquisition. If more than one range is selected, the camera will enter multi-IT mode, playing alternatively, each range.

Another way to configure temperature range is to click on the  button to open the "Range Configuration Wizard" window and proceed:



For Hypercal™ Process:

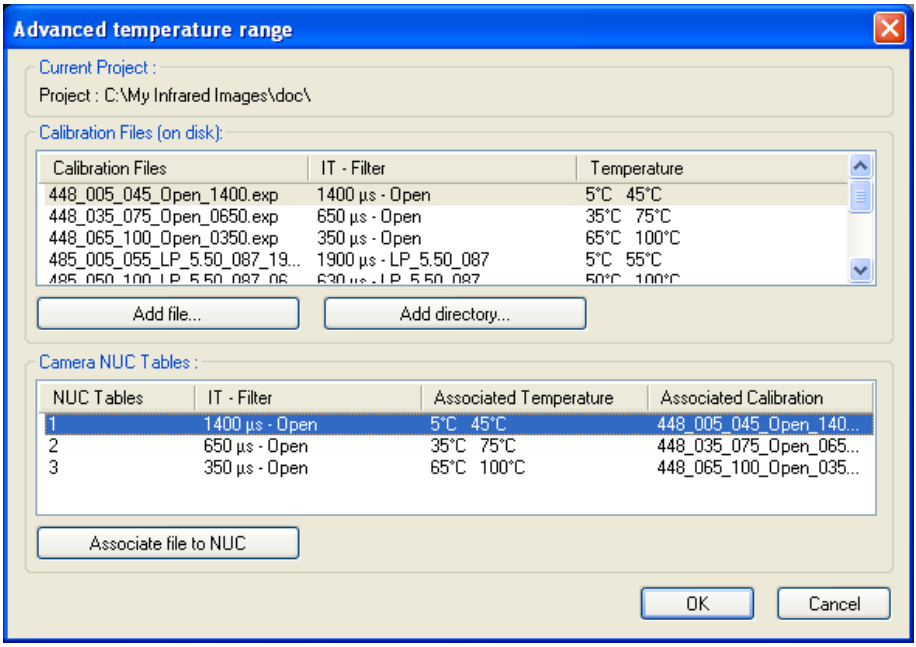
The calibration parameters are automatically saved on the image header. There is no external calibration file. These parameters are automatically loaded from the camera.

For standard NUC process:

Calibration files are automatically loaded from the "Calibration" folder in the project folder.

Warning: If a number of calibrations have been made (e.g. for using different lenses), Altair will load the first one available in the Windows file sequence. You will therefore need to select the calibration file to apply yourself. To do this:

- Click on the  button to open the "Advanced temperature" window:



- The "Project" area shows the address of the project folder. This address can be changed using the **File>Open project** menu.
- The disk's "Calibration File" list shows all of the calibration files available in the current project (filenames, IT and Filter, Temperature range).

Files from other projects can be added individually using the **[Add a file...]** button or all of the files contained in another calibration folder can be added using the **[Add a folder...]** button.

Warning: Files from other projects will not be saved with the project.

- The "Camera non-uniformity table" field lists the NUC tables contained in the camera as well as any associations with the calibration files.

To associate a calibration file to a NUC table:

- Select a calibration file by clicking on its name (the filename is shaded)
- Select a NUC table by clicking on its name (the table is shaded)
- Click on the **[Associate a Non-Uniformity file].** The calibration file name is updated in the NUC field.

Warning: Ensure that the elements you associate are compatible.

Click on the **[OK]** button to exit the advanced temperature window.

Extended range process:

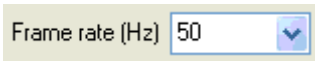
Click on the  button to activate the extended range mode. The extended range mode generates a sequence of images made from the best of each integration time. It can be used by both kind of calibration.

13.2. Camera configuration

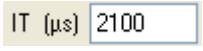
To configure the camera, select the "Camera" tab in the "Capture manager" window.

This window offers the same functions as Cirrus. Using this window avoids the need to move back and forth between the windows of these two programs. The choices made from the "Camera" tab are sent directly to Cirrus to be applied.

The adjustable parameters offered are:

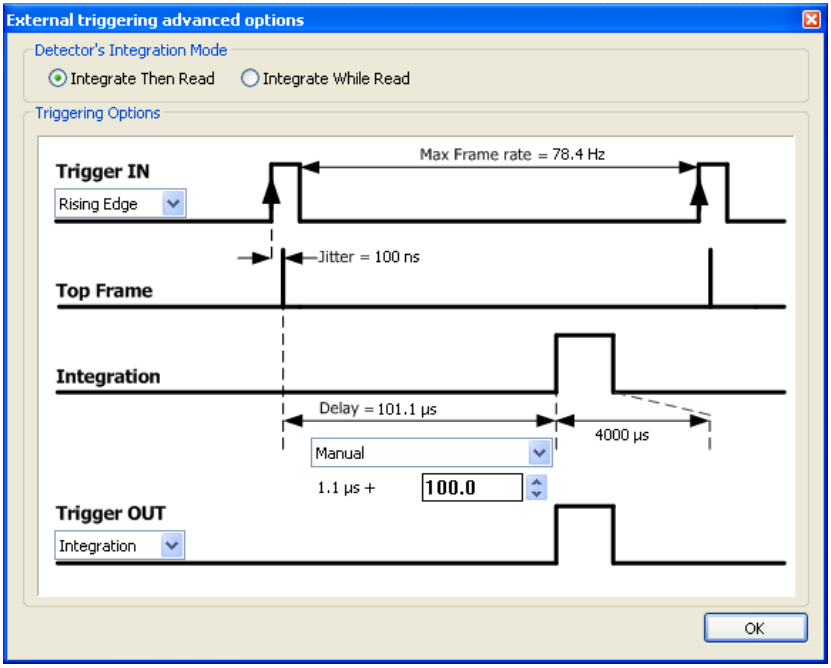
- 

The camera frame rate (in Hz)
- 

The Multi-IT number (Choose "1" to work in mono-IT mode)
- 

The Current Integration Time of the camera (in µs)
- 
External triggering
- 
External triggering advanced options

This button opens the advanced triggering options window, which allow user to manually define the triggering start edge and delay, and also to change the detector's integration mode.



The triggering options such as starting edge, delay and trigger out are modifiable only if the **external triggering** button is checked.

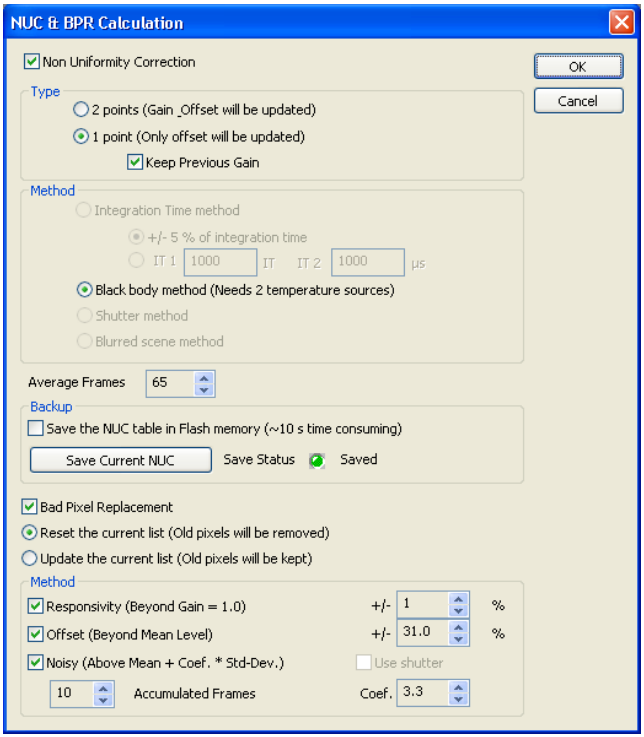
Select the **detector's integration mode** by clicking either on "ITR" (Integrate Then Read) or "IWR" (Integrate While Read) buttons.

Change the **triggering start edge** by selecting in the combo box either "Falling Edge" or "Rising Edge".

Triggering delay can be set either as a fixed value, an optimized value (for IWR mode only), or can be manually adjusted. To set the delay manually, user can select the "Manual" mode in the combo box, then either fills in the desired value (in µs) in the edit box, or use the spin control to increase/decrease the delay (by 0.1 µs steps).

Warning: Any change made to triggering start edge, delay or triggering out is directly applied to the camera.

-  Automatic Gain Control
-  Zoom (x2 factor, centered on the analog frame)
-  Reticule display (to simplify aiming)
-  Analog video palette inversion
-  Palette change (only works with an Emerald camera)
-  Starting a camera non-uniformity operation



This window gives access to the non-uniformity correction and bad pixels replacement procedure.

Non Uniformity Correction

Check this option to proceed to NUC. This option will calculate the new NUC tables based on the classical two-point method. Two uniform temperature targets (cold and hot source) have to be placed consecutively in front of the array or in front of the lens. The software will prompt for placing the first uniform source and later the second one.

Type

Choose the type of correction to process.

- **1 Point**: When this option is activated the NUC module will use the one point correction function (update of the offset matrix).
- **2 Points:** When this option is activated the NUC module will use the two-point correction method (creation of the NUC, gain and offset matrix).
- **Keep previous gain:** When this option is activated with 1-point correction, the previous gain is kept. Otherwise the gain is 1.0 for all pixels.

Method

Two calculation methods are available:

- **Integration Time method**: The two points needed for calculating the correction are obtained by changing the integration time.
- **+/-** 5%: Enabled when Integration time method is selected, Altair will use two integration times at +/-5% from the current integration time.
- **IT1 / IT2:** Enabled when Integration time method is selected, Altair will use the two integration times entered in the fields.
- **Black Body method:** The two points needed for calculating the correction are obtained by placing a black body in font of the lens of the camera.

Backup

- **Save the NUC:** When this option is activated the

NUC table will be saved in the flash memory; it can take a couple of seconds depending on the image format.

- **Save current NUC:** Use this button to save the current NUC into non-volatile memory. The save status indicates whether or not it has already been saved.

Bad Pixel replacement

Check this option to proceed to BPR. The bad pixels list is associated to each NUC table. This option allows determining the bad pixels list and the replacement pixels each time a NUC update is performed. 3 bad pixels tables are available.

- **Reset the current list:** The BPR list will be erased before proceeding to the new BPR detection.
- **Update the current list:** The BPR list will be kept and all the new bad pixels detected will be added to the list.

Method

Three calculation methods are available:

- **Responsivity method:** Check this option to detect bad pixels by the responsivity method. In this case the system will consider pixel as bad if the gain coefficient from the NUC table is lower or higher the predefined percentage. For instance if the threshold is 25%, the system will determine pixel as bad if gain < 0.75 and gain > 1.25.
- **Offset method:** Click this option to detect bad pixels by the offset method. In this case the system will consider the pixel as bad if the offset coefficient from the NUC table is lower or higher the predefined threshold. For instance if the threshold is 30% and if the range of digitization is 16384 DL, the system will determine pixel as bad if offset < -4915 DL and offset > 4915 DL.
- **Noise method:** Click this option to detect bad pixels

by the noisy method. In this case the system will consider pixel as bad if the RMS noise is lower or higher the predefined threshold. For instance if the threshold is 3.5 and the mean and standard-deviation of the noise image are respectively 5.0 and 1.0, the system will determine pixel as bad if RMS noise > 8.5.

- **Accumulated frames:** Amount of frames processed to calculate the noise.

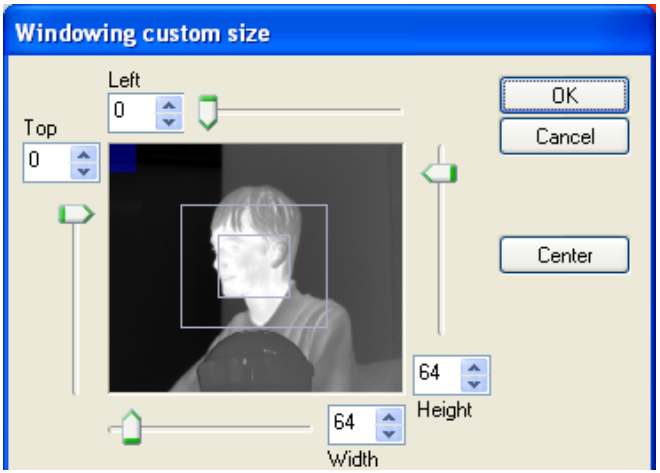
- 

In Multi-IT mode, "Int. Video No." is used to choose the video to display by reference to the IT No.
- Handling detector sub-windowing.

The 

information displays the status of the camera link.

The  buttons are used to choose the "full size", "½ size", "¼ size" and "random size" windowing modes. When "random size" is selected, click on the  button to access a choice window for selecting the position and the size of the detector window:



Move the cursors to set the point of origin for the window (from the upper left hand corner) and the size of the window (height and width). Confirm with the **[OK]** button.

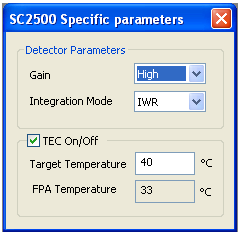
The "Camera" tab window display 

restates the position of the random windowing (positions of the upper left hand and lower right hand corners as well as the size of the window).

- 

Specific SC2500 Configuration :

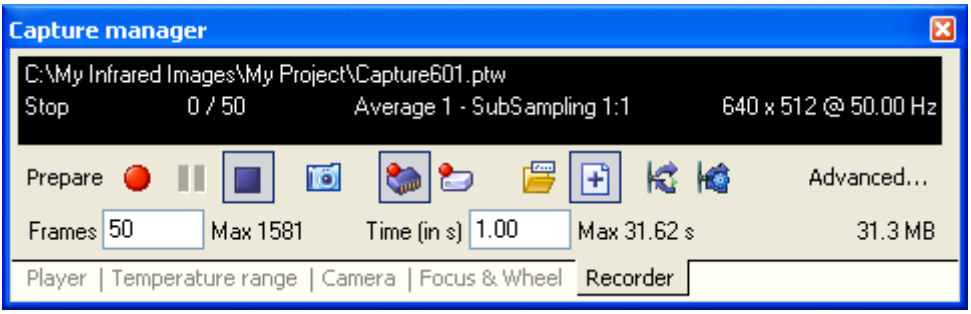
For SC2500 cameras only, you can set the detector's integration mode, the gain level, the input temperature (TEC) and the detector temperature (FPA).



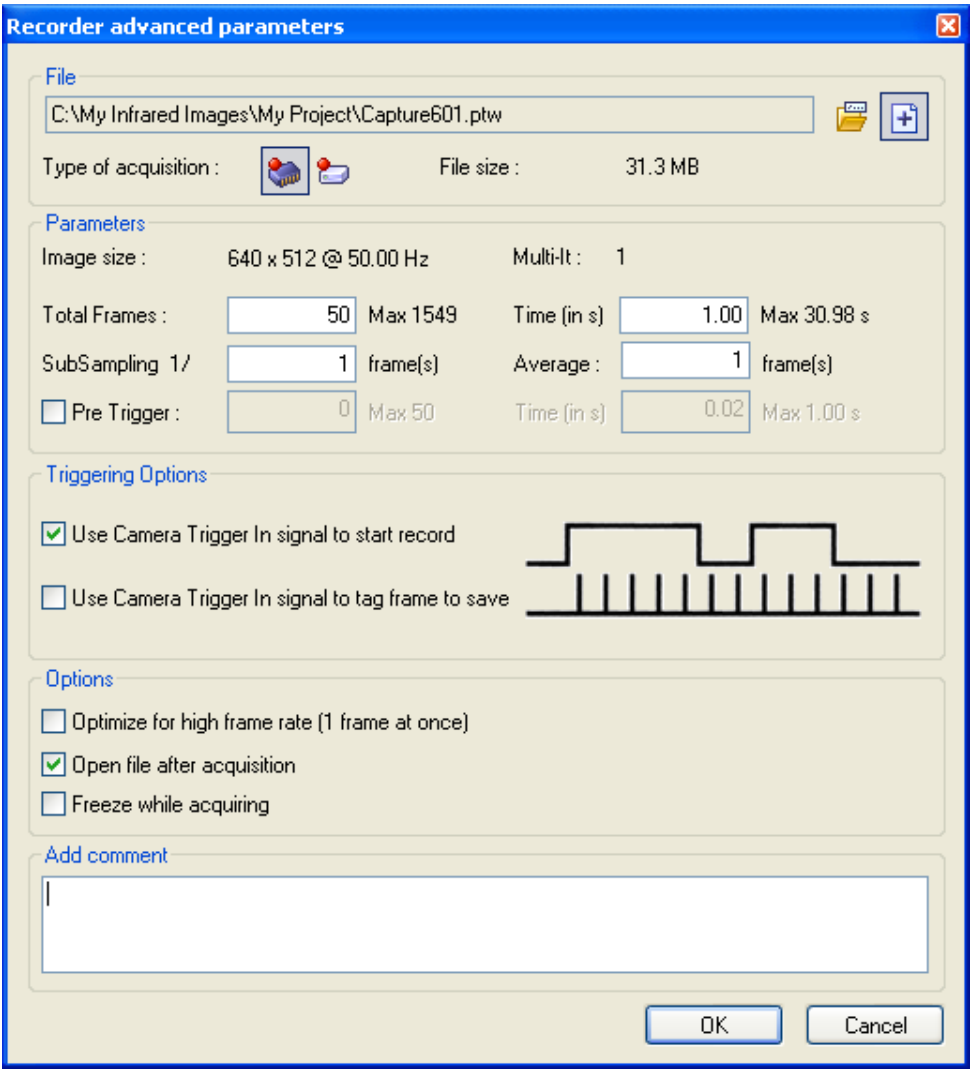
13.3. Acquisition configuration

The camera picture must be activated before recording a film. Click on the  button to activate it.

Click on the "Recorder" tab to call-up the capture panel.



The "Advanced…" button calls up the recorder's advanced settings window:



Advanced acquisition configuration parameters can be chosen directly from the control panel or from the advanced parameters window.

File

Select the location for saving new files using the find button  . If you do not specify your choice, the save location will be that of the current project. The filename prefix and numerical index number must be defined in the preferences window.

Auto increment

Click on the  button to select the auto increment function. The numerical part of the filename of each newly acquired file will be incremented by "1" compared with the previous one.

Type of acquisition

Two types of acquisition are available:

- **Acquire in memory**: Click on the button  . The frames are temporarily stored in the computer memory then transferred to the hard disk drive after acquisition. This option favors the acquisition speed and the integrity of the resulting picture. It does however imply that additional time is required to transfer the frame to the hard disk drive and the film duration is restricted by the amount of memory space available.
- **Acquire directly to hard disk**: Click on the  button. Pictures are stored directly on the PC's hard disk drive. This option makes it possible to acquire large size files, but the recording quality is directly related to the speed of the hard disk drive (the best results are obtained with SCSI disks).

Nbr. frames

Indicates the number of frames (pictures) to acquire. The acquisition duration is calculated according to the choice made for the number of frames.

The maximum is mainly a function of memory size and the amount of space available on your hard disk drive.

Duration (of film)	This parameter specifies the film duration (in seconds). Based on your choice, the number of frames that will be recorded is calculated taking into account the camera frame rate. The maximum duration is calculated taking into account the memory size and the amount of space available on your hard disk drive.
Pre Trigger	The number of frames to be recorded before the start recording event. The maximum quantity is the maximum quantity of film to be used. If you choose the max. value, then the entire film will be recorded before the start event.
Duration (of Pre Trigger)	This parameter specifies the duration (in seconds) of the recording prior to the start event. You can set a number of frames or duration.
Sampling	Shows the sampling ratio **N**. If this ratio is not "1", then one frame out of every N frames will be recorded. This option effectively slows the frame rate (or accelerates play compared with the true duration).
Averaging	Specifies the number of frames over which the average will be calculated during acquisition. A "1" choice means that no average is calculated. Note that the total acquisition time will be multiplied by the number of frames used to calculate the average.
Optimize for small format	This option, when ticked, will optimize the acquisition of small size frames. This feature is especially useful for small size, high frame rate combinations.
Use Trig In to start record	This option when ticked start record on first front of Trigger In signals.
Use Trig In to tag frame to save	This option when ticked only allow to record frames marked by Trigger In signals.
File size	Specifies the forecast file size (in Mbytes) given the parameters

already set.

Open the file after acquisition Automatically opens the film file after acquisition.

Freeze the frame during acquisition Tick this box to freeze the camera frame during acquisition. This releases system resources to enhance the quality of acquisition.

Comments Freeform entry. These comments are saved with the film.

13.4. Acquisition commands

Prepare Prepares film acquisition by checking the amount of disk space available and assigns buffer memory space.

Acquisition starts from the first frame that follows pressing the Record button.

Record Click on the record button  to start acquisition. If no preparation was done, it will be performed when the Record button is pressed, delaying the actual start of acquisition by the preparation time.

Pause Click on the  button to pause during recording. While this button is pressed, no frames are recorded.

Stop Recording stops automatically when the set number of frames has been reached. It is however possible to (definitively) stop recording during acquisition by pressing the  button. If you choose the acquire to memory mode, the file is then transferred to the hard disk drive.

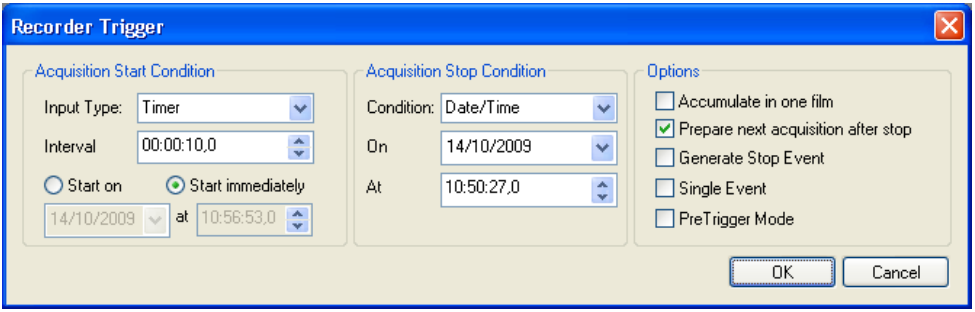
13.5. Recorder Trigger

The recorder trigger enables you to trigger sequence acquisition on FLIR Systems acquisition products compatibles with Altair. It does the interface between recorder and the triggering interface of the computer.

On the raising edge of trigger in signal, recorder trigger commands recorder to start the acquisition. The trigger output signal is set to active level during acquisition.

13.5.1. **Configure the recorder trigger**

Click on the button  to open the recorder trigger configuration window.



13.5.1.1. Select input

The “Input Type” combo box allows you to choose an input type among the four following options:

COM Port Trigger from a serial link. Select the port to scan (COM1 by default).

- Receiving a 'p' (ASCII 0x70) raises an "**acquisition preparation**" event,
- Receiving an 's' (ASCII 0x73) raises a "**start acquisition"** event,
- Receiving a 't' (ASCII 0x74) raises a "**stop acquisition**" event.

COM port parameters are 9600 bauds / 8 data bits / 1 stop bit / no parity.

LPT Port Trigger from the parallel port. Select the address of the port to scan (0x378 by default). Recorder trigger needs the dongle **X0149** to be connected to the parallel port of the PC.

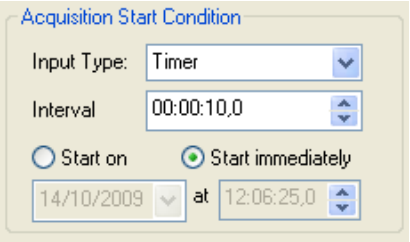
This dongle provides a TTL input and a TTL output.

USB Trigger from the USB port. The recorder trigger needs the USB Trigger Box **R0507** to be connected to an USB port of the PC.

This rack provides three TTL input and output for Prepare, Record and Pause. It provides also one error output for status.

TIMER Trigger from internal timer. Select the timing parameters:

- **Start**: The time on which acquisition begins. You can either choose to start when you click on the "Start Trigger" button or program a delayed start. If you want the process to start on a different day, just select it in the calendar view which appears when clicking on the date. You may also set the desired start time.



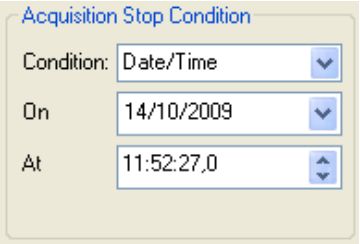
- **Stop**: The number of time the acquisition will be repeated. To select when the trigger should stop, you may switch to one of these modes:

    - **Number of acquisitions:** This mode allows you to set a number of acquisitions you want to be done. The recorder trigger will continue triggering until this number of acquisitions is done.

    - **End time:** Use this option if you want the triggering to stop on a specific day and time. Set it as you may have set the start time.

    - **Maximum duration:** While using this mode, you tell recorder trigger to continue the process until it has functioned for the selected time.

    - **Never stop:** This mode will never stop the triggering process, unless you stop it.



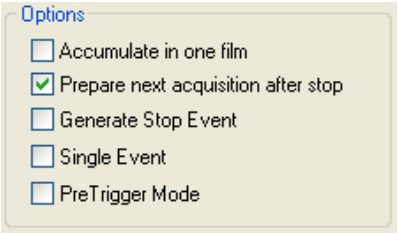
13.5.1.2. Choose trigger generation options

Accumulate in one Film When checked, every acquisition triggered is stored in one unique sequence instead of separated ones.

Prepare next acquisition after stop When checked, the next acquisition will be automatically prepared when the stop acquisition event will be raised.

Generate stop event When checked, raises a stop acquisition event on the falling edge of the PORT INPUT signal.

Single event When checked, raises a start acquisition event only for the next rising edge of the PORT INPUT signal. Following edges will not generate acquisition.



13.5.2. Start/Stop recorder trigger process

When you have set all the parameters, you can click on the button  to start the recorder trigger process.

This button is replaced by  as long as the process is running. A click on this button will stop the recorder trigger process.

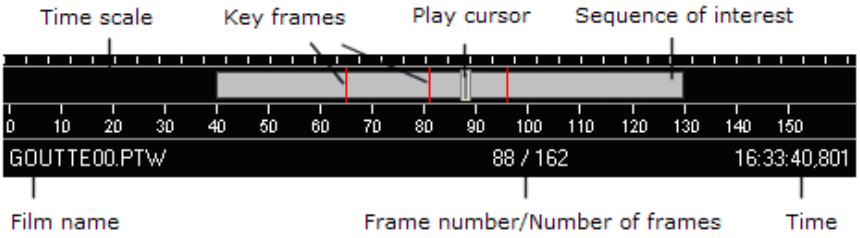
14. Playing a Film

When you open the film to play, the "Player" tab in the control panel is automatically selected.

The control panel lets you play the film using standard VCR commands. It also lets you select key frames and sequences of interest. It comprises two parts:

- A time view
- The toolbars

Note: Depending on the control panel position on-screen, these two parts can be superimposed or juxtaposed.



Refer to the Play commands

15. Film Display Parameters

The digital frame is made up of pixels whose value is linked to the digital value filmed by the camera, affected by the calibration trend and by the palette settings. It is therefore interesting to be able to use the palette adjustments to refine the display of significant frame components.

After first choosing the type of palette, you can change the scale using these three parameters:

- Low value
- High value
- Offset compared with the measurement scale

Adjust palette manually

You can shift the palette range opposite the value (numerical and temperature) scale: click and hold the left mouse button on the palette, then drag it vertically. This function is used to refine frame contrast over a given measurement range.

Choose low palette value

To choose the low palette value, two options are available:

- Using the left mouse button, enter the low limit for the graphic part of the palette, hold the button down and move the mouse vertically over the palette until the display shows the required value.
- Click on the low value displayed and enter the desired value from the keyboard.

Choose high palette value

To choose the high palette value, two options are available:

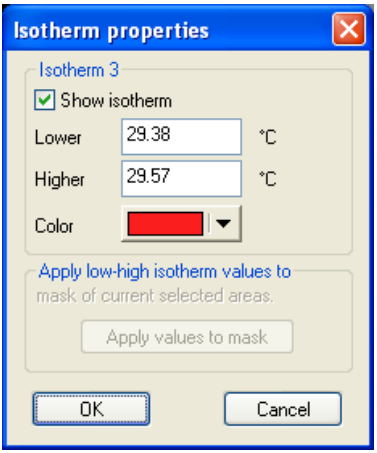
- Using the left mouse button, enter the high limit for the graphic part of the palette, hold the button down and move the mouse vertically over the palette until the display shows the required value.
- Click on the high value displayed and enter the

desired value from the keyboard.

Isotherms

You can display isotherms directly in the frame by proceeding in one of the ways described below:

- Click on an isotherm marker  located at the bottom of the palette. A marker appears in the palette. Enter the marker high and low limits to adjust it for the required temperature range. If necessary, move the marker along the palette.
- Click on an isotherm marker with the right mouse button and select "Properties". A dialog box opens so that you can directly choose the low and high limits as well as the color. Tick the "Show isotherm" box and click on **[OK]**.



Multiple report view layout

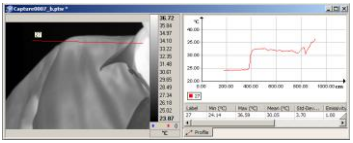
Click on the  button in the "Layout" toolbar to choose the way the elements appear in the multiple report view. The following menu is displayed:

Then choose the layout for the views by clicking on the options shown.

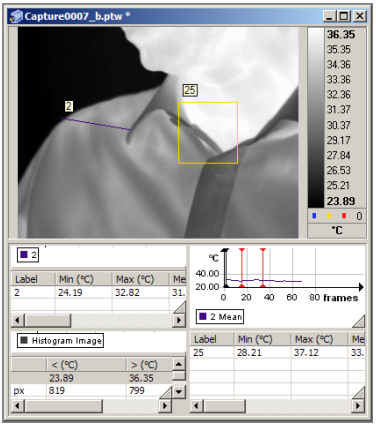
Note: the popup menu varies depending on the number of views displayed.

Toggle layout

Click on the  button to display the analysis window in multiple view or tab view format.



Tab view



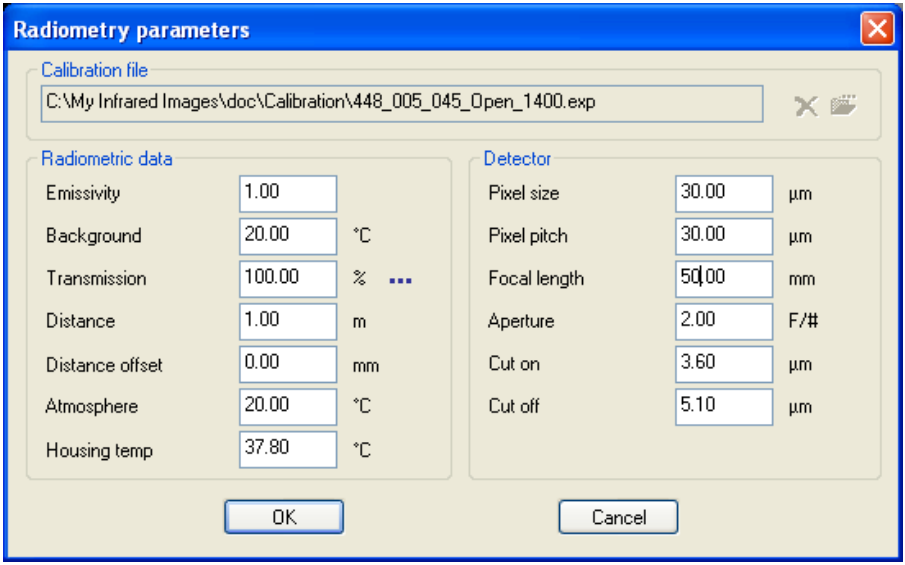
Multiple report view

For every element, you can toggle from the tab view to the multiple report view and back by double-clicking on the lower right hand corner of the element.

16. Radiometric Data

16.1. Adjusting radiometric parameters

Call up the Radiometric parameters dialog box by selecting the **Measurement>Radiometry** dialog box (or by pressing [**Ctrl**] + [**Shift**] + [**R**]).



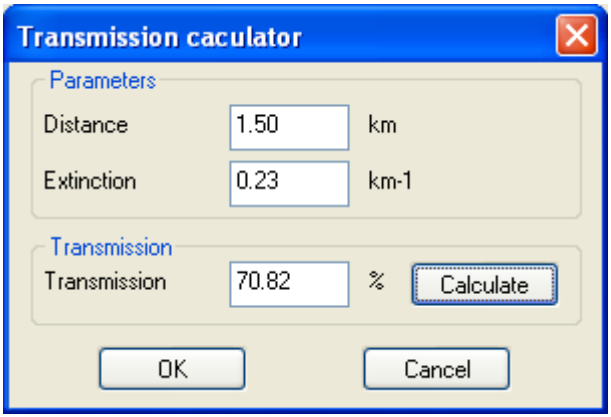
Calibration file Use the find button  to help you when specifying the access path to the calibration file linked to the recorded frame or the camera frame.

16.2. Radiometric data

Emissivity The object's emissivity value is used to calculate the temperature and the brightness. This value is applied by default to all of the frame's tools. It is however possible to assign each tool its own factor.

T. Environment Specify the ambient temperature level of the object's location. This is used for temperature and brightness calculations.

Transmission Object transmission factor (as a %). This parameter is used to calculate the temperature. You can directly enter the value or use the ▪▪▪ button to display the calculation box.



The calculation is based on object distance and extinction factor (Km^{-1}). The formula is:

$$\tau_{atm} = e^{(-d \times a)}$$

With

τ_{atm} the transmission factor (%)

d the object distance (Km)

a the extinction factor (Km-1).

Distance The distance is that which separates the object from the camera.

T. Atmospheric	The atmospheric temperature is used to calculate the object's temperature and brightness.
T. Camera	The camera's internal temperature is used to correct the effect of the camera's internal temperature on the sensor.

16.3. Detector related data

Pixel size	The basic pixel size (in µm), used for radiometry calculations.
Pixel gap	The gap between two adjacent pixels (in µm), used for distance and surface calculations.
Focal	The lens focal length (mm) used for the lens horizontal and vertical field and for distance and surface calculations.
Aperture	Lens aperture (F#) of the system.
Low cutoff	Low cutoff at 50% of transmission on the system wave length (µm), used to calculate the brightness.
High cutoff	High cutoff at 50% of transmission on the system wave length (µm), used to calculate the brightness.

16.4. Radiometric temperature equation

The radiometric temperature is calculated using the following formula:

$$Q = \tau_{atm} \cdot [\varepsilon \cdot f(T_{obj}) + (1-\varepsilon) \cdot f(T_{bkg})] + (1-\tau_{atm}) \cdot f(T_{atm})$$

With:

- Q the amount of radiation (DL)
- ε the emissivity [0 … 1]

- T_{obj} the object temperature (K)
- T_{bkg} the surrounding temperature (K)
- T_{atm} the ambient temperature (K)
- τ_{atm} the transmission factor [0 … 1]
- $f(x)$ the reverse calibration function (DL)

16.5. Radiometric brightness equation

The radiometric brightness level is calculated with the following formula

$$L = \int_{\lambda cuton}^{\lambda cutoff} Planck(\lambda,T)$$

With:

L the brightness

λ the wavelength

T the object temperature

$Planck(\lambda,T)$ Planck's law

16.6. Saving radiometric data

Radiometric data is saved at the same time as the frame.

It is however possible to change the radiometric parameters saved with the frame *afterwards*:

1- Open the frame file,

2- Open the radiometric parameters dialog box (**Measurements>Radiometry**) menu

3- Change the parameters

Click on the **OK** button.

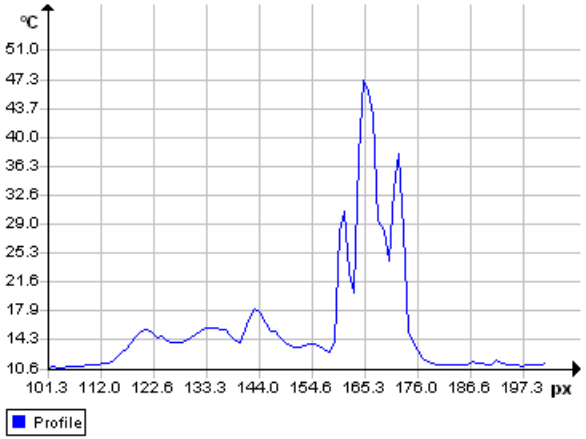
Save the frame (**File>Save frame** menu) to replace the radiometric parameters with your new choice.

17. Graphic Representation Configuration

This section describes the graphic representations linked to frame tools. To clarify this text, these graphic representations will be called "Graphs".

A graph can be displayed as soon as a tool is applied to the frame.

17.1. General presentation

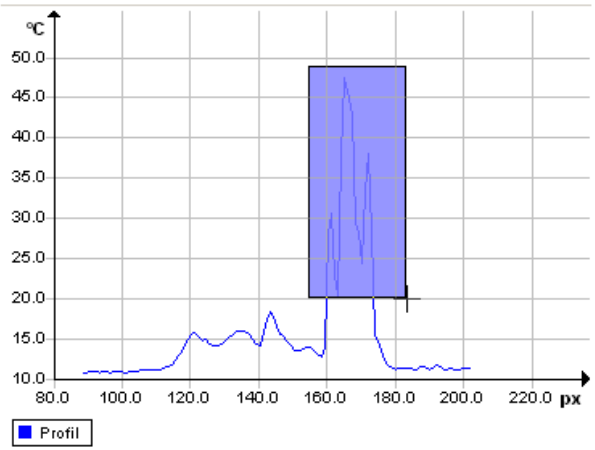


The graph uses the standard representation conventions: axes, grid, curves and keys. Every element in the graph has its own specific properties as described below:

17.2. Contextual menu

Use the right mouse button to display a contextual menu

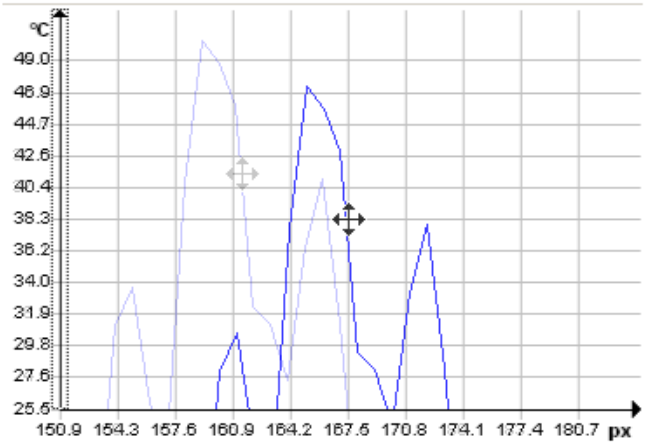
Zoom window Lets you zoom in on the graph. When this function is activated, the mouse cursor takes a crosshair shape. Click on the graph, hold the mouse button down and drag the mouse to define the zoom window. Release the mouse button to apply the zoom to the selection.



Zoom auto Resizes the contents of the graph so as to present all of the data (cancels the Zoom window and Panoramic functions).

Panoramic Use this function to move the graph window in relation to the curve. When this function is activated, the mouse cursor pointer changes to a crosshair pattern. Click and drag to move the window.

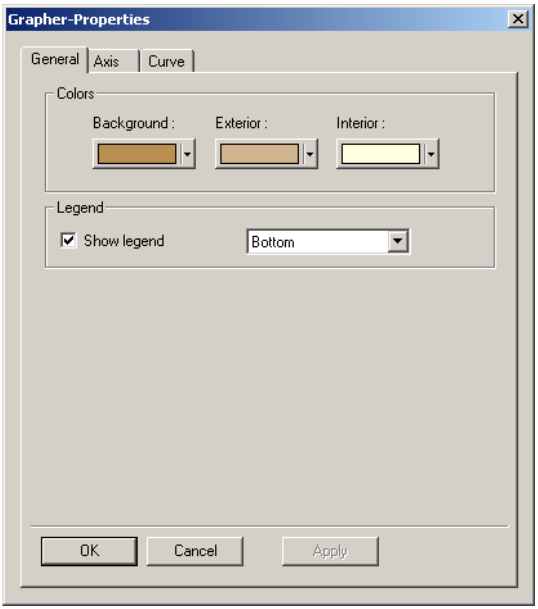
Use the Zoom auto function to return to the initial view.

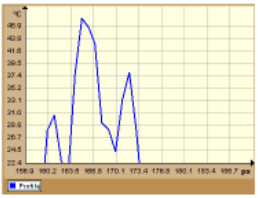


Properties Displays the properties for the selected part of the graph.

17.3. General properties

Double-click on the graph to open the "Grapher-Properties" dialog box and select the "General" tab. You can also use the right mouse button and select "Properties".





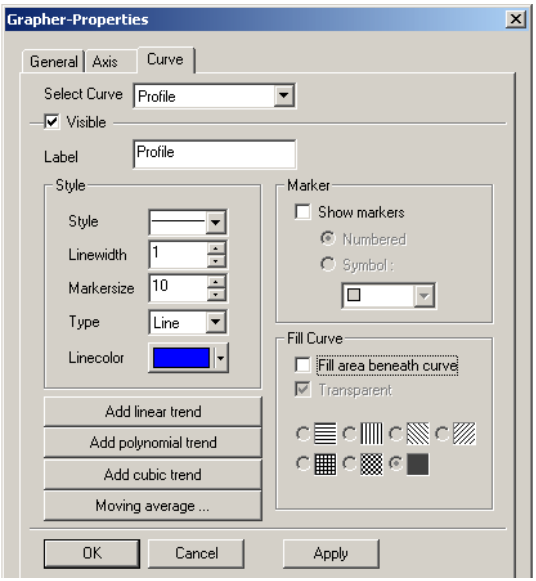
Colors Choose the colors to assign to the different graph areas (Background, Exterior and Interior of the graph).

Legend Tick box to show the legend and choose its location in the graph.

Use the **[Apply]** button for your choice to take effect.

17.4. Curve properties

Double-click on a curve to open the "Grapher-Properties" dialog box, "Curve" tab. You can also use the right mouse button and select "Properties".



Select Curve — Choose the curve that you want to change the properties of.

Visible — Untick this box to mask the curve. By default, all newly created curves are visible.

Label — You can change the label assigned to the curve. All alphanumeric characters are valid.

Style — You can choose the line style, its width, the marker size, the type of curve and its color.

Marker — Tick box to display the Markers. You can then define whether they are numbered or use a symbol.

Fill curve — Tick box to color the area beneath the curve.

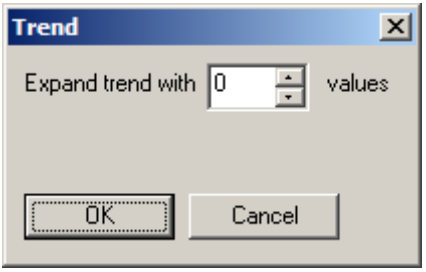
Choose the fill curve style and if necessary, tick

the "Transparent" box to allow the other graph elements to be displayed by transparency.

17.5. Specific curve handling

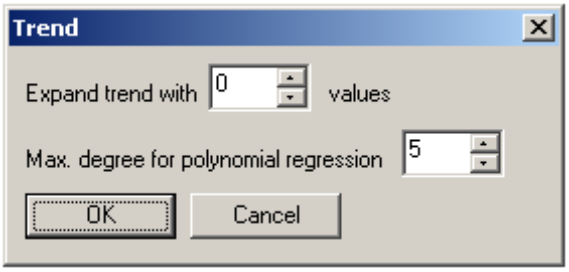
This function is used to assign specific handling to the curve.

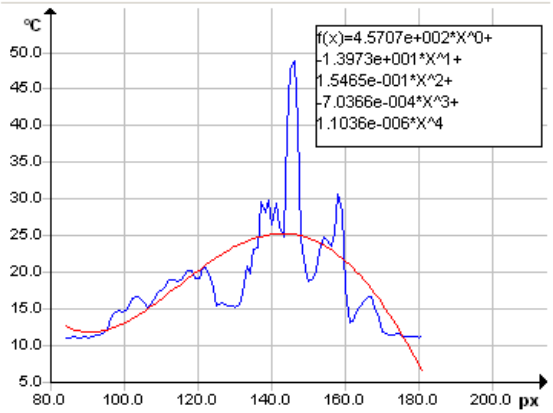
Linear trend Adds a linear trend curve to the graph.



Choose the number of values that the trend must be calculated on.

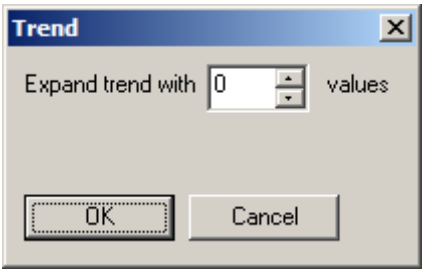
Polynomial trend Adds a polynomial trend to the curve. Select the polynomial trend curve using the button and click on **[OK]** to confirm.





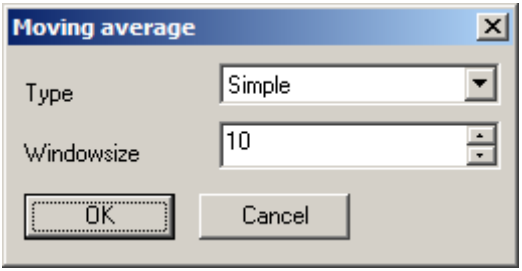
Cubic trend

Choose the number of values that the trend must be calculated on.



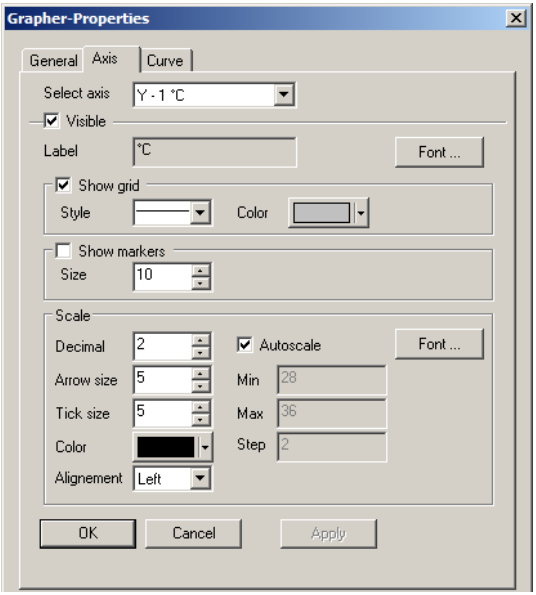
Moving average

You can calculate a moving average by clicking on the corresponding button. Choose the type of moving average (Simple, Linear, Exponential, Triangular, sinusoidal) and the number of samples.



17.6. Axis properties

Double-click on an axis to open its properties window or use the right mouse button and select "Properties". The following dialog box is displayed:



Select Axis Choose the axis that you want to change the properties of.

Visible Untick this box to mask the axis.

Font This button opens a new window for choosing the font and its attributes.

Show grid Untick this box to mask the axis grid.

Style Choose the axis grid style from the list.

Color Choose the axis grid color from the palette offered.

Show markers Tick this box to display the axis markers.

Size Choose the size of the axis markers.

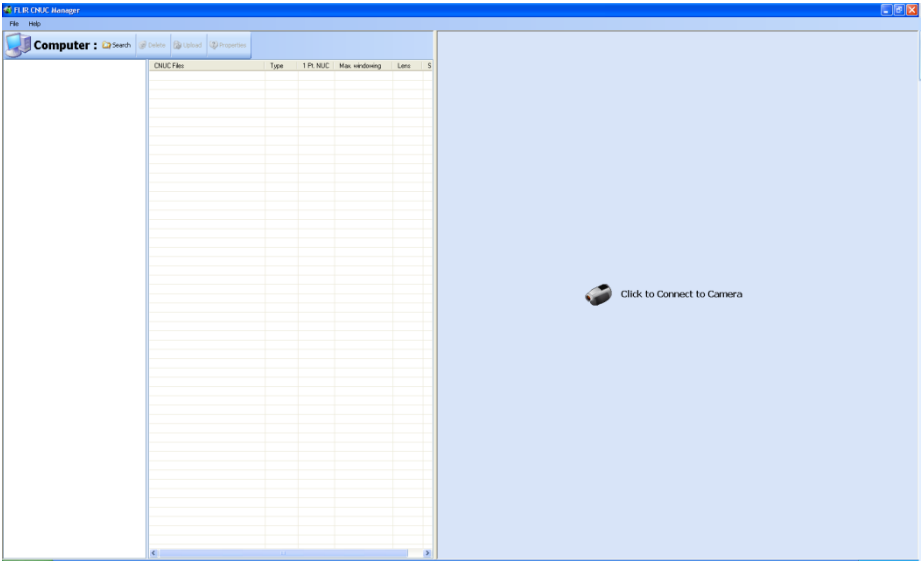
Scale	Choose the axis scale parameters (number of decimals, font, arrow size, tick size, color, alignment).
Autoscale	Tick this box to automatically scale the axis. Else, choose the min. and max. values to display as well as the scale step increment.

18. CNUC Manager

18.1. General Presentation

CNUC Manager is dedicated to manage and transfer CNUCs files from and to a camera. It can be accessed from Altair by clicking the  icon. CNUC manager can also be launched thru the Windows' Program Menu All Programs>FLIR Systems>Utilities>CNUC Manager.

The following interface is displayed.



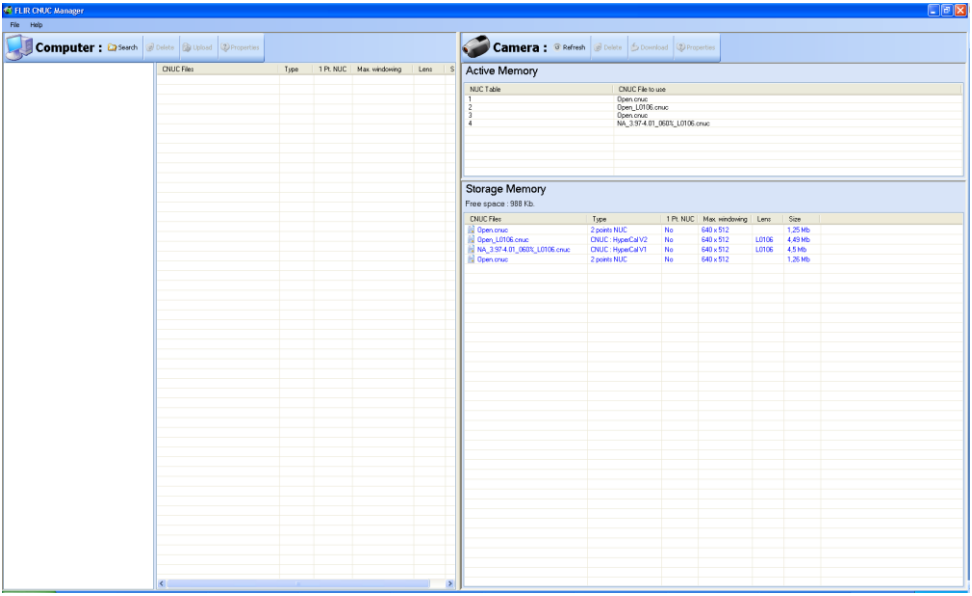
The left pane is dedicated to CNUC management in your PC, the right pane is dedicated to CNUC files in the camera.

To be able to manage CNUC files in the camera, you have to connect to it first.

18.2. Connect to camera

To establish a connection to the camera, just click on the "Click to connect to camera" button in the center of the right pane.

Once connected, CNUC Manager will search and display every CNUC file found in the camera. You may now manage CNUC files on your PC and in the camera, and transfer them.



When the connection is done, a new panel appears to the right side of the CNUC Manager window, which represents the camera. This panel is split in two parts:

- The "**Active Memory**" : the CNUC files currently in use by the camera,
- The "**Storage Memory**" of the camera: The internal Flash Disk where CNUC files are stored.

18.3. CNUC Management

The following actions can be performed on a CNUC file (depending on where the CNUC is located, in the PC or in the camera, some actions are available or not):

Search for CNUC Files

(For CNUC files on PC only.)

Click on the "Search" button of the toolbar, this will prompts you to select a folder on your PC in which CNUC Manager will search for CNUC files (any file with ".cnuc" extension).

Once finished, the left panel below the tool bar is a tree view of the scanned folder and sub-folders (if any).

The right panel is a list in which a line represents a single CNUC file. Each CNUC file is displayed with following information:

- File name,
- CNUC type (HyperCal V1, V2, …),
- File has one point NUC,
- Maximum windowing of the CNUC,
- Lens reference,
- File size.

Delete CNUC File

Select one or more CNUC file(s) in the list, then click on the "Delete" button of the toolbar to remove the selected file(s) from your PC.

You can also right click on a file and choose the "Delete" option from the contextual menu.

Rename CNUC File

(For CNUC files in PC only.)

Right click on a single CNUC file in the list, and then choose the "Rename" option from the contextual menu.

You can also left click on a CNUC file in the list while it is selected, and type the new name for the file.

View the details of a CNUC File

To get more details about a CNUC file, select it in the list then either double-clicks on it, click on the "Properties" button of the toolbar or right-click on it then choose the "Properties" option from the contextual menu. (see § 18.3.1)

Upload a CNUC file from PC to camera

(For CNUC files in PC only.)

Select one or more CNUC file(s) in the list, and then click on the "Upload" button of the toolbar. You'll be prompt to the Upload Manager. (see § 18.3.2)

Download a CNUC file from camera to PC

(For CNUC files in CAMERA only.)

Select one or more CNUC file(s) in the list, and then click on the "Download" button of the toolbar. You'll be prompt to the download manager. (see § 18.3.3)

Load a CNUC file in the active memory of the camera

(For CNUC files in CAMERA only.)

You can link one CNUC file per NUC table in the camera. (see § 18.3.4)

Restore original CNUC File

(For CNUC files in CAMERA only.)

You can remove the one point NUCs applied on a CNUC, with a right click on the CNUC file you want to restore, and then choose the "Restore

Original CNUC" option from the contextual menu.

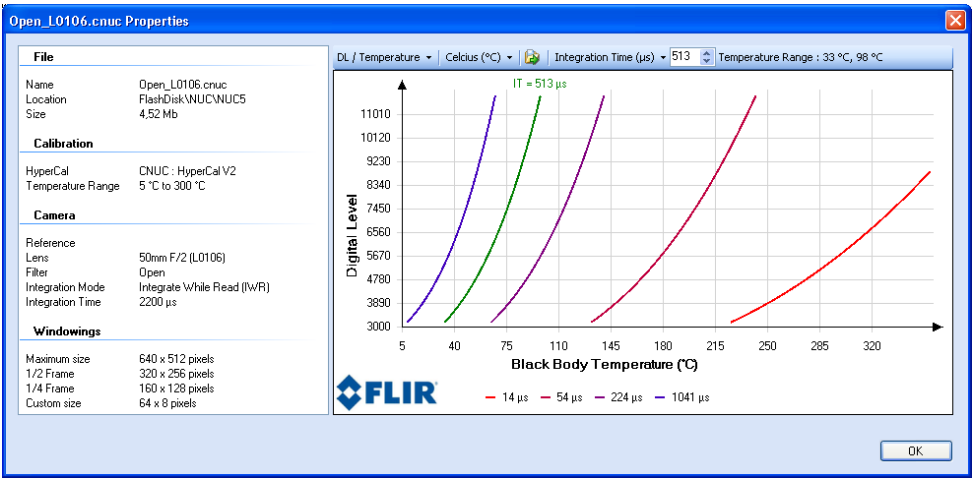
This option is enabled only when the CNUC file has one point NUCs.

Edit the Bad Pixels of a CNUC

Right click on a single CNUC file in the list, and then choose the "Bad Pixels" option from the contextual menu. You'll be prompt to the Bad Pixels manager. (see § 18.3.5)

18.3.1. **View the details of a CNUC File**

The property window displays details about CNUC files such as windowing, calibrations, filter name or wheel position.



The left panel gives information about the CNUC File, the right panel is a plot of the calibration curves, associating detector's DL to black body temperature used for calibration.

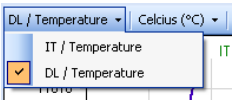
File Displays CNUC file's name, path and size.

Calibration The calibration type (HyperCal V1, V2) and the temperature range.

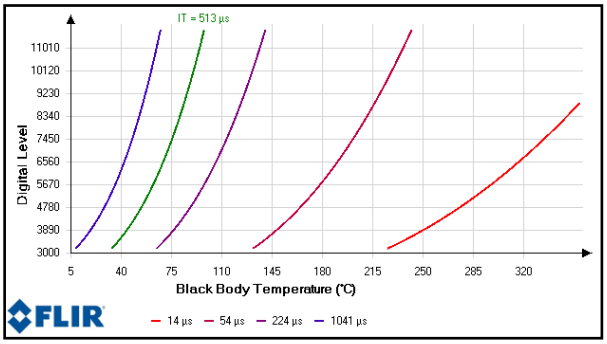
Camera Some useful camera information (lens, camera's reference, filter position…)

Windowing Windowing defined in the CNUC (Full size, Half size, Quarter size and custom size).

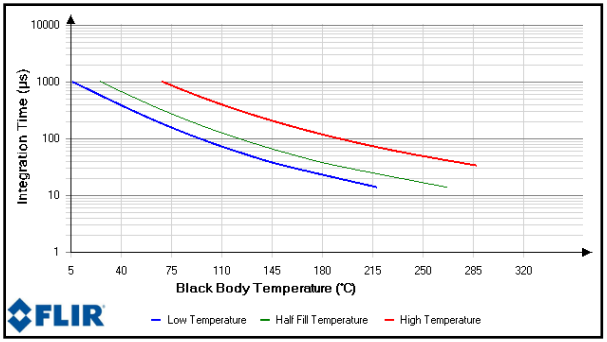
Plot type Choose calibration plots: DL/Temperature or Integration Time/Temperature graphs.



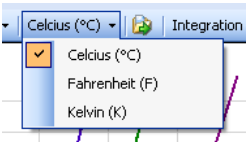
- **DL/Temperature:** Displays the relation between detectors Digital Levels (DL) and black body temperature.



- **IT/Temperature:** Displays the minimum, half fill, and maximum temperatures for each integration time between 1 and 10000 µs.

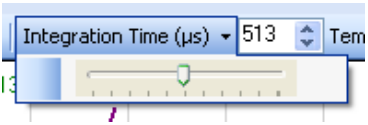


Temperature units Change temperature unit of for the graph: (°C, °F, K)



Export data Click  will prompt a file dialog that allows you to export calibration data to either CSV file format (*.csv) or directly to an Excel sheet (*.xls)

Integration Time (µs) Only for DL/Temperature plots: Clicking this button drops down a track bar that allows you to see the calibration curve for a specific integration time.



Temperature range Only for DL/Temperature plots: Temperature range with current integration time.

18.3.2. **Upload a CNUC file in the camera**

To upload a CNUC in the camera, you need to connect CNUC Manager to a camera (see § 18.2)

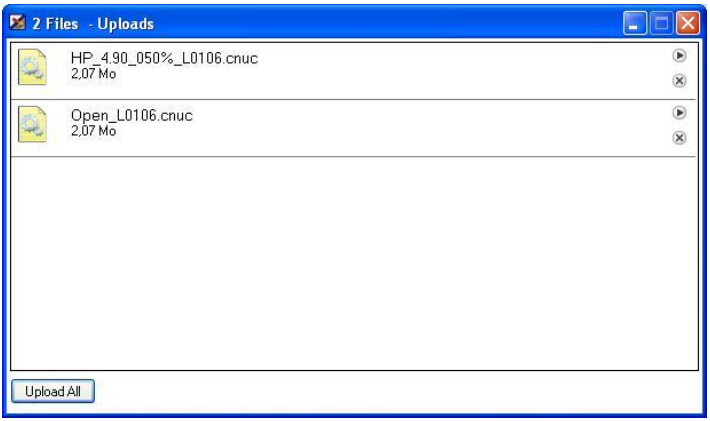
18.3.2.1. Select the CNUC file(s) to upload

Any file on your computer that has the "**.cnuc**" extension is visible with CNUC Manager. Just select in the list one or more files, then,

- Click on the **Upload** button in the tool bar ;
- Right-click on any selected item then clicks on the **Upload** button in the contextual menu.

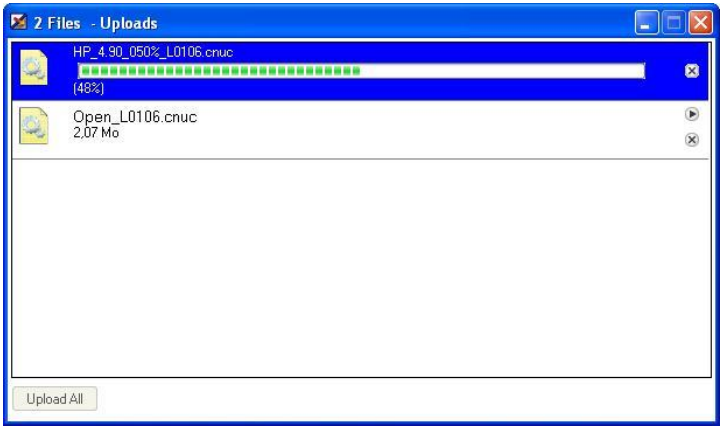
18.3.2.2. Upload CNUCs

Once the Upload button is clicked, the Upload manager window opens, which allows you to upload CNUC files one by one or as a batch.



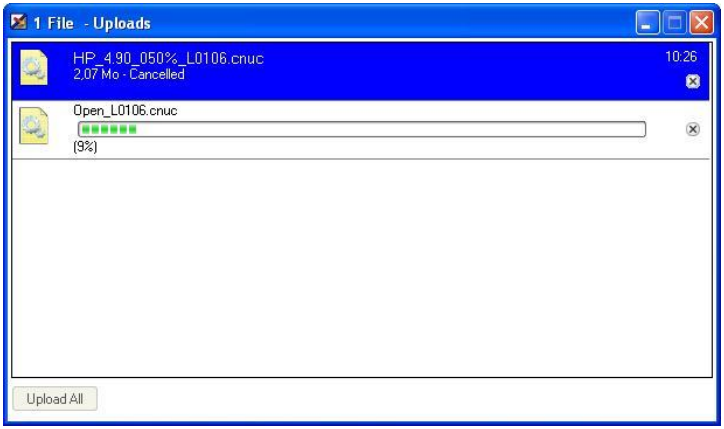
18.3.2.3. Upload a CNUC file

To upload a CNUC file, click on the **Start** button of the file to upload: . Upload will start **only if there's enough available memory** in the camera to store the CNUC. If not, every upload is cancelled.



18.3.2.4. Cancel an upload

To cancel an upload, click on the **Cancel** button of the uploading file: .



18.3.2.5. Upload a batch of CNUC files

To upload all the selected files in the upload manager, click on the **Upload All** button at the bottom left corner of the Upload manager.

18.3.3. Download a CNUC file from camera to PC

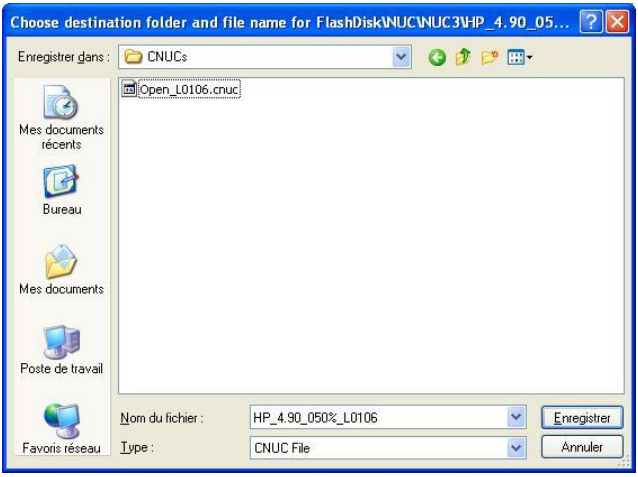
18.3.3.1. Select the CNUC file(s) to download

Select a CNUC in the storage memory of the camera, then,

- Click on the **Download** button in the tool bar: ;
- Right-click and select the **Download** button in the contextual menu.

18.3.3.2. Choose a name and the destination folder

A folder browser opens and allows you to specify the file name and destination folder.

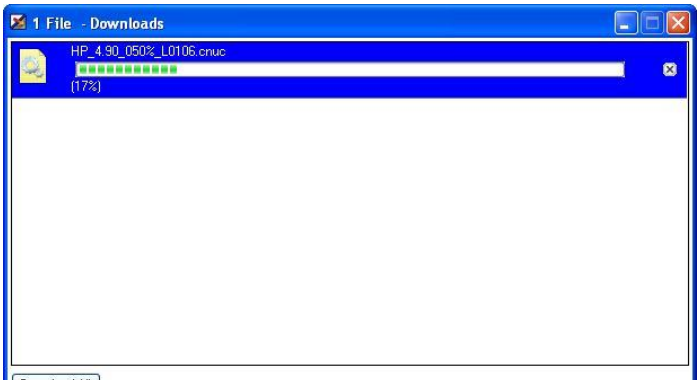


18.3.3.3. Start downloading the file

Once name and destination is chosen, the download manager pops up:

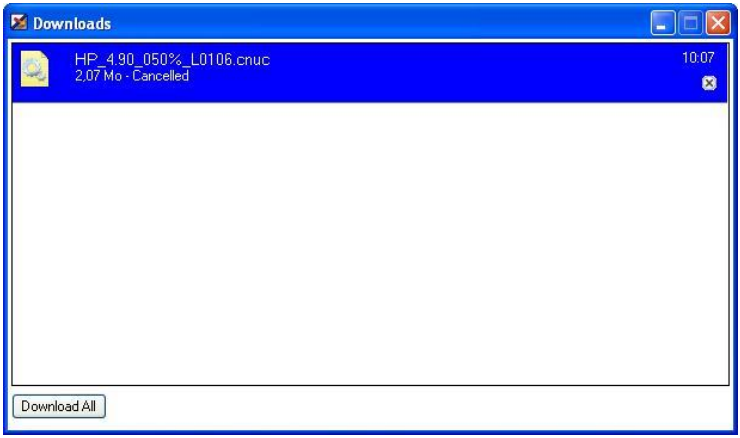
You can start downloading the file by clicking on the **Start** button of the download manager: .

While download is running, a progress bar shows the percentage of download's completion.


1 File - Downloads
HP_4.90_050%_L0106.cnuc
(17%)

18.3.3.4. Cancel download

At any time, it's possible to cancel a download by clicking on the **Cancel** button of the Download manager: .



18.3.3.5. Download a batch of CNUC files

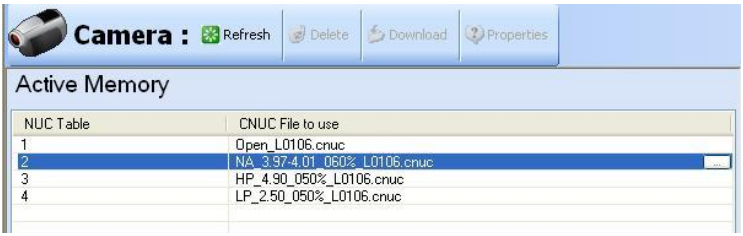
To download all the selected files in the download manager, click on the **Download All** button at the bottom left corner of the Download manager.

18.3.4. Load a CNUC file in the Active Memory of the camera

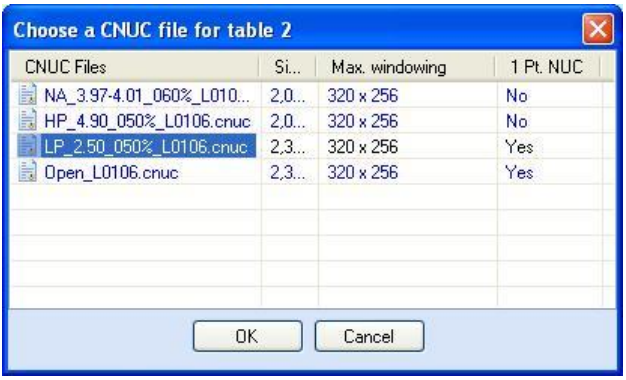
The active memory of the camera shows the NUC tables that can be applied on the image. The number of NUC tables depends on the camera configuration.

18.3.4.1. Link a CNUC file to a NUC table

Select a NUC table in the active memory view, then either double click an item, or click on the button at the right side of the selected item.

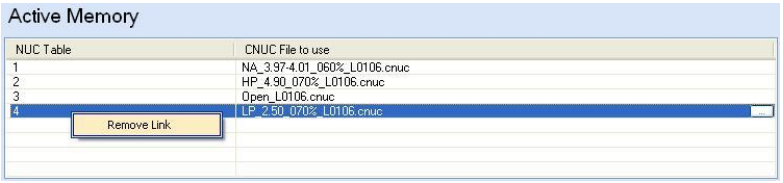


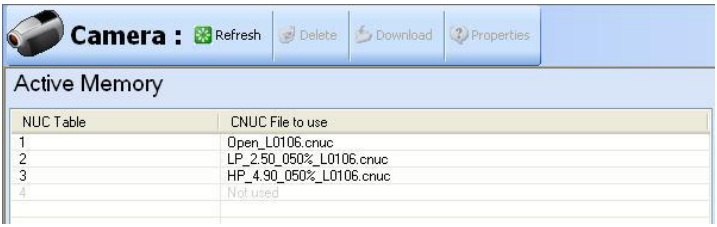
A new window pops up and displays all the CNUCs available in the storage memory of the camera. Select the desired CNUC and click **Ok**.



18.3.4.2. Delete a link between a CNUC file and a NUC table

Right click on a NUC table in the active memory view, then click on the **Remove Link** button of the contextual menu.





In the example above, the link with NUC table 4 has been removed.

18.3.5. **Work with bad pixels of a CNUC**

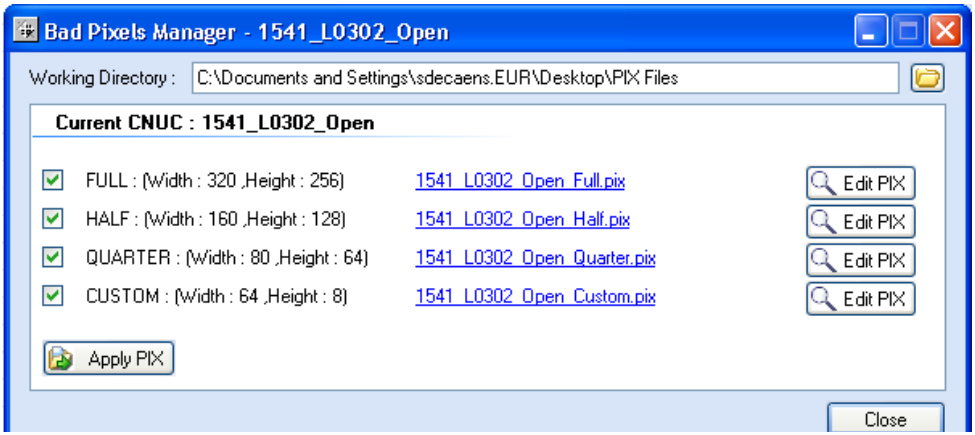
Each CNUC file can contains a list of bad pixels, which stores coordinates of bad pixels and coordinates of replacement pixels. Those lists are embedded in the CNUC file but can be extracted and edited as PIX files. A CNUC contains one bad pixels list per windowing.

18.3.5.1. Choose a working directory for bad pixels

The first step to work with the bad pixels of a CNUC is to choose a working directory where the bad pixels files (PIX) will be extracted from the CNUC file. At bad pixel's manager startup, you will be prompt to select such a folder.

18.3.5.2. Edit bad pixels files using bad pixels manager

Once a working directory is chosen, you have access to the extracted PIX files of the CNUC file.



This tool displays the name of each extracted PIX file, with the related CNUC windowing.

From here you can:

Edit the PIX file — A click on the "Edit PIX" button launches the **BPR Viewer** application that displays the bad pixels map of the file. (Refer to BPR Viewer's reference guide).

Set/Replace a PIX file — Click on the hyperlink of the file you want to set/replace, you'll be prompt to choose a new PIX file as replacement.

***CAUTION**: The new PIX file must have the same windowing than the existing one.*

Reload PIX files in the CNUC — Click on the "Apply PIX" button will upload the extracted PIX files back in the CNUC file.

18.4. Displaying CNUC Manager Preferences

The **File>Preferences** menu lets you display the preferences and change some of them.

18.4.1. **Camera's auto connection**

If this option is checked, CNUC Manager will try to establish a connection with a camera automatically at start-up.

If not, user will have to connect manually with a click on the **Connect** button of the tool bar. (see chap. 5)

18.4.2. **Default PC's CNUC folder**

If specified, the application will search for CNUC files in this folder at start-up.

18.5. Quitting CNUC Manager

To quit CNUC Manager, select the **File->Quit** menu.

19. ORION Manager

19.1. The ORION mode

The Orion SC7000 Series system is an infrared multispectral radiometer capable of producing IR sub-band images at video rate within the SW-MWIR or LWIR region.

A filter wheel is inserted between the lens and the focal plane. The rotation of this filter wheel is driven synchronously with the FPA clocking, such that a single image snap shot is obtained for each particular filter position.

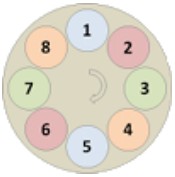
The Orion SC7000 is capable of capturing up to 400 frames per second, each high quality image being captured in snap-shot mode. The integration time is variable by software and can be different for each filter. An image is captured for each given position of the filter wheel, providing true multispectral imaging. The Orion SC7000 Series can also be used as a normal IR camera at full speed by removing or stopping the filter wheel.

19.2. The ORION configurations

Depending on your application, several configurations are available for the Orion SC7000.

19.2.1. **The standard Orion mode (2x4 Filters)**

Mount four sets of identical pairs of filters on the wheel.



This is the standard ORION configuration, which optimizes speed of acquisition, snapping 8 frames for one turn of the wheel (50 Hz). You can reach the max frame rate (400 Hz) in sub window mode.

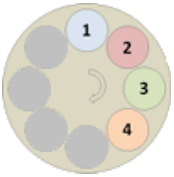
The resulting acquisition is 4 sequences alternatively composed of diametrically opposed filter images. Each sequence features a maximum 100Hz frame rate.

Due to the use of two different filter per set, and because filter characteristics are never exactly the same, some light image to image flickering may appear on the sub bands sequences.

19.2.2. **Consecutive filters (4 Filters)**

This mode allows reduce the image to image flickering by using only the first or the second filter per wheel rotation. In consequence, the maximum frame frequency achievable is reduced.

This mode can be used with the filters mounted on the same position as in standard configuration.

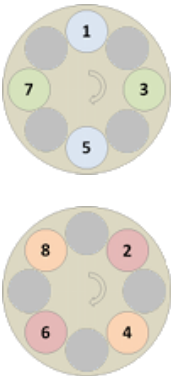


This configuration will optimize time period between sub bands, but a longer time is present between images of filter 4 and filter 1 or between filter 8 and filter 5.

The resulting acquisition is 4 sequences composed of individual filter images at maximum 50 Hz frame rate.

19.2.3. **Alternated filters (4 Filters)**

This mode inherits from the previous mode (consecutive filters), but filters need to be repositioned on the wheel as shown in the picture bellow.



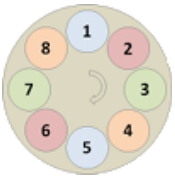
This configuration will provide a constant delay between sub bands

The resulting acquisition is 4 sequences composed of individual filter images at maximum 50Hz frame rate.

19.2.4. **8 Filters mode**

- **Consecutive filters**

In this mode, the CNUC process is applied on the PC side. Therefore, it opens the possibility to mount 8 different filters on the wheel.



Beside of increasing the number of sub bands configuration available, this configuration will reduce image to image flickering, considering that a unique and specific CNUC correction will be used for each one of the height filters (instead of two per film for the standard ORION mode).

You can reach the max frame rate (400 Hz).
The resulting acquisition is 8 sequences composed of individual filter images at maximum 50Hz frame rate.

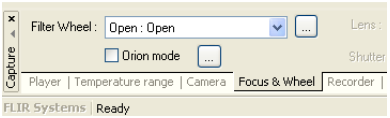
- **Combine 2*4 filters**

This mode allows having the same configuration as in standard mode, but with CNUC applied on the PC side, thus reducing the image to image flickering.

This option allows you to combine the height output in 4 to a virtual 2*4 standard mode.
But a different NUC is applied for each filter.
The resulting acquisition is 4 sequences alternatively composed of diametrically opposed filter images. Each sequence features a maximum 100Hz frame rate.

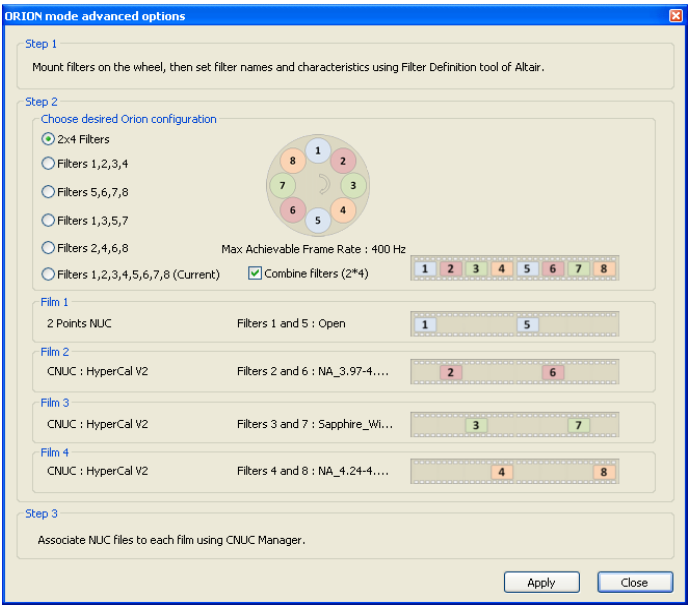
19.3. Select an ORION Configuration

Open the ORION Mode advanced options window by clicking on the button to the right of the ORION Mode checkbox, in the Focus & Wheel panel:



The ORION Manager displays every possible configuration, detailing filters disposition on the wheel, calibrations and filter names for the four films.

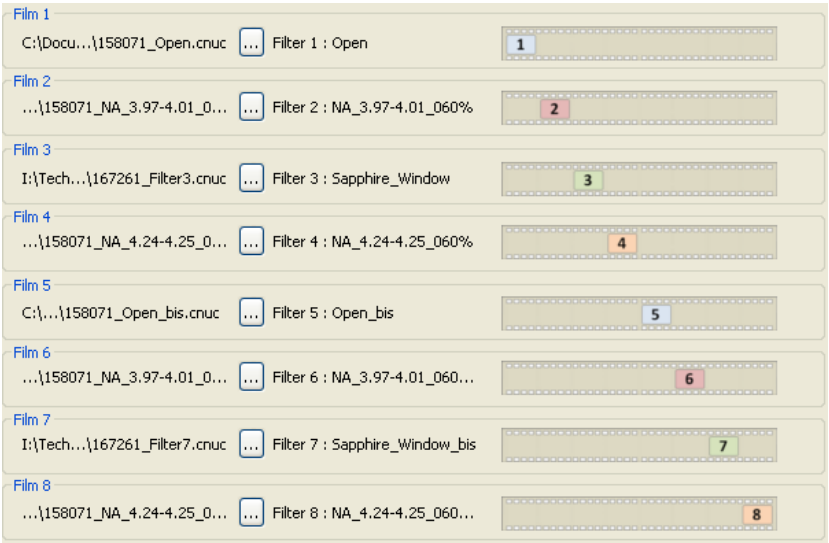
Choose one of the available configurations, and then click **Apply**. Camera's software will reboot to take into account the new configuration.



19.4. Specificities of the 8 filters Mode

19.4.1. **Selecting NUC for each filters**

In this mode, NUC file are applied by the computer and no more by the camera. The user needs to select NUC files for each filter.

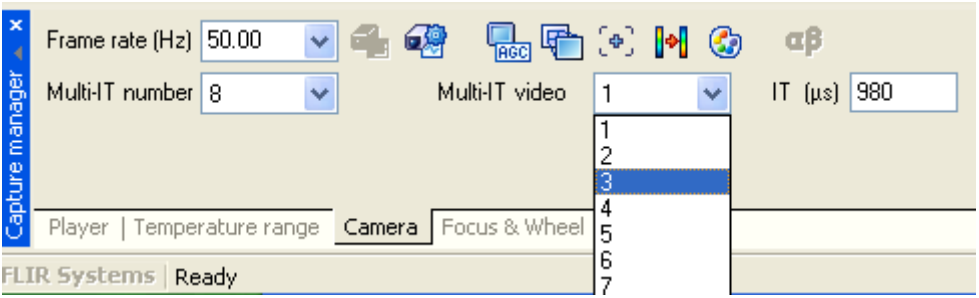


NUC selection is accessible in Orion Manager Window when the 8 filters mode is selected.

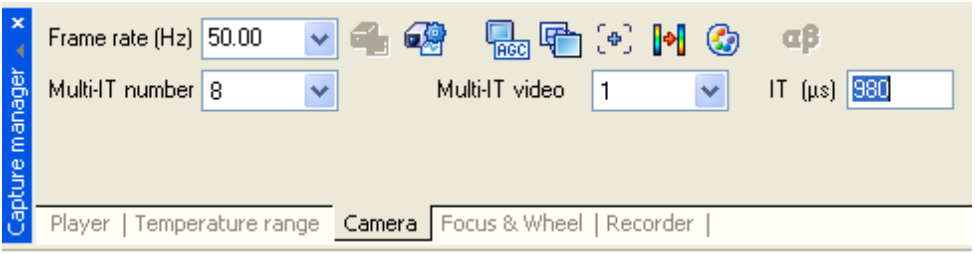
19.4.2. **Changing integration time for each filters**

To change the integration time for an optical configuration you can do it via the Camera table.

- Select the Multi-IT video.



- Set Integration Time wanted



Note that you can change it via Temperature range table if you have CNUC with HyperCal.

20. Create A Custom Palette

To create your own palette you have to edit the "**Palette.ini**" file which can be found in Altair path.

Open it with a basic editor like notepad and implement your palette as describe just below:

A palette is defined by a name, color stages, and numbers of colors.

[Name]	Name of the palette between square brackets.
(Red, Green, Blue)	First stage color composed of the 3 primary colors between brackets.
(Red, Green, Blue)	Color stage 1
…	
(Red, Green, Blue)	Color stage n (You have a maximum of 20 color stages).
NBCOLORS=n	Number of color contained in the palette (256 is the maximum allowed).

Example:

[IronBow 256]

(0, 0, 0)

(0, 0, 255)

(255, 0, 0)

(255, 255, 0)

(255, 255, 255)

NBCOLORS=256

21. Plugins

21.1. Frame Flip

You can flip an image horizontally or vertically. The focused document is flip.

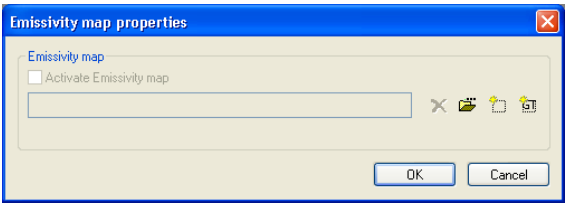
 Vertical flip

 Horizontal flip

21.2. Emissivity map

To obtain a greater precision in temperature measurements, you can extract the emissivity of a scene, i.e. the ratio of energy radiated by a particular material to energy radiated by a black body at the same temperature.

 Open emissivity map properties dialog box.



From there you can either:

 Create a new emissivity map.

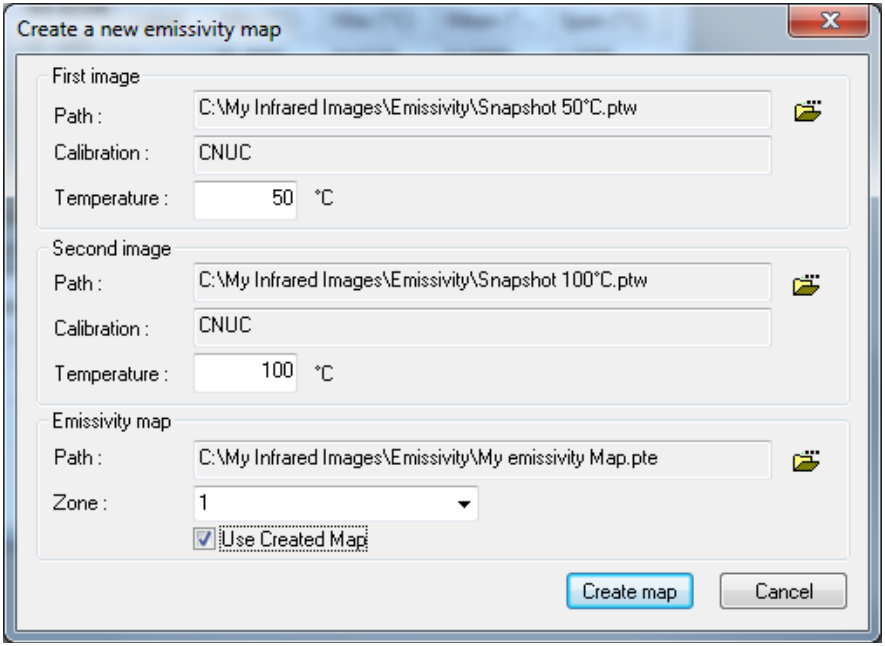
 Load an existing emissivity map (.pte file).

 Unload current emissivity map.

21.2.1. **Create a new emissivity map**

The object of which you want to know the emissivity must be placed into a climatic chamber to obtain two snapshots of the scene at two different temperatures. Those two temperatures **must be above 40°C**, with a **difference of forty degrees** at least.

Once you have those two snapshots, you may open the emissivity map creation tool:

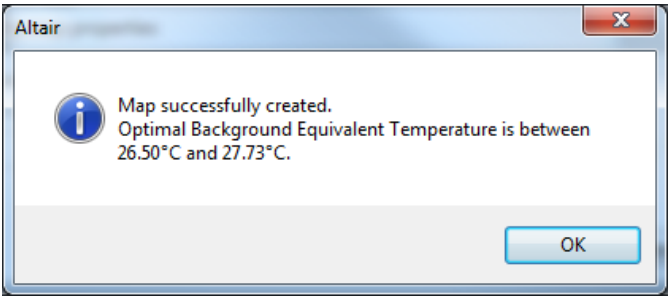


Click on the browse buttons to load the two snapshots of the scene, and then specify the corresponding temperature of the climatic chamber. (In the example above, the first snapshot has been taken at 50°C, the second one at 100°C).

It is also possible to select an area within your image where the emissivity correction is to be optimised. This is of interest where the sample under

evaluation does not cover the full field of view of the camera. The area is defined with a standard area tool (please refer to §10.5)

Finally click the browse button of the emissivity map, choose a name and location for the resulting file, then click the **Create map** button.

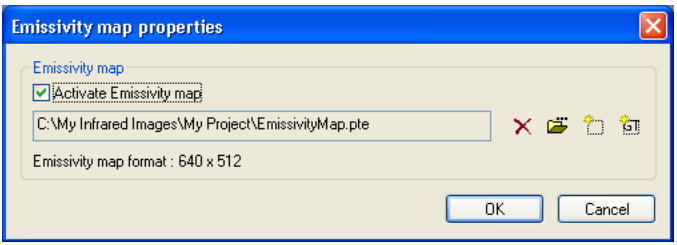


The Optimal Background Equivalent Temperature (OBET) is the calculated background temperature for which the mean temperature of the chosen area will be as close as possible to the equivalent black body temperature. The OBET temperature is to be used in the radiometry module as the background temperature. This range is stored within the emissivity map for later use. The information is shown by displaying the image information window (see §8).

Once created, the map will apply automatically to the current image, if the **Use Created Map** check box is selected.

21.2.2. **Load an existing emissivity map**

You can apply an emissivity map to any document which size fits with the map size. When you click on the **Browse File** button, an open file window will pop up and prompt you to select any (*.pte) file stored in your PC.



Once loaded, click **OK**.

21.2.3. **Unload current emissivity map**

You can unload current emissivity map by clicking on the **Remove file** button.

21.2.4. **Activate an emissivity map**

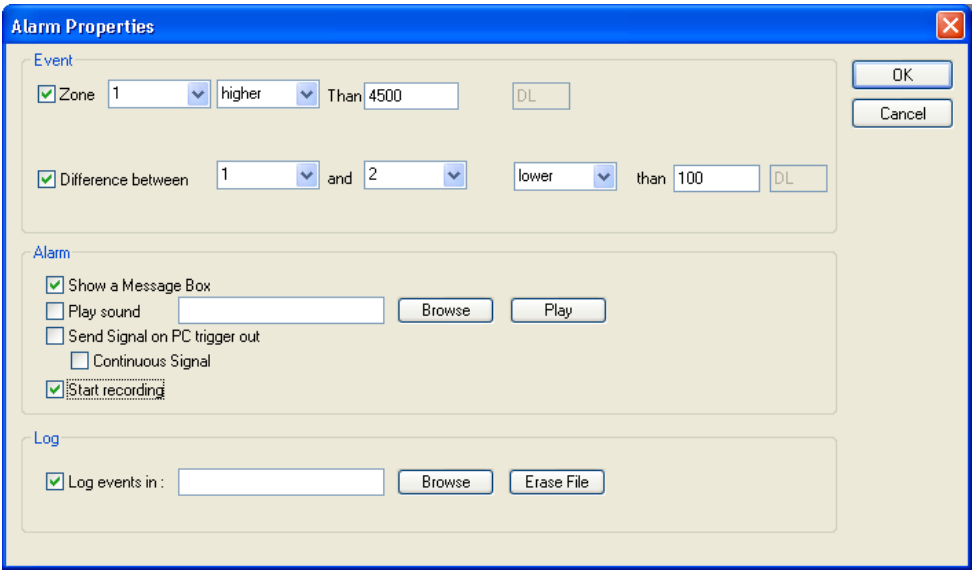
Activate the loaded emissivity map on focused document. This document must have the same size than the map.

21.3. Alarm

The alarm plugin allows you to be notified when one or two specific areas within a scene fulfil some user defined temperature conditions like passing over or under a threshold, or showing a difference of temperature between them lower or higher a temperature threshold.

21.3.1. Set up an alarm

Open the alarm properties window, which allows you to define the triggering event of the alarm as well as the kind of notifications you want to receive.



In the example above, we have defined two areas (1 and 2), on which we want to be notified whenever area 1 temperature is getting higher than 4500 DLs, and when the temperature difference between areas 1 and 2 is getting lower

than 100 DLs. In both cases, you'll be notified by a message box, and the record of the scene will start.

21.3.2. Enable/Disable alarm

Once you've specified the alarm properties, click on this button to enable/disable the alarm.

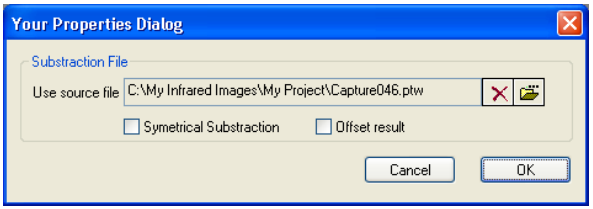
21.4. Frame subtraction

You can subtract one frame by another, which means that each pixel of the source frame is the result of the subtraction in DL of the source frame's pixel minus the subtraction frame's pixel.

$$result = Source\ Frame - Subtraction\ Frame$$

21.4.1. Select subtraction frame

Open properties window to select the subtraction file and choose the subtraction method (symmetrical or offset).



21.4.2. Subtract two frames

Subtract the focused Altair document (source frame) by the selected subtraction frame.

21.5. Frame threshold

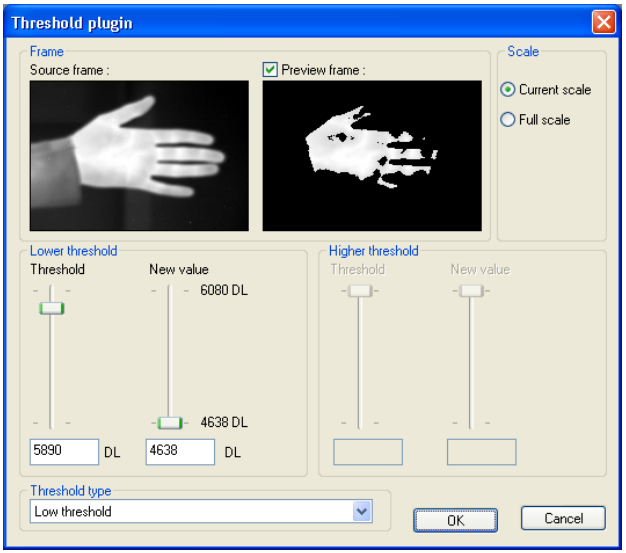
You can "mark" each pixel of an image that is either under or above a specific digital level, called threshold, or between two specific digital levels.

 Open threshold properties window

 Apply threshold to currently focused document.

21.5.1. **Low threshold**

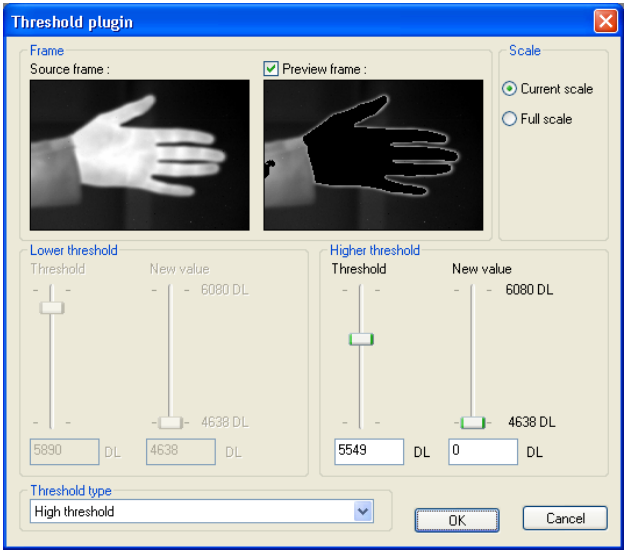
Define the DL you wish to use as low threshold, and then choose the new DL that will mark each pixel below the threshold.



In this example, every pixel under 5890 DL is "marked" and displayed at 4638 DL.

21.5.2. **High threshold**

Define the DL you wish to use as high threshold, and then choose the new DL that will mark each pixel above that threshold.

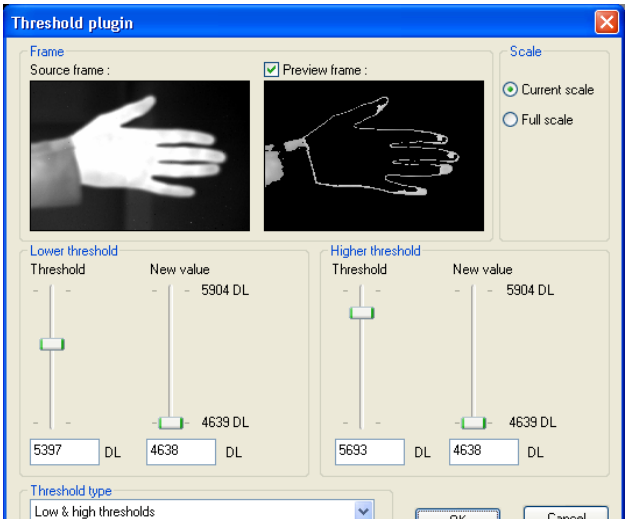


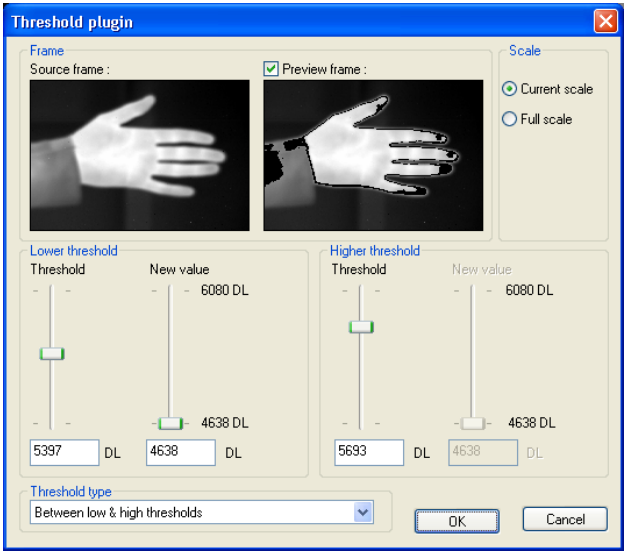
In this example, every pixel above 5549 DL is "marked" and displayed at 4638 DL.

21.5.3. **Low & High threshold**

You can apply both low and high thresholds to a frame. The result is that every pixel under the low threshold or above the high threshold will be "marked". You can specify two different replacement DLs, one for pixels under low threshold and one for those above high threshold.

You can also mark the pixels within the DL range defined by the two thresholds, by selecting "**Between low & high thresholds**".


Threshold plugin
Frame
Source frame :
Preview frame :
Scale
Current scale
Full scale
Lower threshold
Threshold
New value
5904 DL
4639 DL
5397
DL
4638
DL
Higher threshold
Threshold
New value
5904 DL
4639 DL
5693
DL
4638
DL
Threshold type
Low & high thresholds


Threshold plugin
Frame
Source frame :
Preview frame :
Scale
Current scale
Full scale
Lower threshold
Threshold
New value
6080 DL
4638 DL
5397
DL
4638
DL
Higher threshold
Threshold
New value
6080 DL
4638 DL
5693
DL
4638
DL
Threshold type
Between low & high thresholds
OK
Cancel

21.6. Filters

You can apply filters based on convolution matrices. Each pixel of a frame is processed with an (NxM) kernel matrix that uses pixel's neighbourhood, using following algorithm:

$$result = \frac{\sum\sum_{i=0}^{i<N}{}_{j=0}^{j<M} source(i,j) * kernel(i,j)}{divisor} + bias$$

Altair gives you a bunch of predefined useful filters such as low pass, high pass and "find edges". You can also define your own custom filters.

21.6.1. Low pass filter

Apply low pass filter (blur) to currently focused image.

21.6.2. High pass filter

Apply high pass filter (sharpen) to currently focused image.

21.6.3. Find edges filter

Apply a "find edges" filter to currently focused image.

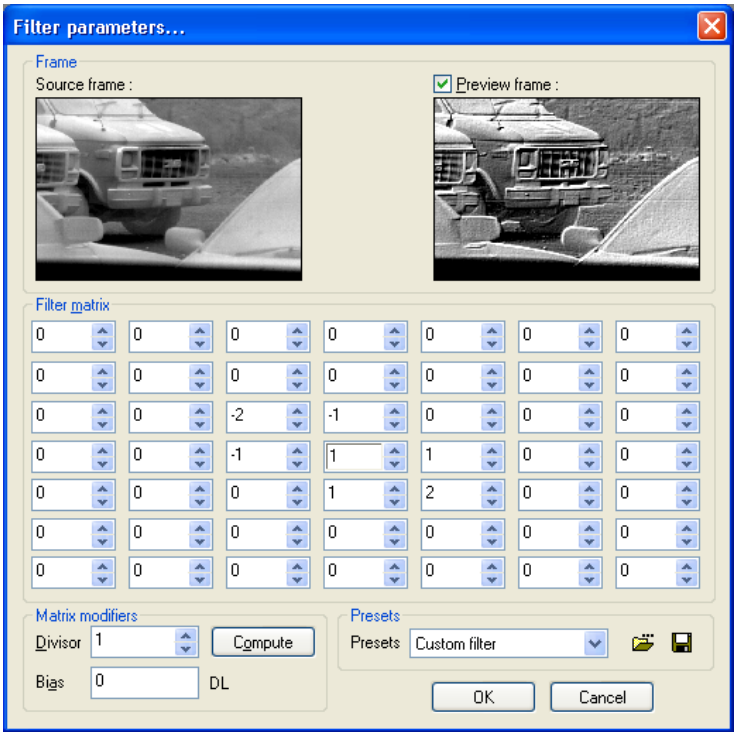
21.6.4. Custom filters

Apply a user defined filter to currently focused image.

21.6.5. Create/Load/Save a custom filter

Open filter definition tool.

To create a custom filter, you must specify the kernel matrix, the divisor and the bias.



In the example above, we've created an emboss filter. You can either:

Save this filter as a (*.flt) file

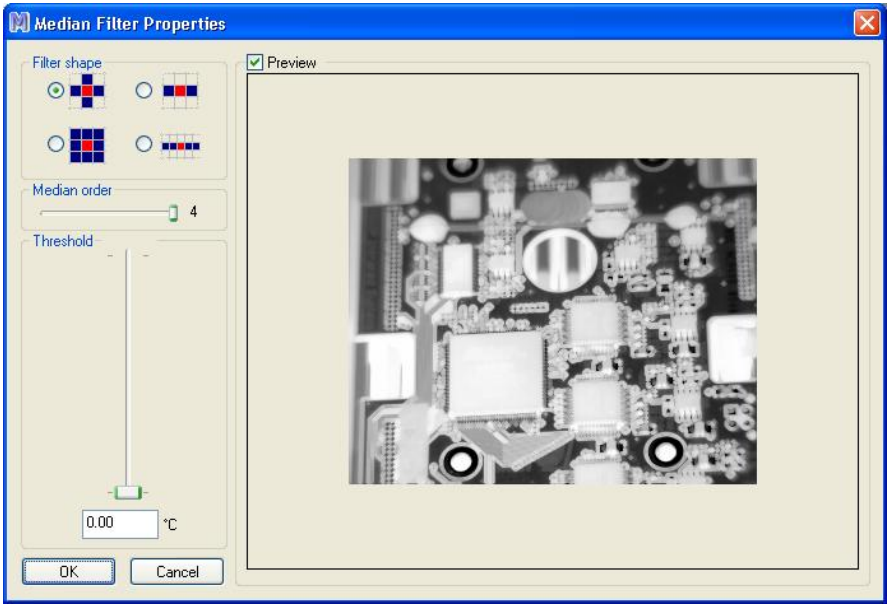
Load another custom filter (*.flt) file

21.7. Median Filter

You can use a non linear median filter to clean a noisy image. This filter smoothes the data while keeping the small and sharp details.

Each pixel of the image will be replaced by the median value within a set of pixels in a neighbourhood.

Open median filter properties window.



You can select the shape of the neighbourhood in which the median value will be searched, set the median order, then click **Ok**.

Apply median filter to currently focused image.

22. Quitting Altair

To quit Altair, call up the **File>Quit** menu. An alert window prompts you to save the modified files (frames, tools, averages, etc.).