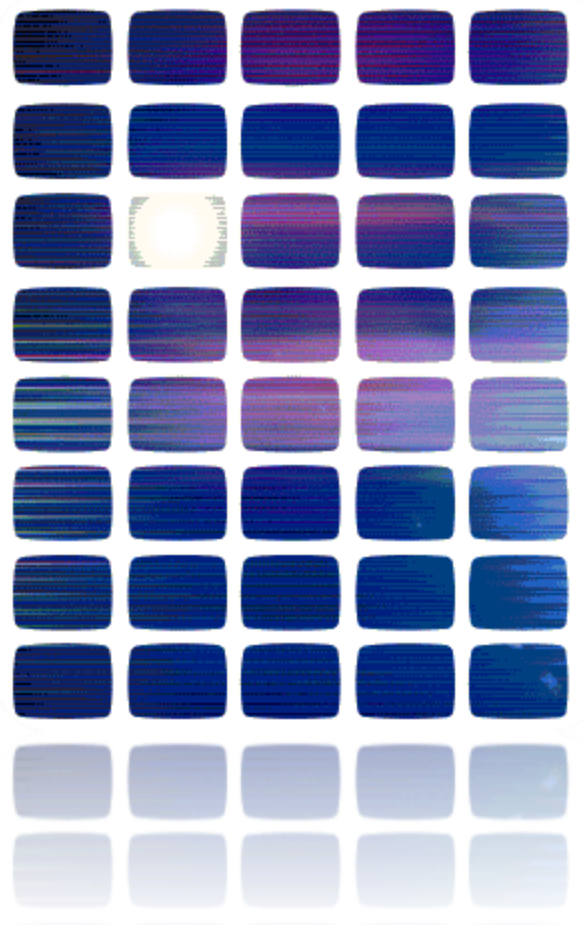


HardingFPA

CAMBRIDGE RESEARCH SYSTEMS

HardingFPA-XLite User's Manual

This manual details how to use the HardingFPA-XLite system.

For HardingFPA-XLite Version 3.1.0

Documentation date: 23/01/2013.

Overview

The *HardingFPA-XLite* is a file-based version of the HardingFPA Broadcast Flash and Pattern Analyser, which is capable of analysing High Definition (HD, up to 1080i60). It analyses using new Version 3 analysis algorithms, which have been designed specifically for HD standards and file analyses. For compatibility the software can be switched to use SD Legacy Mode, which allows SD material to be analysed using Version 2.5 analysis algorithms which are the same as in the previous 2.54/2.57 versions of the *HardingFPA*, and Version 1.x of the *HardingFPA-X* file-based systems.

It is a limited version of the full HardingFPA-X system that is designed to run on a single computer and allow analysis of a single movie file at any one time. The *HardingFPA-XLite* has the ability to output PDF Certificates only (although no detailed reports are available - only single page pass/fail reports).

This manual covers both the Mac OS X and Windows versions of the *HardingFPA-XLite*, which operate in an identical manner.

System Requirements

The *HardingFPA-XLite* is cross platform, and can run on both Windows and Mac computers.

The *HardingFPA-XLite* will run on Intel powered Mac computers running OS X 10.6 (or later).

For Windows platforms, the *HardingFPA-XLite* has been tested on Windows® 7 (or later).

Optimum performance will be obtained with multi-core processors, and at least 1 GB of RAM. The provided HASP USB software protection key will need to be inserted into the computer for the application to run, and will not operate without one.

The *HardingFPA-XLite* will analyse any movie file for which the computer it is installed on has the codec, and will attempt to open all files with the following file extensions:

***.avi;*.mov;*.mpg;*.mpeg;*.m2v;*.mp4;*.vob;*.wmv;*.mxf;*.flv**

QuickTime Codecs are not provided with the *HardingFPA-XLite*; therefore any required codecs will need to be installed on the computers to be used.

In general, if the file can be viewed correctly using QuickTime (or QuickTime or Windows Media Player on Windows installations) on the computer that the application is running on, then it will be able to be analysed, although the video must fall within the whitelist for Accepted Video Formats.

Movie Files

The system will open and attempt to analyse any movie file for which the computer it is installed on has the codec. There are number of codecs included (see below). Any further codecs required will need to be installed on the computer(s) running the application.

Only movie files with the following extensions will be analysed:

***.avi, *.mov, *.mpg, *.mpeg, *.m2v, *.mp4, *.vob, *.wmv, *.mxf, *.flv, *.qt, *.ps, *.3gp, *.mkv, *.m2ts**

In general, if the file can be viewed correctly using QuickTime (or Windows Media Player) on the computer that the application is running on, and is within the accepted limits for frame size and frame rate (see below), then the application will be able to analyse it.

The list of accepted frame sizes and frame rates are as follows:

Legacy SD analysis frame sizes:

320x240, 352x288, 384x288, 640x480, 640x486,

702 – 720 x 480

702 – 720 x 486

702 – 720 x 576

768x576

Legacy SD analysis frame rates:

25, 29.97

Version 3 SD analysis frame sizes supported:

320x240, 352x288, 352x240, 384x288, 480x360, 640x360, 960x540 640x480, 854x480, 640x486, 854x486,

702 – 720 x 480

702 – 720 x 486

702 – 720 x 576

768x576, 1024x576,

Version 3 HD analysis frame sizes supported:

960x720, 1280x720, 1440x1080, 1920x1080

Version 3 analysis frame rates:

24, 25, 29.97, 30, 50, 59.94, 60

The HardingFPA-X uses the following frameworks to access video frames:

- FFmpeg
- QuickTime
- DirectShow (on Windows only)

When presented with a file, a framework is selected based on the movie file extension.

MXF Files

An attempt is made to open the MXF file using the internal MXF library. This library has support for OP1A and OP ATOM wrapped MXF files with the following codecs:

- D10 (IMX)
- DV
- DVCPRO
- DVCPRO HD
- DNxHD
- AVC Intra

If the internal MXF library does support the MXF file format, then the FFmpeg library is used to decode these frames. The MXF library includes support for AVID MXF files as well as MXF time code tracks.

If the MXF file format is **not** supported by the internal MXF library, an attempt is made to use the FFmpeg library to open the file directly.

On Windows platforms, if all else fails an attempt to use DirectShow (using any codecs installed in the system) will be made. If this is successful, an attempt will be made to use the VITC information, if any, embedded in the video material.

MOV Files

The QuickTime library will be used to open QuickTime files. File support depends on the QuickTime codecs that are installed on the computer used for analysis. The QuickTime library supports QuickTime timecode tracks. The system does not support multi-track QuickTime movies.

Other Files

Firstly the use of FFmpeg is attempted, followed by an attempt (on Windows platforms only) to use the DirectShow framework, and finally the QuickTime framework.

Why use FFmpeg?

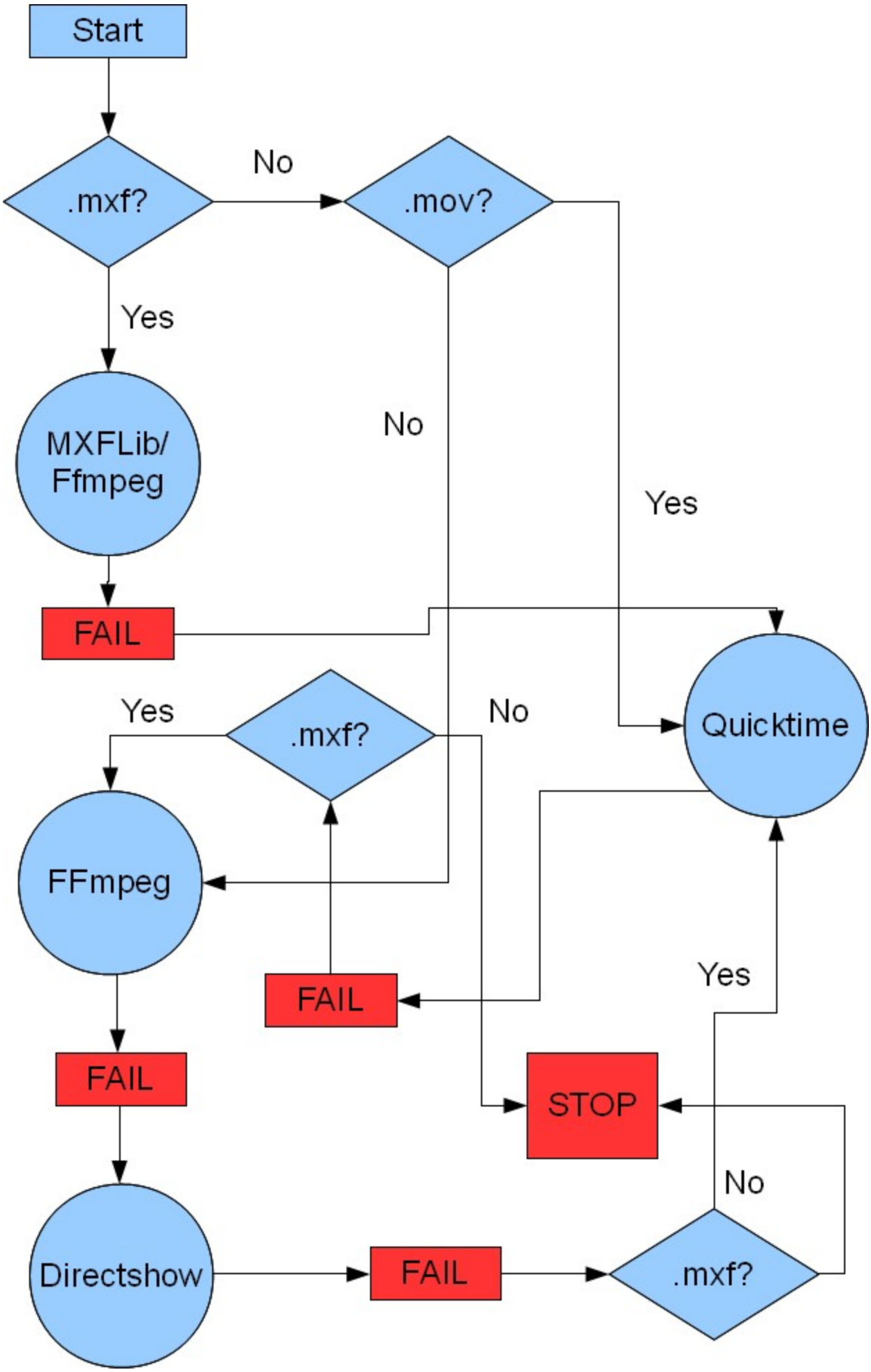
- FFmpeg provides a uniform set of embedded codecs that allow for consistent results across different platforms and installations.
- If a previous version of the application used DirectShow or QuickTime, and a newer version uses FFmpeg, there is a possibility that the results will differ due to the slight differences between codec algorithms. The use of FFmpeg in current and future versions of the HardingFPA product range will mitigate this problem.
- FFmpeg in many cases removes the requirement of purchasing 3rd party MXF support and codecs as the MXF library, in conjunction with FFmpeg, now fulfils this requirement.

The FFmpeg library supports the following codecs:

D10 (IMX), DV, DVCPRO, DVCPRO HD, DNxHD, MPEG1VIDEO, MPEG2VIDEO, H261, H263, RV10, RV20, MJPEG, MJPEGB, MPEG4, MSMPEG4V1, MSMPEG4V2, MSMPEG4V3, WMV1,

WMV2, H263P, H263I, FLV1, H264, INDEO3, VP3, THEORA, ASV1, ASV2, FFV1, MSVIDEO1, SNOW, XVID, FFVHUFF, INDEO2, FRAPS, VP5, VP6, VP6F, FFH264.

The decision tree that is used to decide which framework to use is shown in the flowchart below:


Start
.mxf?
No
.mov?
Yes
MXFLib/
Ffmpeg
No
Yes
FAIL
Yes
.mxf?
No
Quicktime
FFmpeg
FAIL
Yes
FAIL
STOP
No
Directshow
FAIL
.mxf?

Licensing

The *HardingFPA-XLite* must be licenced with a USB hardware protection key in order to run (see below).

Once it has been run on a particular computer, it will **only be allowed to run on that same computer**, although there is limited scope for de-registering the product to move it to another computer (once per week).

Reregistering

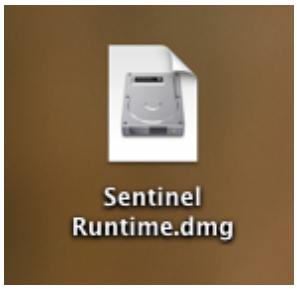
If you move the USB protection key to a new computer and run the *HardingFPA-XLite*, you will be given the option to transfer the licence to the new computer, as long as one week has passed since the last re-registration / first registration. The re-registration screen is shown below:

Only one re-registration is possible in a week long period, so be certain that you wish to move the licence to the new computer, otherwise you will see the dialogue box below:


HardingFPA-XL
The application has been moved to another computer. You may De-Register the application once per week. Please wait 7 days until you can De-Register.
OK

Prerequisites (Mac OS X)

In order to work correctly, a USB HASP key must be installed, and therefore the drivers for this must be installed. To install these, click on the **SentinelRuntime.dmg** icon.



This will then mount the disk image containing the driver installer. This screen can be seen below. Double-click on the **Install HASP USB Driver** icon within this image to install the driver.

The HASP Installer disk image contents

Installation (Mac OS X)

Before continuing, note that the HardingFPA-XLite software locks itself to the current machine, but can be moved once per week.

Once the prerequisites are in place, simply open the HardingFPA-XLite disk image and run the installer within. The application will be installed in **Applications -> HardingFPA** as *HardingFPA-XLite*.

Installation (Windows)

Before continuing, note that the HardingFPA-XLite software locks itself to the current machine, but can be moved once per week

The *HardingFPA-XLite* requires the QuickTime framework in order to operate, which can be obtained from:

http://www.apple.com/quicktime/download/

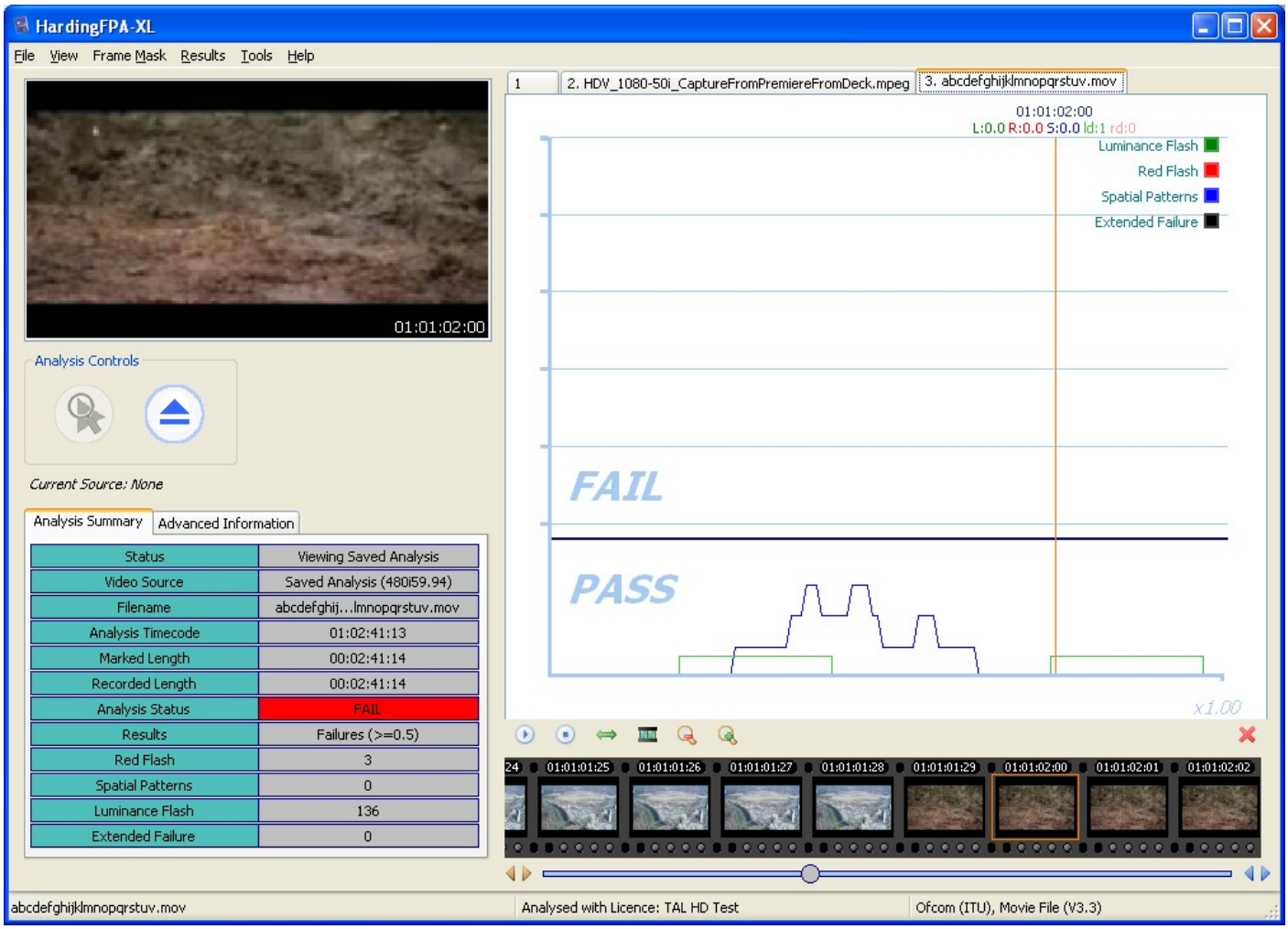
The Windows installer is self-contained (it includes the HASP drivers and the *HardingFPA-XLite* software). To install it, simply run the *HardingFPA-XLite* installer. The application will be installed in the **HardingFPA** section of the Start Menu as *HardingFPA-XLite*.

The Main Screen

Upon running the *HardingFPA-XLite*, the main screen will be displayed. This is the main and only screen for the *HardingFPA-XLite* and is shown below.

It displays a graphical representation of the characteristics of the analysed clip, and some additional advanced diagnostic information, so that the user may quickly and efficiently view the locations of failures or cautions in the source material, and optionally play back the areas around these failures to aid in rectifying the offending material. Its appearance is similar to both the *HardingFPA HD* and *HardingFPA-X Viewer* applications.

All functionality of the *HardingFPA-XLite* is performed from this screen.



The main HardingFPA-XLite screen

All of the buttons and sections of the *HardingFPA-XLite* screen have help text associated with them. To see what a particular part of the interface does, simply hover the mouse cursor over the button/section.

A large version of the thumbnail at the current cursor position is shown on the top left hand side of the screen.

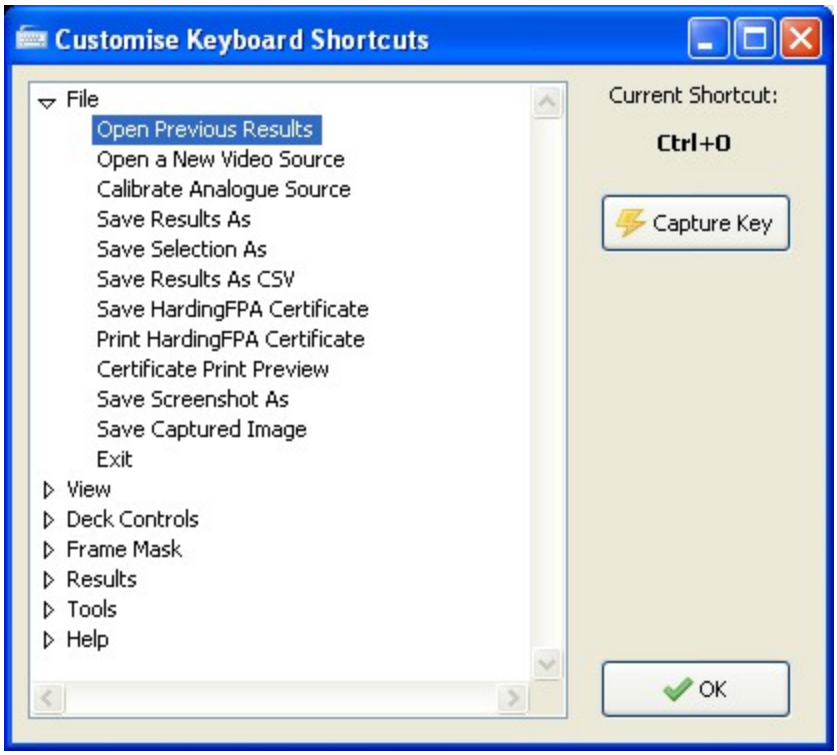
The results can be browsed either by dragging the graph display left and right or by moving the scroll bar located at the bottom of the screen. Clicking the left and right cursor keys will move the results one frame at a time.

To the right of this scroll bar there are two buttons which will move the cursor to the next or previous failure. To the left are two buttons which will move the cursor to the next or previous warning.

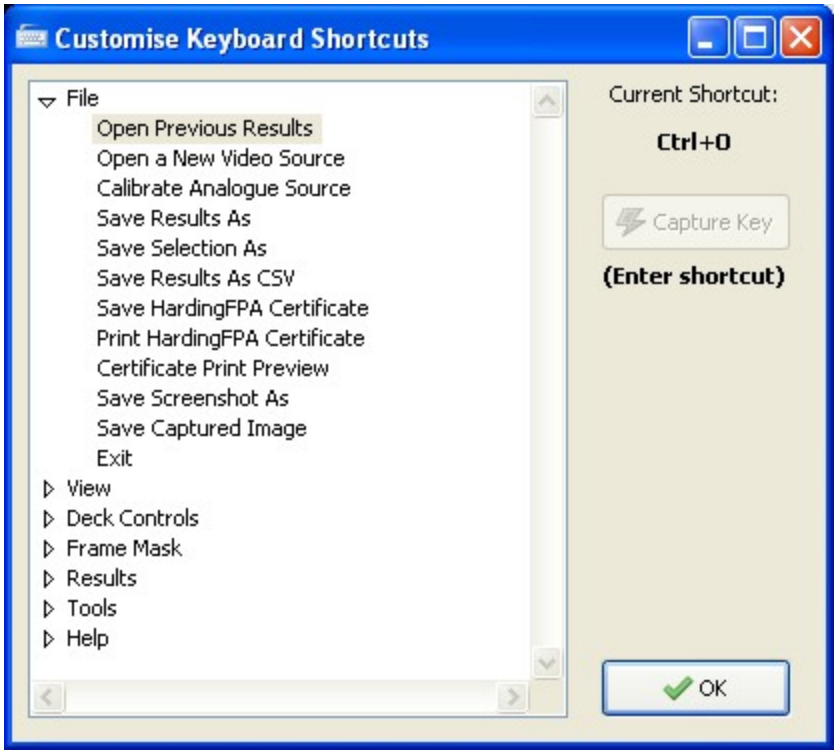
Customising Keyboard Shortcuts

All shortcuts in the *HardingFPA-XLite* can be modified. To do this the software must be running as an administrator. A menu item under the *Tools* menu then appears with the ability to *Modify* the shortcuts, and to *Reload Default* values. Once the values have been changed, the configuration for the shortcuts is stored in the file **HfpaXL.xml** which is placed in the executable directory. This file can then be backed up and/or copied to other *HardingFPA-XLite* installations if the same shortcut configuration is required on more than one installation.

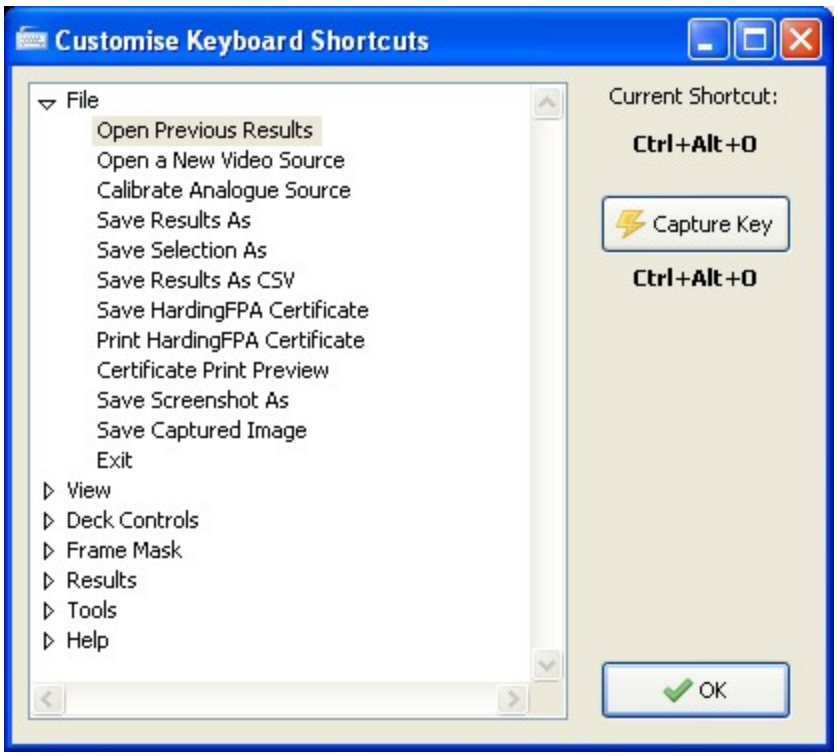
The *Customise Keyboard Shortcuts* window then appears:



Selecting a menu item displays its current shortcut. Click the *Capture Key* button to remap the shortcut for the selected menu item, The screen changes to capture the key as shown below:



At this point, press the key combination that is to be mapped to the shortcut for the select menu item. The new shortcut is bound, and the screen changes to reflect this, as shown below:



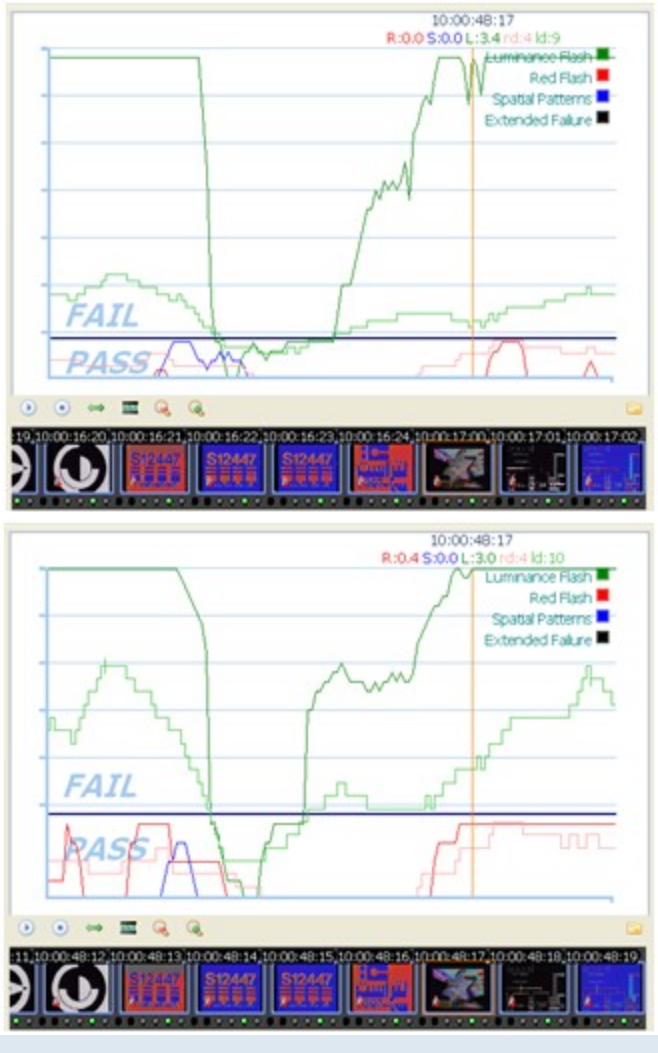
Version 3 Analysis Algorithms

HardingFPA software now features new analysis algorithms, which are better tuned to High Definition and File-based work.

The Version 3 analysis algorithms are better suited to accommodate subtle changes in the image data, and provide much closer results when testing the same material repurposed either into a different video format, or encoded with a different codec. The main differences between the legacy algorithms and the Version 3 algorithms are detailed below:

Different Graph Scaling

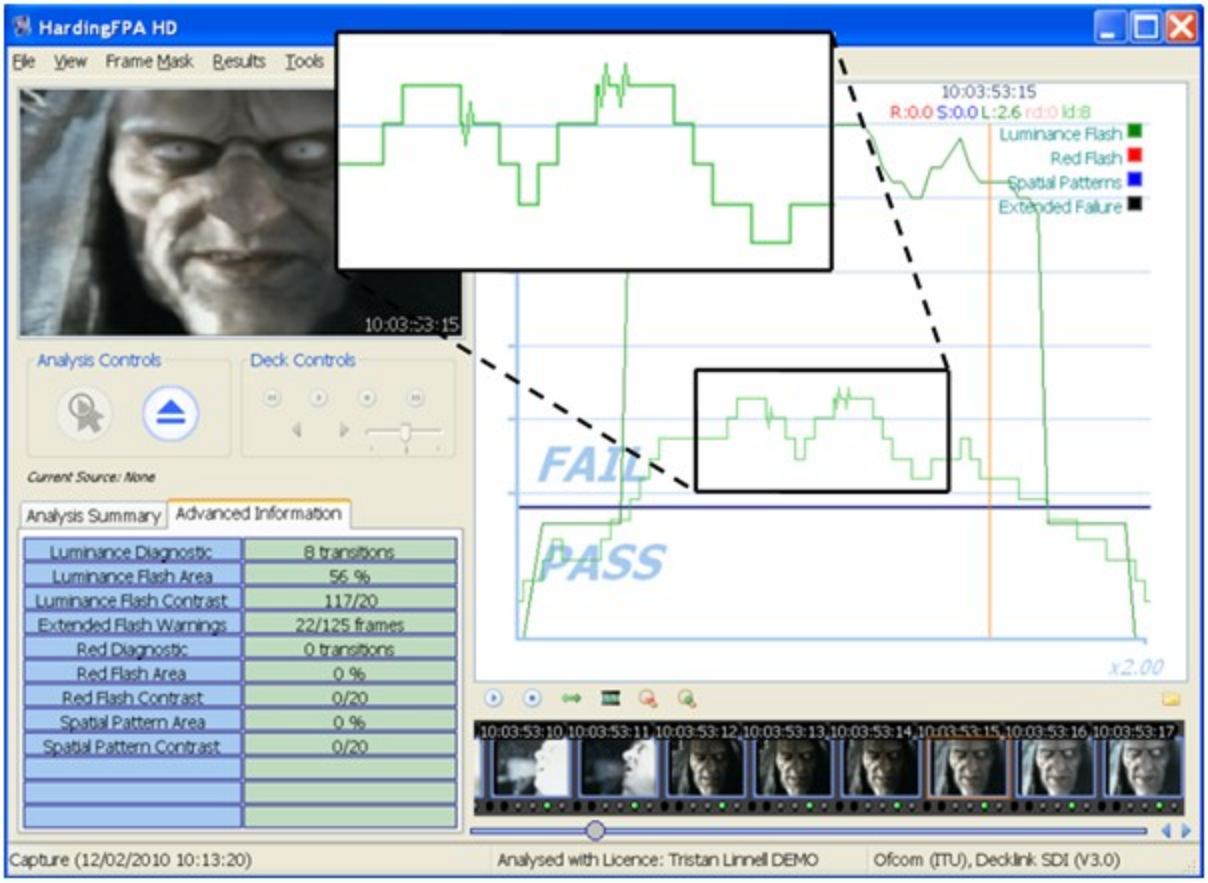
The HardingFPA generates risk values using the same range as its predecessor (i.e. 0 to 3.4) but displays the graphical data using a revised vertical scale. This modified scale allocates much more vertical space for risk trace warnings and diagnostic trace steps but only displays risk traces up to the value of 3.0. Risk traces values from 3.1 to 3.4 are still logged as part of the results files but are graphically displayed capped at 3.0.



(left) Version 2 and (right) Version 3 Graphing

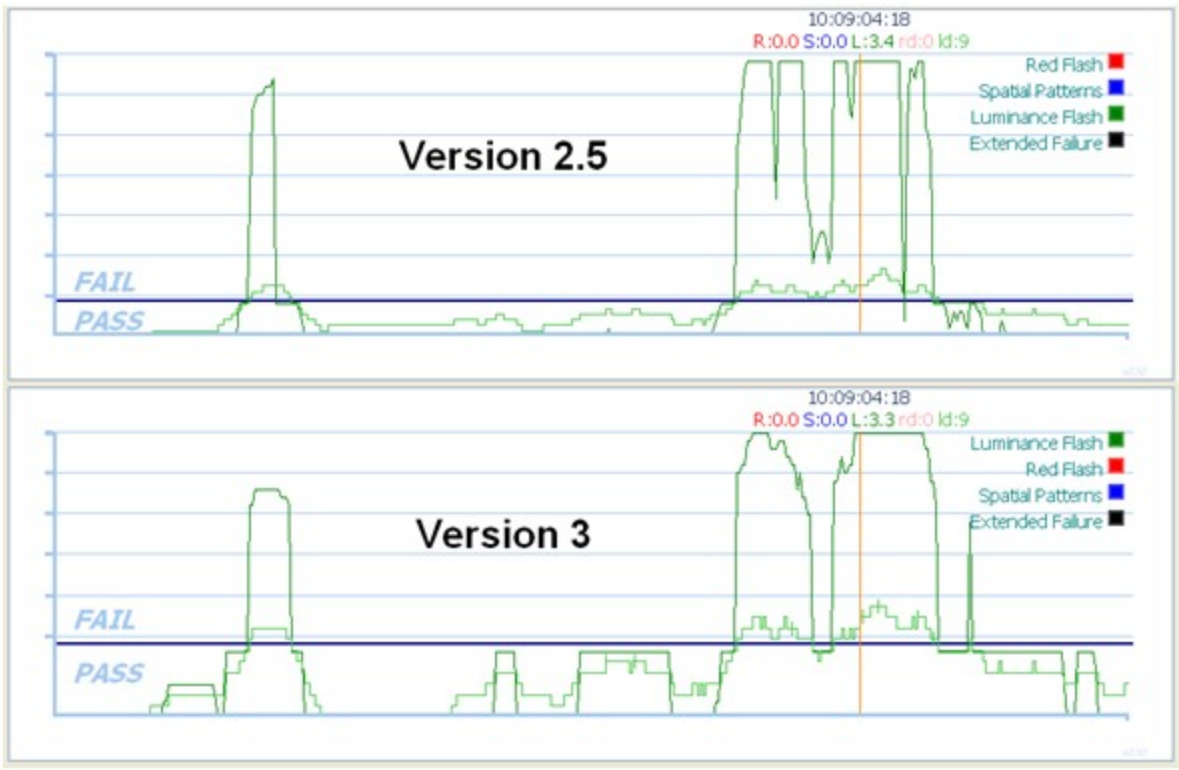
The Squiggle

The HardingFPA gives enhanced visual diagnostics when an incoming transition coincides with an outgoing transition from one exactly second earlier. The Version 3 algorithms insert a squiggle (see below) to indicate when the diagnostic trace has simultaneously gained and lost a transition over the most recent second between video frames.

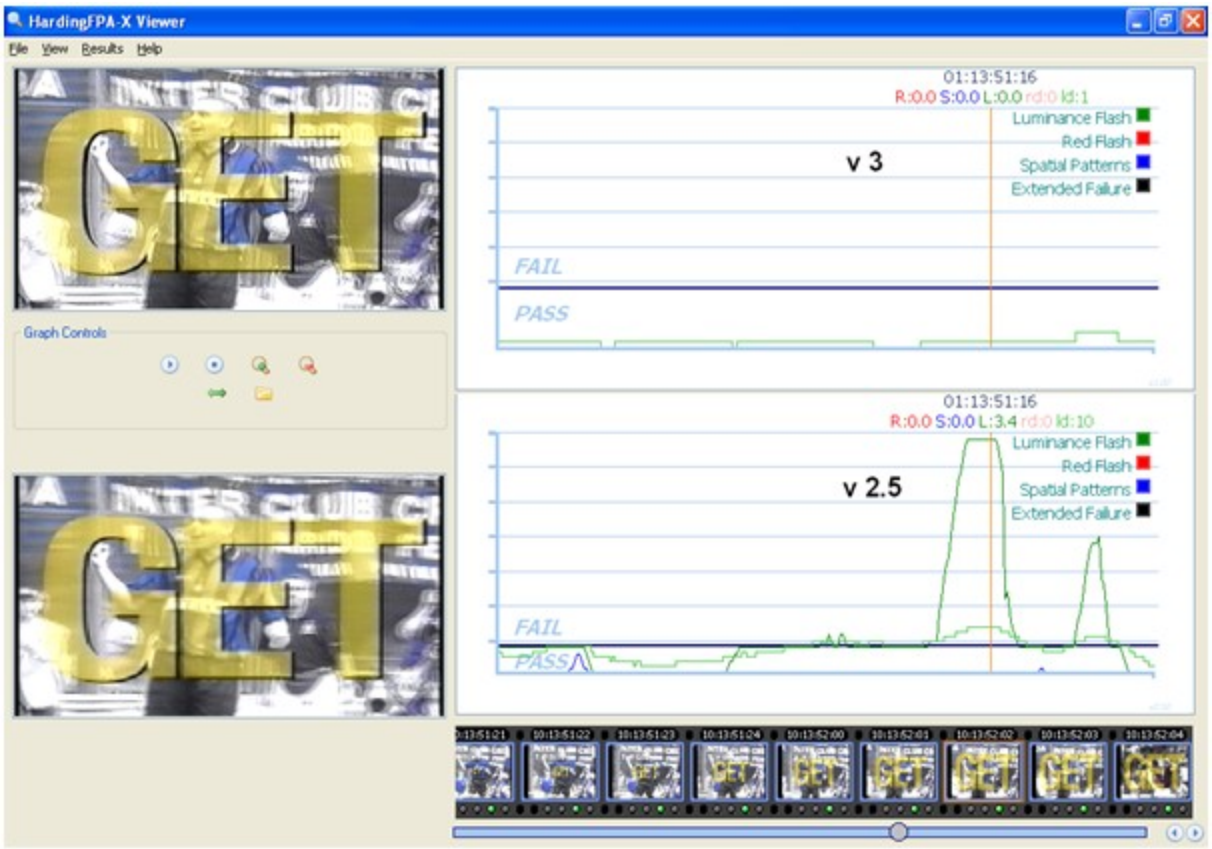


Analysis Results

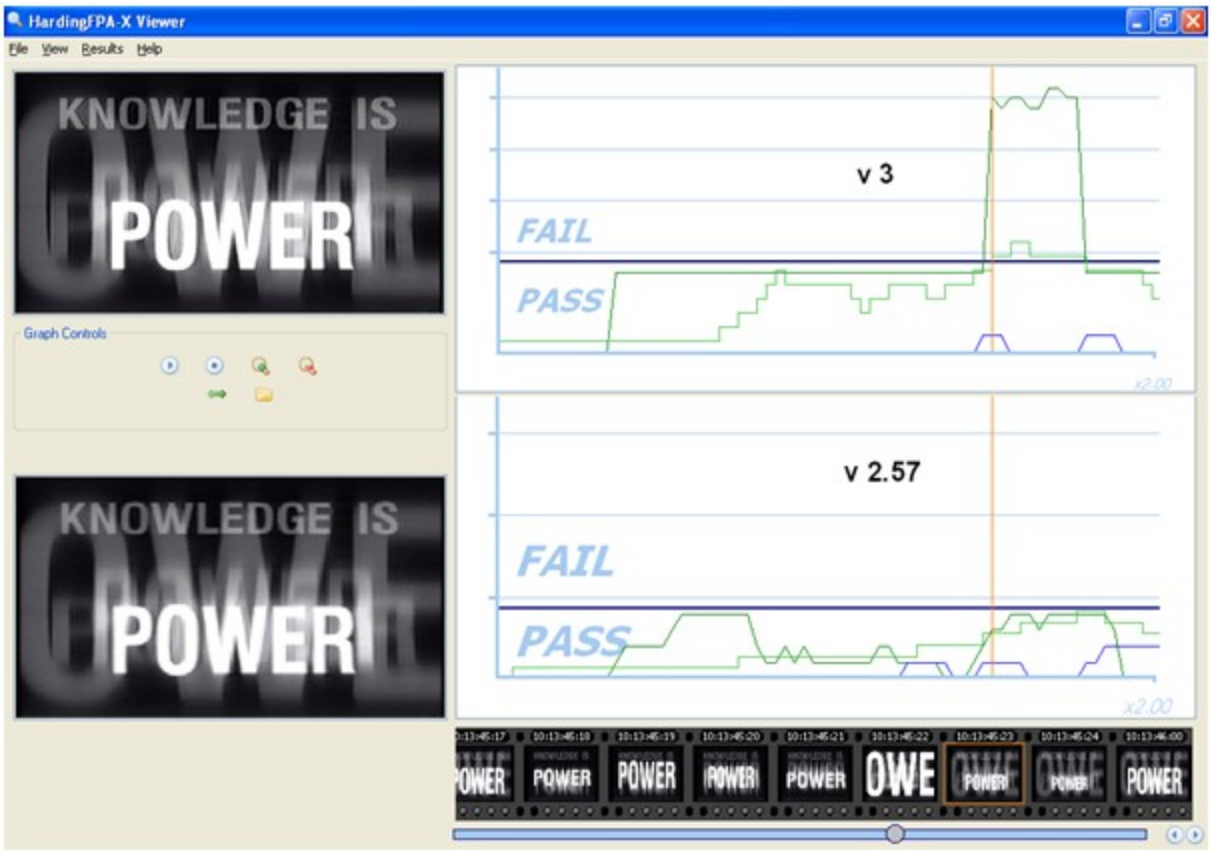
The Version 3 algorithms give results which are broadly similar to those generated by version 2.5. The figure below shows the results of both versions when analysing the same video input under the same guidelines:



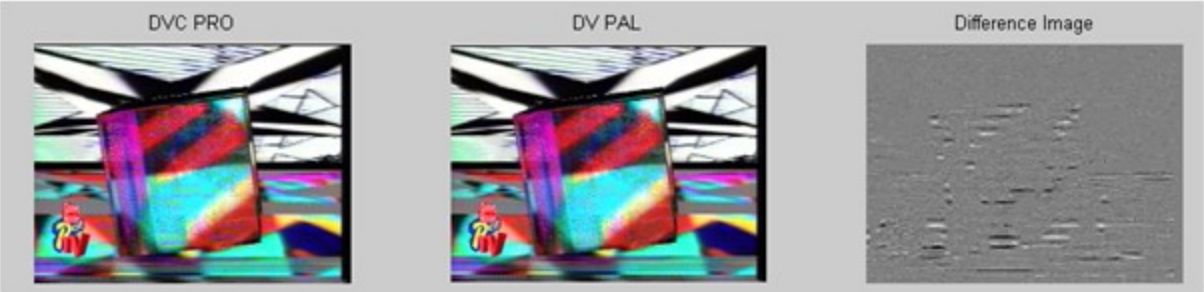
However, the results between the two versions will not be identical. The Version 3 algorithms will, in general, be more slightly more lenient to complex, rapid motion:



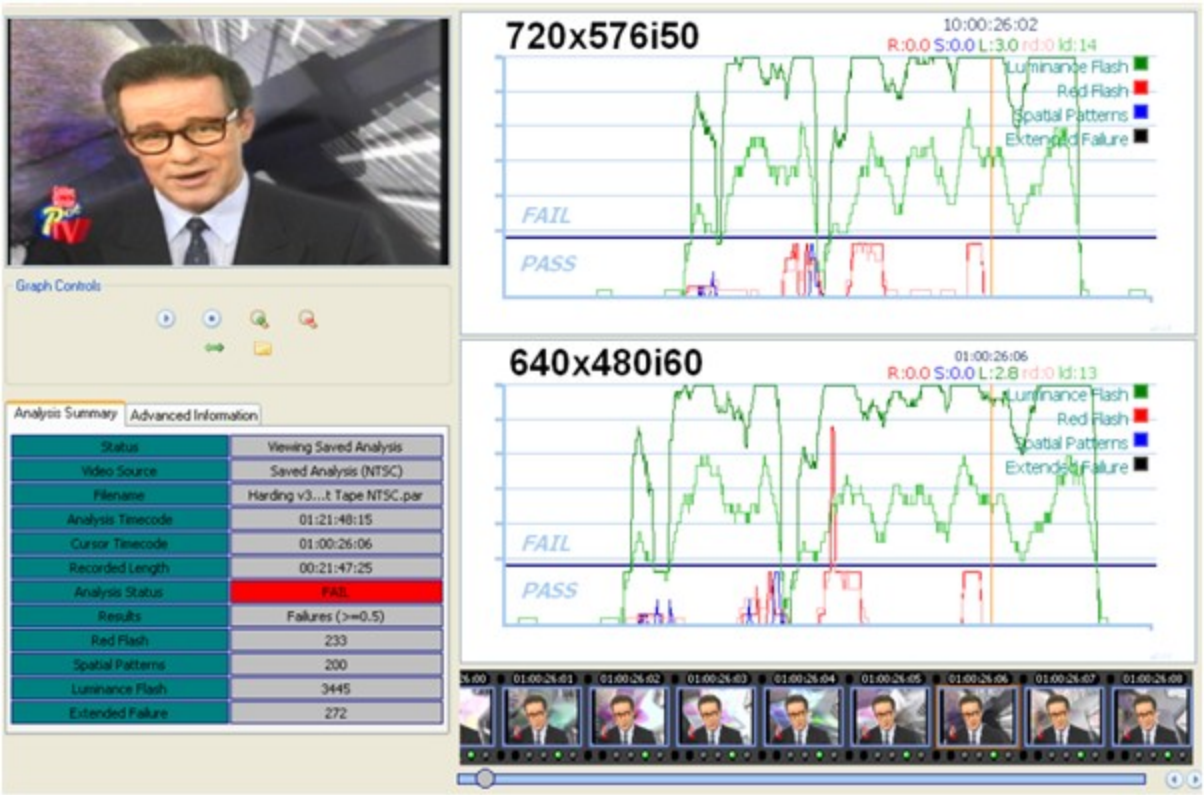
... but more strict to examples of powerful, localised flashing:



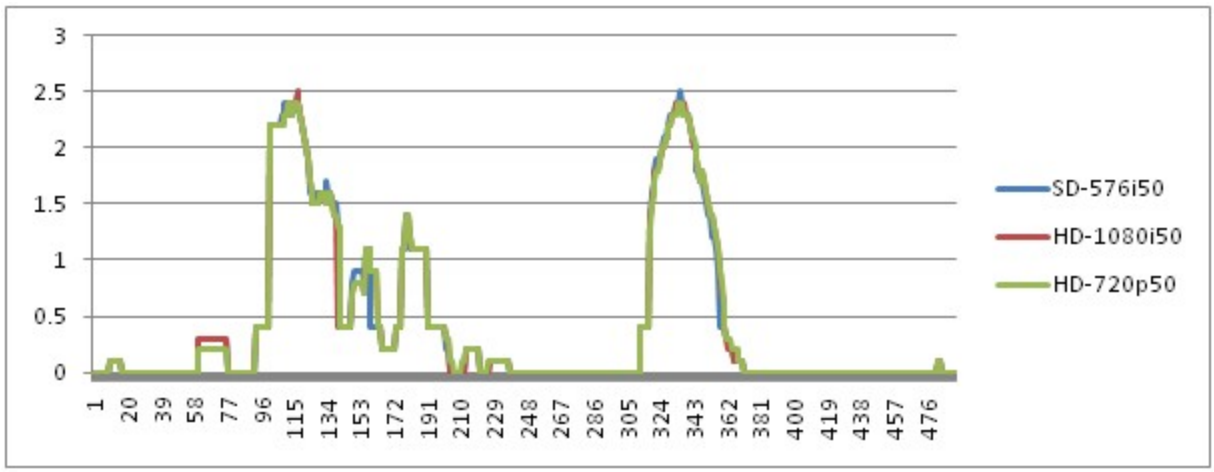
Most importantly of all, the Version 3 algorithms have been designed to be as format-agnostic as possible. Changes in file formats or codecs will alter the underlying video data even if these changes are not visually apparent. Here, the same video has been encoded at the same resolution using two different codecs. The absolute differences between the two images are shown in the third image as deviations from mid grey.



The Version 3 algorithms generate highly consistent results from different image resolutions and frame rates. Here, the same movie has been analysed in 720x576i50 and 640x480i60 formats. The only noticeable difference is in the horizontal graph scale due to the different frame rates.



The graph below shows three sets of luminance flash risk results of the same movie analysed in SD-576i50, HD-720p50 and HD-1080i50 formats, and highlights the considerable similarities in the results:


3
2.5
2
1.5
1
0.5
0
1
20
39
58
77
96
115
134
153
172
191
210
229
248
267
286
305
324
343
362
381
400
419
438
457
476
SD-576i50
HD-1080i50
HD-720p50

Operation

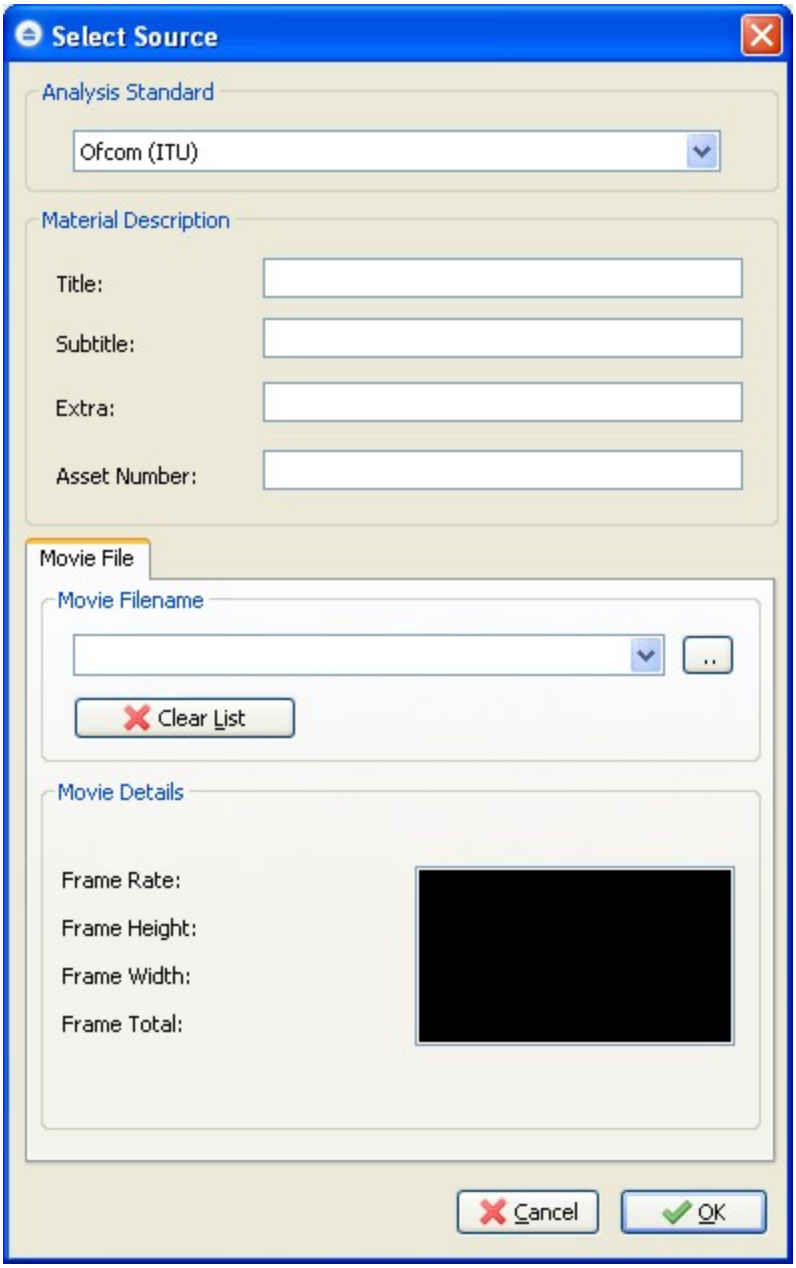
The *HardingFPA-XLite* has three tabs available for analysing movie clips, in order to allow you to work on reviewing one piece of material whilst another is still analysing, or to work on reviewing multiple parts of an edit at the same time (if you were to analyse reference clips for example). Each tab has its own results set, and therefore its own graph etc, and operates independantly of the other tabs.

Only one of these tabs may actually be in the process of analysing a clip at any one time, although after the analysis is complete, you may switch tabs and analyse another clip whilst keeping the results visible in the first tab. This is especially useful if you have a major project open and analysed in the first tab and you need to analyse clips from it in the other two tabs whilst keeping the original results visible.

Opening a Source

The HardingFPA-XLite operates on a system of *Sources*, whereby a source (a movie file) can be open, and is only analysed when the analyse button on the main window is clicked. The currently opened source is always displayed below the controls on the main window, and on startup displays *Current Source: None* to depict the fact that no movie file has yet been opened. To open a new source, click the *Open New Source* button, shown below.

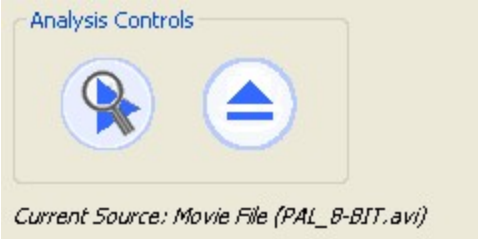
Clicking on the *Open New Source* button brings up the dialogue box shown below, where you may enter additional information in the form of the *Material Description*, that you require to appear on the PDF certificate. To browse for a new movie file, click on the small button labelled "..", or choose a recently selected movie file from the drop-down menu box. If you would like to clear this list at any time, click the *Clear List* button underneath.



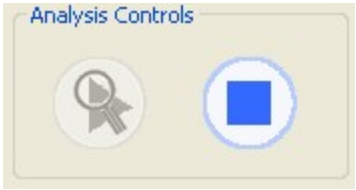
When ready to analyse the movie file, click OK and the *Current Source* notification on the main window will change to reflect the chosen movie file name.

Analysing a Movie

To start analysing the current source movie clip, click the Analysis button in the *Analysis Controls* section, on the left, shown below...



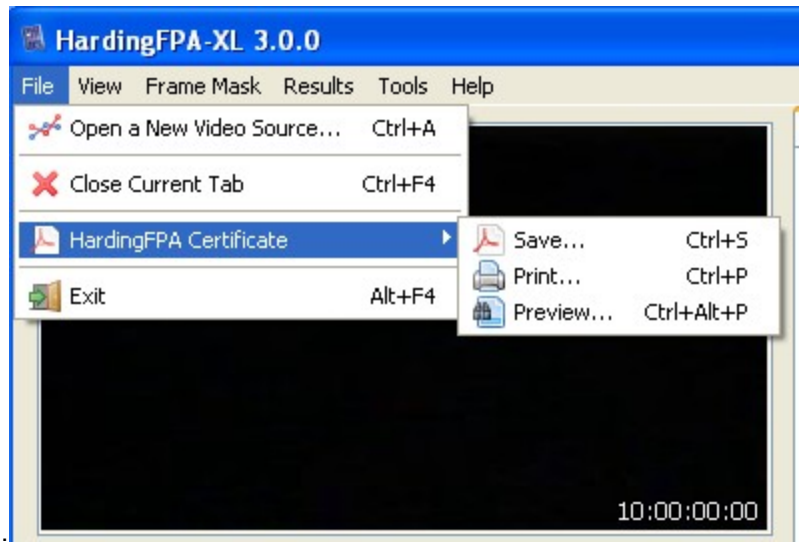
Once the movie clip is analysing the Open new Source button will change to a *Stop Analysis* button.



Whilst the analysis is being performed, you may still change tabs to view any results that are still open in those tabs. The small red LED light in the Analysis Controls will flash to let you know that a movie file is still being analysed.

To stop the analysis, click the *Stop Analysis* button (the big blue square in the Analysis Controls panel).

Once the analysis is complete, a basic PDF Certificate can be saved, printed or previewed by clicking *File -> HardingFPA Certificat*e



When you are finished with the clip, and wish to free up the tab for analysing other movies, click the *Close Current Tab* menu option or the red cross under the graph on the right.

Resuming Work

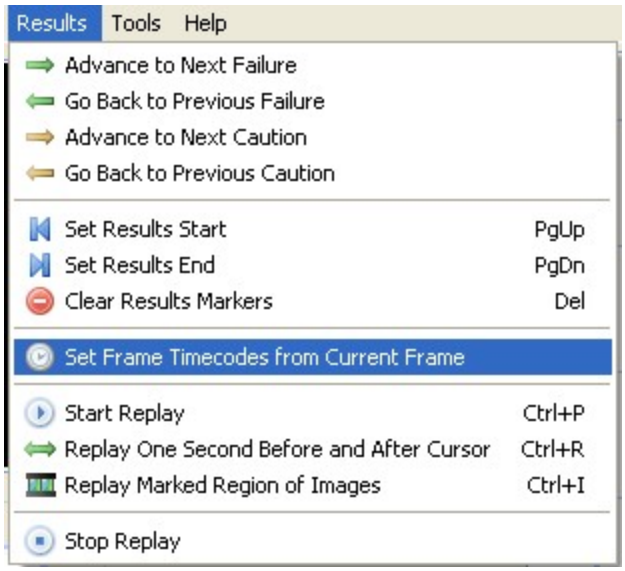
It is possible to resume working on a particular job between sessions using the *HardingFPA-XLite*. When the application is closed and re-opened, the open tabs are remembered by the application so that you may continue working. The settings for this are user specific, so that different user accounts may use the software and each user has their own saved tabs and results.

If the application is closed during an analysis, the clip will still be re-opened, but only up to the point where the analysis was stopped. You will need to re-run the analysis if you would like to continue where this left off.

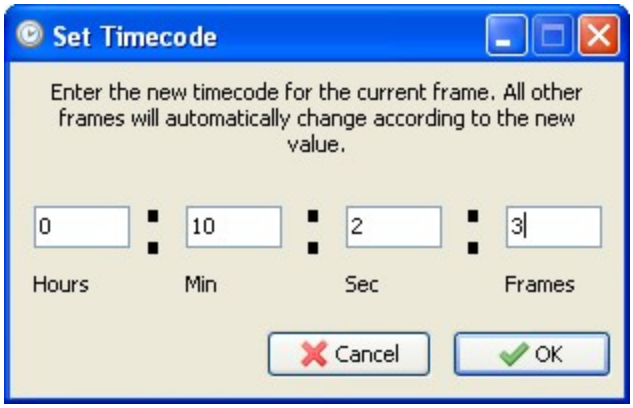
Note that once the close tab button (the cross underneath the graph on the right) is clicked, there is no way to get the results back without re-analysing the movie.

Renumbering Frames

After analysis is complete, or when a result has been reloaded, it is possible to renumber all of the frames based on the current cursor position. To do this, first move the cursor to the frame you wish to renumber and click the *Set Frame Timecodes From Current Frame* from the *Results* menu.



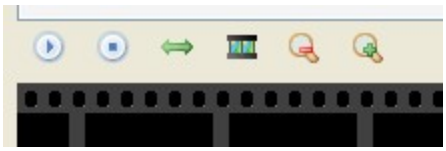
Now type the required timecode values into the pop-up window:



When *OK* is clicked, all frames in the result will be appropriately renumbered.

Replay Functions

With results displayed in the graph window, the clip and graph can be played back to aid the rectification of problem areas in the clip. The *Graph Controls* panel underneath the graph contains buttons to facilitate this replay functionality.



From left to right, the buttons perform the following functions...

Start Replay: Starts playback in real-time from the current position.

Stop Replay: Stops all playback.

Replay one second before and after current cursor position: Animate the images for one second before and one second after the current cursor position whilst leaving the graph positioned at the current cursor position. this is especially useful when you are looking for the causes of a particular failure and need to look at the graph in detail and yet still see the offending section being played back.

Replay marked region: Replays from the Start marker to the End Marker. Set marker positions by either right-clicking on the graph or pressing the Page Up and Page Down keys.

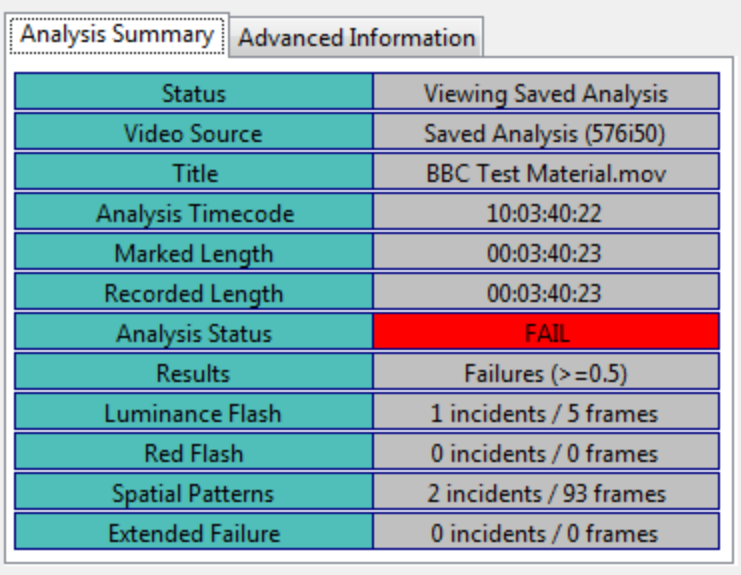
Zoom Out: Zoom the graph out.

Zoom In: Zoom the graph in to see the results more clearly.

In all playback modes, the playback will loop when reaching the end (after a small pause). The playback can be stopped at any time with the *Stop Playback* menu item or button, by clicking anywhere on the graph, by dragging the seek slider or by opening a new file.

Analysis Information

The table on the left hand side of the screen contains two tabs which display diagnostic information about the clip. The *Analysis Summary* tab shows the following pieces of information, which are applicable to the entire clip:



Status: Shows whether the HardingFPA-X is reviewing results or in another state such as loading/results/analysing/not loaded etc.

Video Source: The video standard of the analysis being viewed.

Filename: The filename or title of the source that was analysed to obtain the results currently being displayed.

Analysis Timecode: The timecode of the final frame in the clip. This is expressed in hours : minutes : seconds : frames.

Marked Length: The length of material currently marked off with *Begin* and *End* markers. This is expressed in hours : minutes : seconds : frames.

Recorded Length: The total length of the clip expressed in hours : minutes : seconds : frames.

Analysis Status: The Pass / Fail status of the clip with respect to the currently selected Flash and Pattern guidelines.

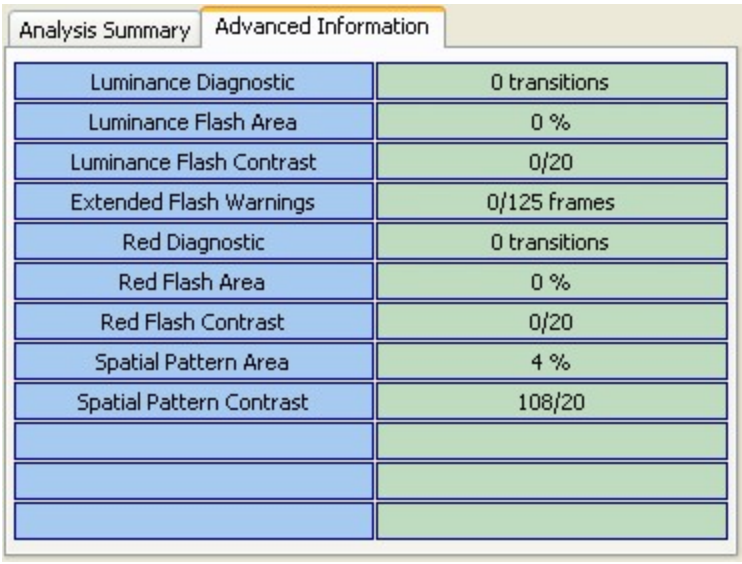
Luminance Flash: The number of incidents and frames that have exceeded the test guidelines for luminance flash.

Red Flash: The number of incidents and frames that exceed the test guidelines for red flash.

Spatial Patterns: The number of incidents and frames that have exceeded the test guidelines for spatial patterns.

Extended Failure: The number of incidents and frames that exceed the test guidelines for extended failure. This represents the number of frames for which the black trace has appeared or equivalently, the number of times that the maximum allowed number of flash warnings (levels 0.3 or 0.4) in the most recent 5 seconds has been exceeded.

In addition to this information, there is a second tab featuring *Advanced Information*. This tab contains detailed information corresponding to the individual frame at the current cursor position, and may be of use in determining the build up to a failure. The items described are as follows:



Luminance Diagnostic: This is the numerical value of the diagnostic plot shown on the graph. It represents the minimum number of transitions which the most active 25% of the image frame has seen in the most recent second.

Luminance Flash Area: The percentage area of the image frame which has exceeded the Flash Guidelines.

Luminance Flash Contrast: The average contrast of the area of the image frame which has exceeded the Flash Guidelines.

Extended Flash Warnings: The number of image frames which have generated flash warnings (levels 0.3 or 0.4) in the most recent 5 seconds.

Red Diagnostic: The number of red transitions which the most active 25% of the image frame has seen in the most recent second.

Red Flash Area: The percentage area of the image frame which has exceeded the Red Flash Guidelines.

Red Flash Contrast: The average amplitude of flash to and from saturated red of the area of the image frame which has exceeded the Red Flash Guidelines.

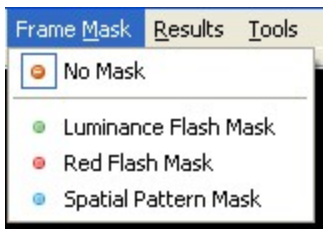
Spatial Pattern Area: The percentage area of the image frame which has exceeded the Spatial Pattern Guidelines.

Spatial Pattern Contrast: The average contrast of the area of the image frame which has exceeded the Spatial Pattern Guidelines.

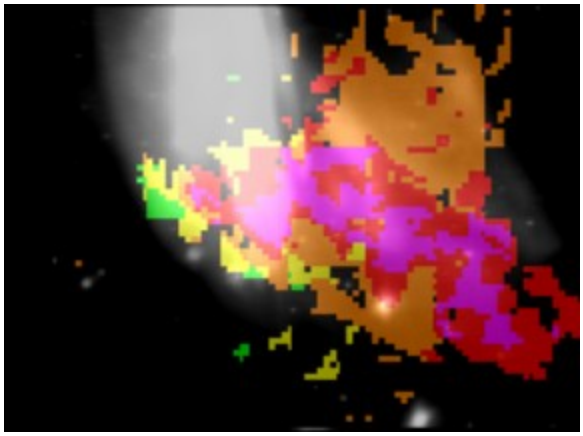
Frame Masks

The results include visual information in addition to the results images in the form of Frame Masks. These mask images are overlaid on top of the frame images on the large image in the top-left of the main screen and depict the locations of problem areas in the sequence, to aid in the repair of failing sequences.

When the results first appear on the graph, the large image in the top left hand side will appear as usual. In order to utilise the frame mask images, Click on the Frame Mask menu, and select the type of failure that you want to see the mask overlaid for:



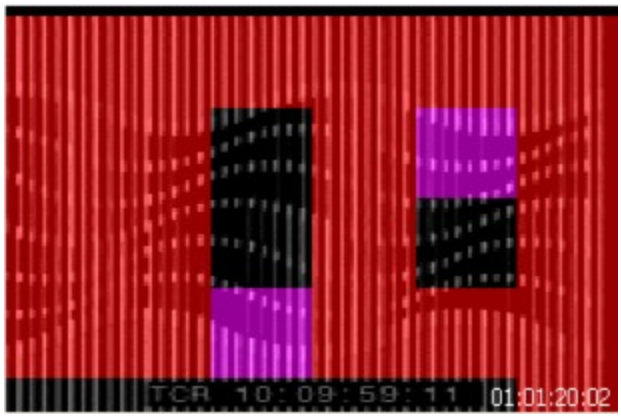
When any of the frame masks are chosen from this box, the images will change and the mask will be overlaid onto a darkened, black-and-white (monochrome) version of the original frame image. A frame will appear around the image to depict the currently selected mask. An example is shown below:



The colours represent the number of transitions which each pixel has experienced in the most recent second after allowing for motion. The analyser will issue a failure when more than one quarter of the image contains red or purple pixels. The same colour coding (shown below) is used for both luminance and red flash analysis.

Pixel Colour	Number of Transitions
none	0
green	1 or 2
yellow	3 or 4
orange	5 or 6
red	7 or 8
purple	9 or more

The spatial pattern mask data logs the activity which exceeds the spatial guideline limits as shown below:



The mask data appears as a set of uniformly coloured tiles in the image which represent how long they have persisted in the image sequence. Spatial mask data only appears for stationary, regular patterns which lead to failure. Any spatial patterns which drift, or are not regular, or do not persist in the video long enough to trigger a failure are excluded.

Pixel Colour	Persistence
none	no regular stationary pattern present
green	0 to 1/6 second
yellow	1/6 to 1/3 second
orange	1/3 to 1/2 second
red	more than 1/2 second = FAILURE
purple	outside of pattern regularity limit

The actual colours used represent how close the spatial pattern is to causing a failure rated in terms of how long the pattern has persisted in the image sequence. When running under Ofcom guidelines, the HardingFPA will only tolerate illegal spatial patterns to persist for up to half a second -- any longer than this will lead to a failure. Therefore the green, yellow and orange colours denote the build up to failure while red represents the actual failure itself. Purple is reserved for tiles which are part of the detected spatial pattern but whose pattern characteristics lie outside of the allowable range when compared with the rest of the spatial region. These purple tiles do not represent persistence and can accompany spatial masks of any colour.

It is important to note that the HardingFPA ***only*** presents mask colours for pixels which ***will*** go into failure. This allows the editor to focus on the region(s) of the image which lead to the failure rather than flooding the user with unnecessary information. As a result, many images will contain no masked / coloured pixels even though there may be some flash or pattern activity occurring. However, all luminance

and red flashing activity is exposed in the mask data if an extended flash failure is either occurring or is due to occur wihin the next 5 seconds.

In addition, frame mask activity may suddenly disappear after an isolated failure sequence if the remaining pixel transition activity does not lead to a subsequent failure.

SD Legacy Mode

The HardingFPA has a version 2.5 legacy analysis option for when comparisons with earlier HardingFPA analyses are necessary (i.e. those that have come from versions 1.x of the HardingFPA-X, and to have some level of compatibility with HardingFPA V2.5x SD-SDI Standalone tape-based systems).

If this has been enabled, it will be apparent in both the results graph interface and the generated PDF certificate (see below).

HardingFPA
broadcast flash & pattern analyser

BROADCAST IMAGE ANALYSIS
CAMBRIDGE RESEARCH SYSTEMS

TEST CERTIFICATE

Analysed in SD Legacy Mode

Results of Analysis by HardingFPA Flash and Pattern Analyser for Compliance with Ofcom Guidance Note for Licensees on Flashing Images and Regular Patterns in Television (Ofcom Code May 2008). Analysis results also comply with ITU-R BT.1702.

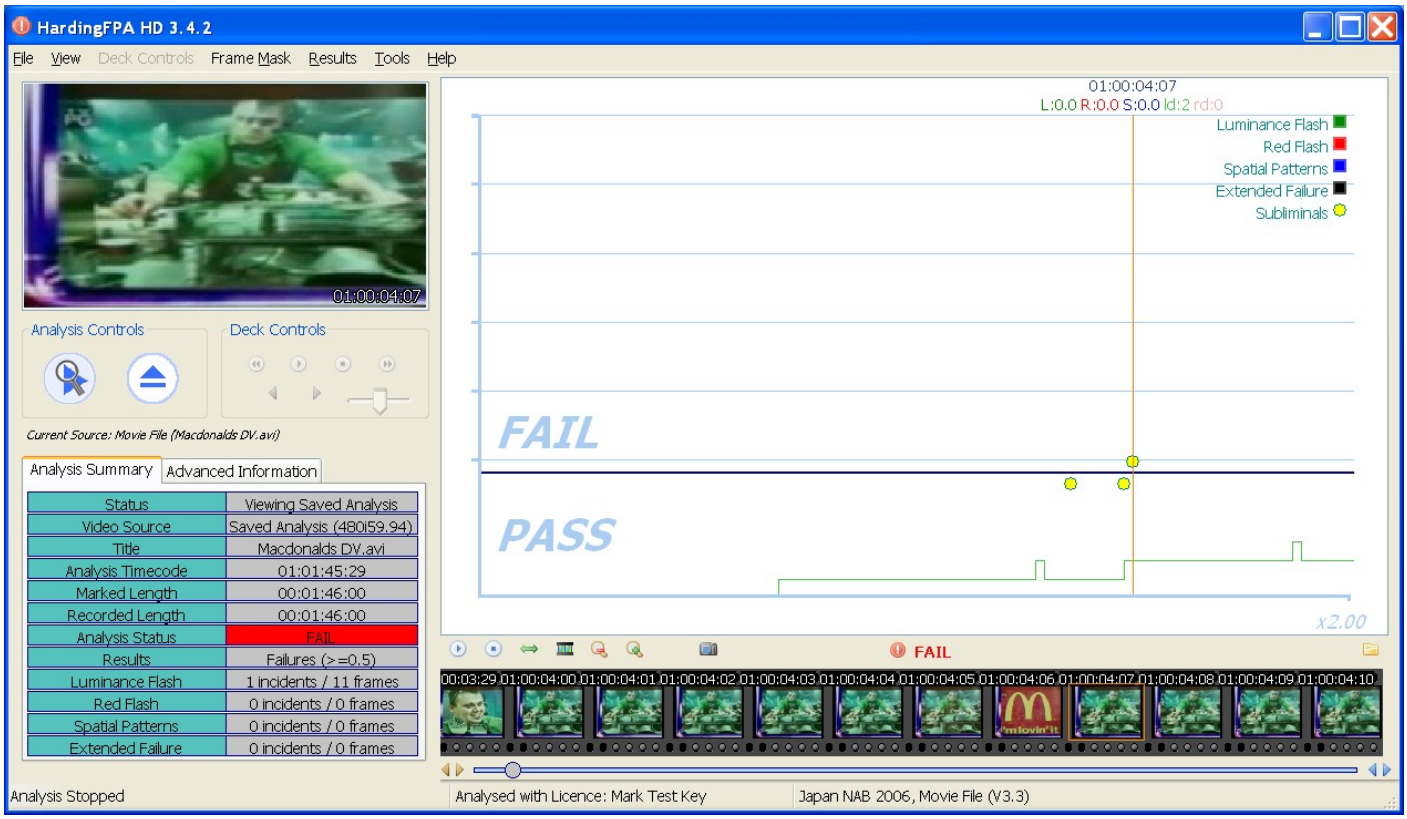
LICENCE NUMBER: 2-045-715-700

Subliminal Event Analysis

If enabled in the *Settings*, the system will test the incoming material for potential subliminal frames at the same time as it is analysing for the usual flash and pattern criteria.

These frames will be identified on the graph visualisation as yellow circles, shown in the example below. A yellow circle below the PASS/FAIL line indicates a subliminal warning, and one above the line indicates a subliminal failure.

The appearance of the subliminal results can be switched on and off in the usual manner, by clicking on the Subliminals yellow circle in the top-right corner of the graph.



What is a Subliminal Event?

The insertion of an image (or images) with contents different from the preceding or following images which is too short for the viewer to be consciously aware of. The duration of a subliminal event is user-configurable. The default settings are currently up to 0.05 seconds for a subliminal failure and up to 0.2 seconds for a subliminal warning. A subliminal event may be inserted at a scene change as it is not

necessary for the images preceding and following the subliminal event to be similar. Additionally, a subliminal event may involve inserted text or a change to only part of the image.

It is important to note that a subliminal event must contain information. An inserted blank image that is black, white or uniform grey does not mean anything, and is therefore not regarded as subliminal.

Examples of subliminal and non-subliminal events

Example 1

This is a subliminal event because of the inserted images. The blue border in the 7th image shows the end of the subliminal event.

Example 2

This is a subliminal event because of the inserted picture of a person's head. The blue border in the 7th image shows the end of the subliminal event.

Example 3

This is a subliminal event because of the inserted text. The blue border in the 7th image shows the end of the subliminal event.

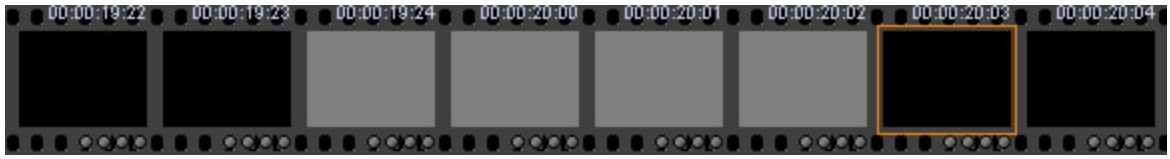
Example 4

This is not a subliminal event because the inserted images are just the inverse of the preceding and following images and therefore contain no new information.

Example 5

This is not a subliminal event because the inserted images contain no information.

Example 6



This is not a subliminal event because none of the images contain any information.

Example 7

This is a subliminal event because the inserted images contain information. The blue border in the 7th image shows the end of the subliminal event.

Example 8

This contains more than one subliminal event as shown by the blue border images.

How does the HardingFPA Detect Subliminal Events?

The HardingFPA searches for two sudden uncorrelated changes which occurred at different times but at the same position in the image sequence. Changes which are blended in over several frames are not considered as potentially subliminal as they would be consciously noticed by the viewer.

The HardingFPA can log the occurrences of two sudden uncorrelated changes and issue a subliminal event or a subliminal warning depending on its duration. These are indicated as yellow dots above and below the failure line respectively and are indications of where subliminal insertions may have occurred.

It is important to note that the HardingFPA may issue a large number of subliminal failures or warnings especially when analysing rapidly flashing imagery. This does not necessarily mean that the video contains a large number of subliminal insertions but merely that the HardingFPA has detected a large number of potential candidates. It is ultimately up to the user to verify whether these flagged events constitute subliminal insertions or benign uncorrelated changes.

Why does the HardingFPA indicate a subliminal event one frame after it has occurred?

The HardingFPA needs to detect the start and end times of any potential subliminal insertion to determine whether the effect was rapid enough to be viewed subconsciously. Therefore, the HardingFPA can only log a subliminal event after it has disappeared.

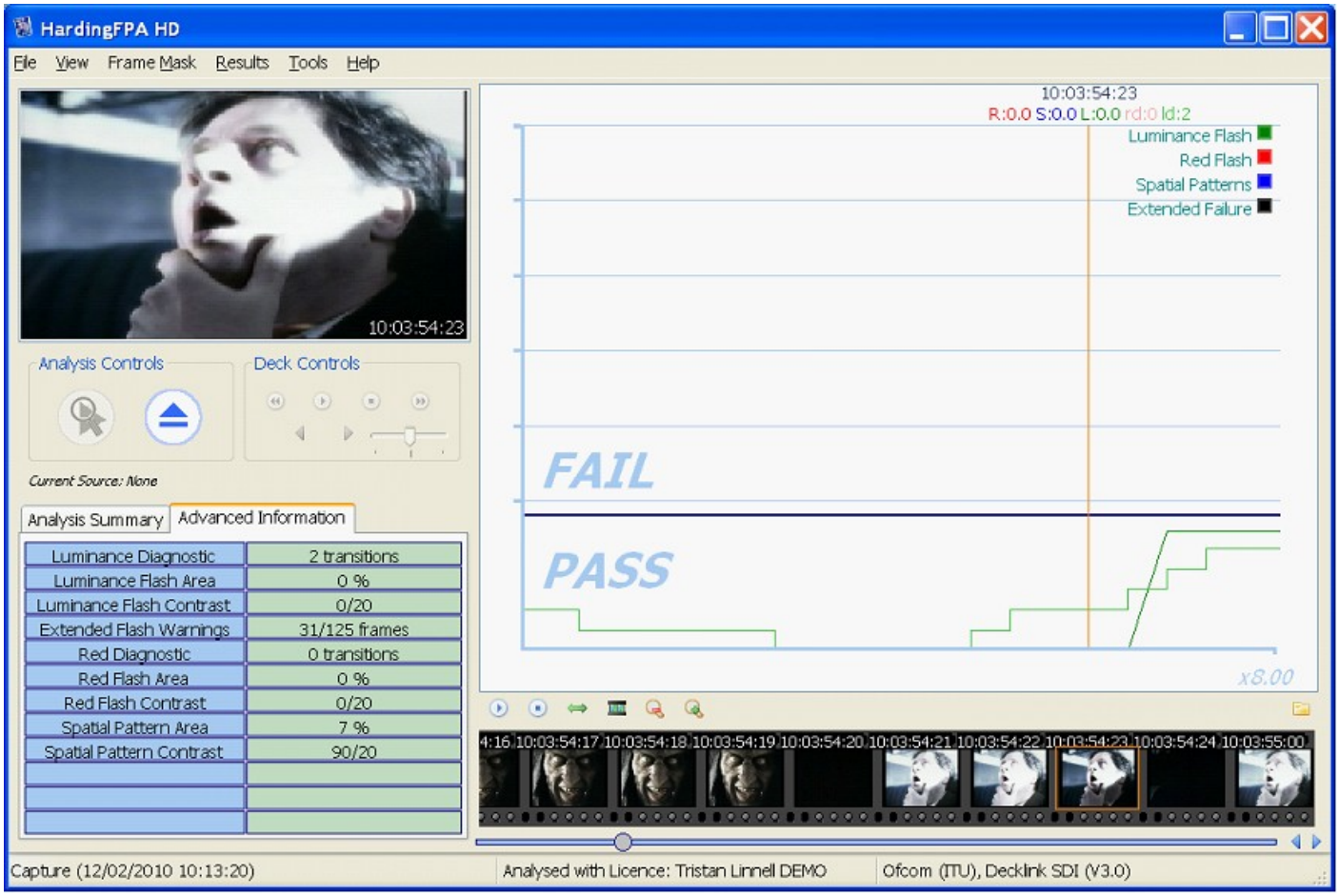
Interpreting Results

It is important to note that material re-encoded at a different frame rate, will usually have a different number of failed frames, and the results may differ because of the extra or missing frames that were introduced during the conversion process.

The following items are phenomena commonly seen in the results along with explanations for the behaviour.

1) A flash occurred but the normal flash risk trace didn't appear – The main flash risk trace (dark green line) may not appear if flashing is less than 20cd/m2 in contrast or if the flash frequency is significantly within guideline limits. Remember that 2 opposing transitions make up a single flash.

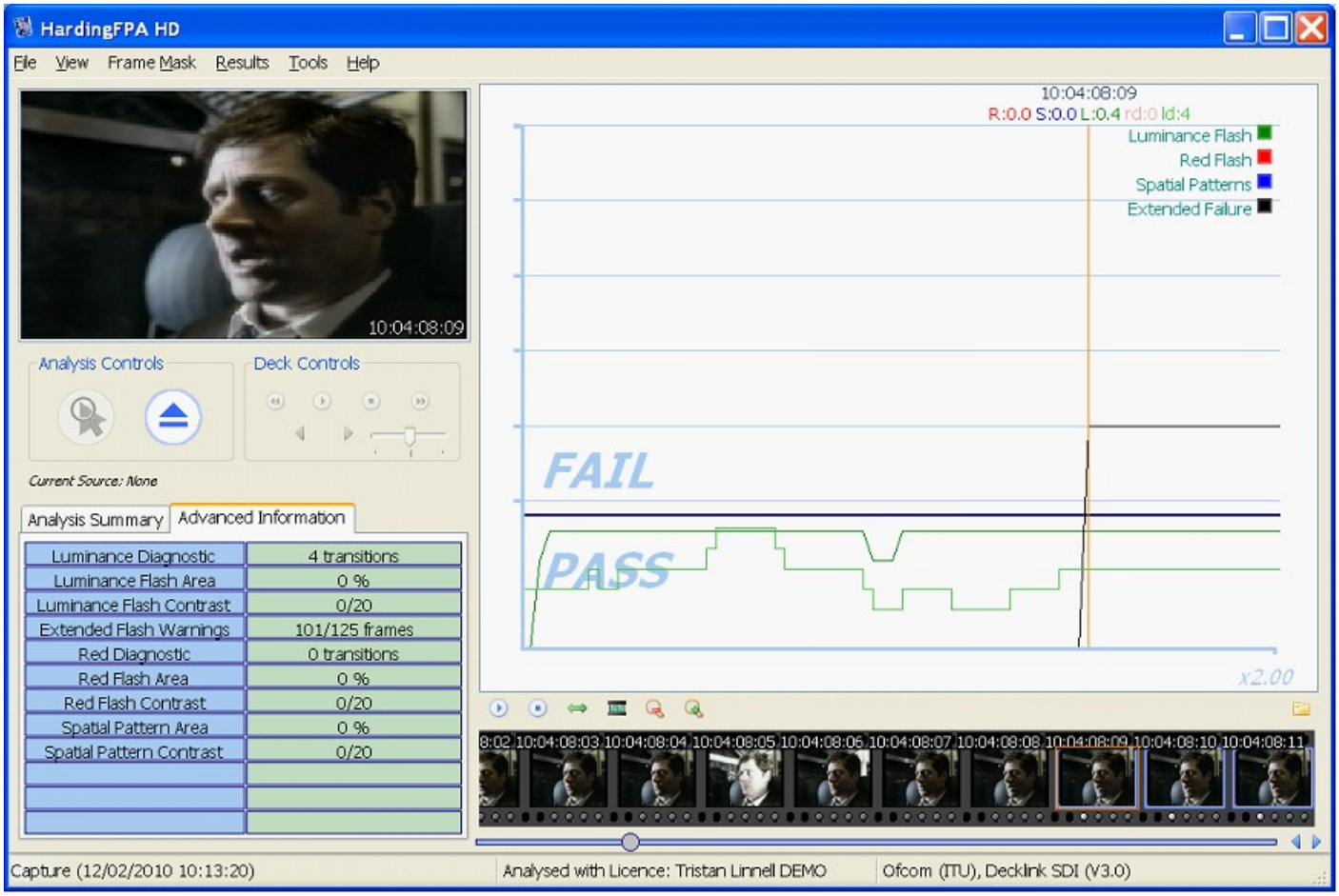
The example below shows that two transitions have been detected by the diagnostic trace (light green line) but that the main risk trace has not yet appeared because the flash frequency up to this point is not considered to be significant.



(1) Showing a flash but no flash risk trace

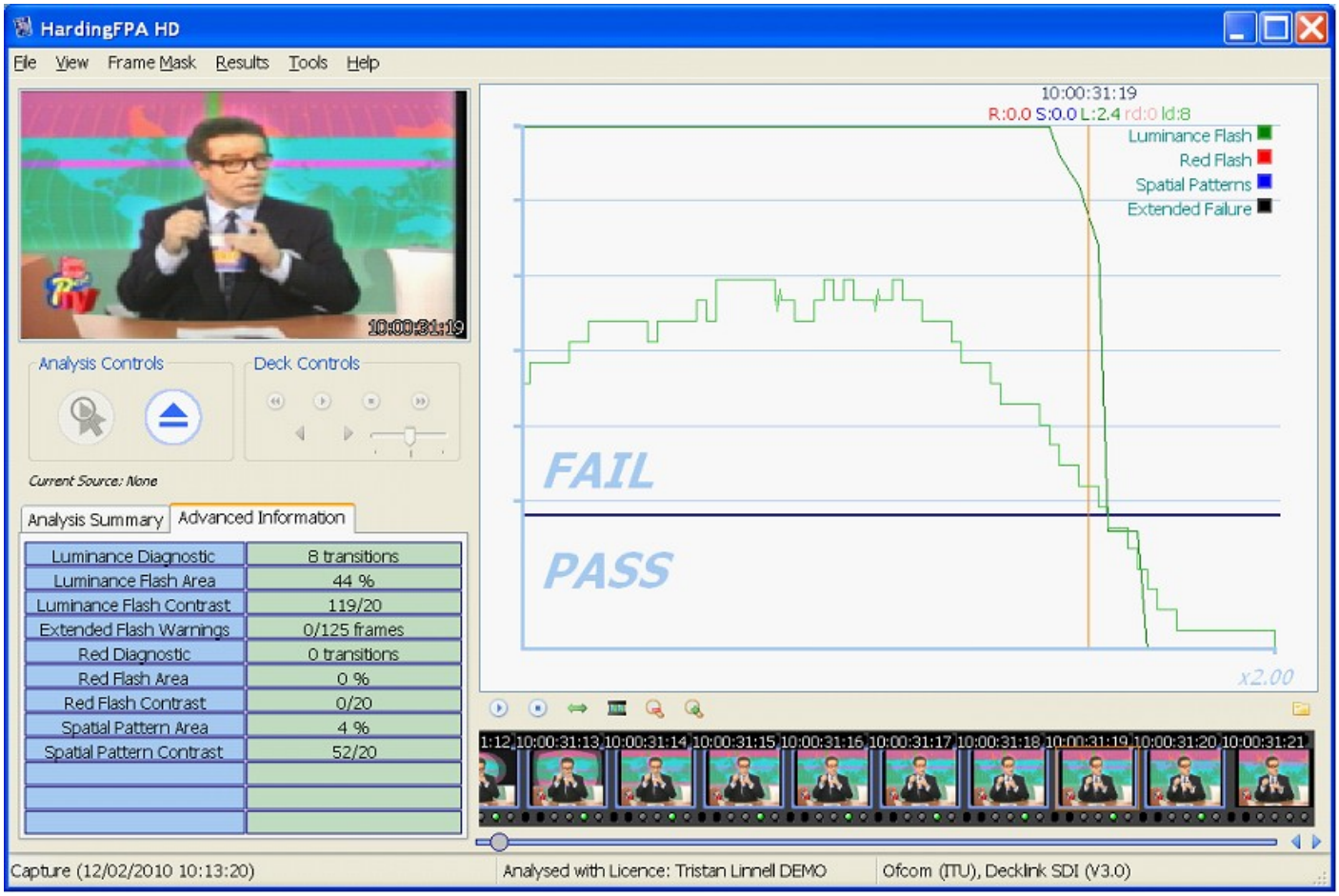
2) The flash risk trace (dark green line) appeared close to the pass-fail limit for a long sequence of images but didn't enter the fail zone – The system has detected flashing of above 3Hz and 20cd/m2 in amplitude; but the flash area is less than 25% of the screen area. If the criteria for failure are not all met then the system will generate a line based on how close the material is to failure. If the line is hovering just below the failure line then it might only need a tiny change in size of the flashing area to push it into failure. Such a tiny change could be introduced when converting between formats, frame rates or codecs if this is not done carefully using professional grade codecs.

The example below shows that the flash risk has remained close to the failure line for long enough to generate an extended flash failure. This occurs whenever more than 80% of the frames in the last five seconds generated flash risk warnings of 0.3 or 0.4 (i.e. close to failure).



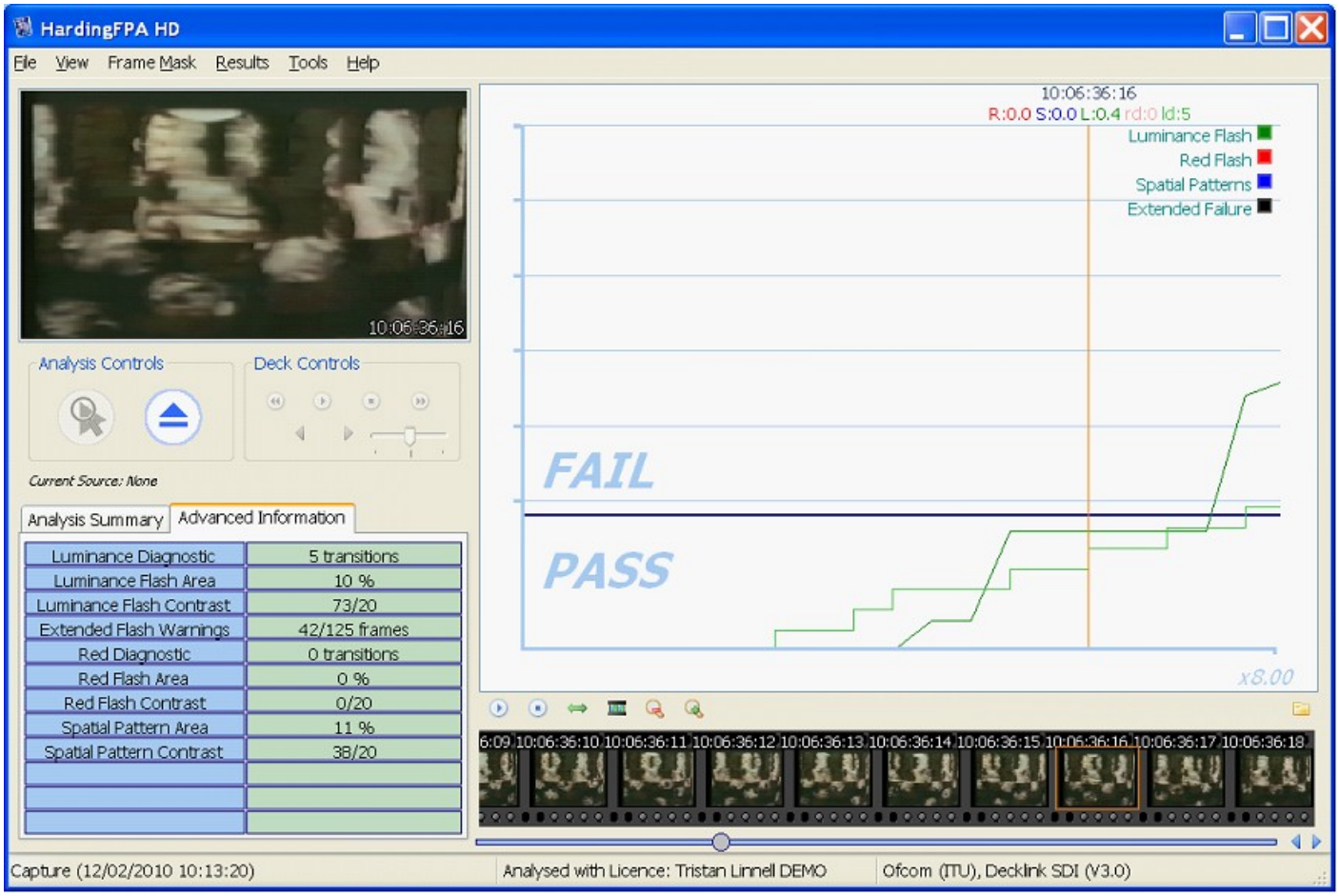
(2) Long sequence of flashing that eventually led to an Extended Flash Failure

3) The flash risk trace (dark green line) persists for several frames after a flash occurred – This is perfectly normal, and arises because of the way the system has to detect flashing frequencies over the most recent second. You do not need to worry about the persistence of the flash risk traces, you need to principally examine the second before the line moves into failure, or where the diagnostics trace shows that the transition count is still rising. Once you have corrected all the causes of the line first moving into failure then the material at that point will pass the test. Note, however that lots of flashing close together will generate a much longer compound failure: the best thing to do is deal with the flashes one at a time until the material passes the test.



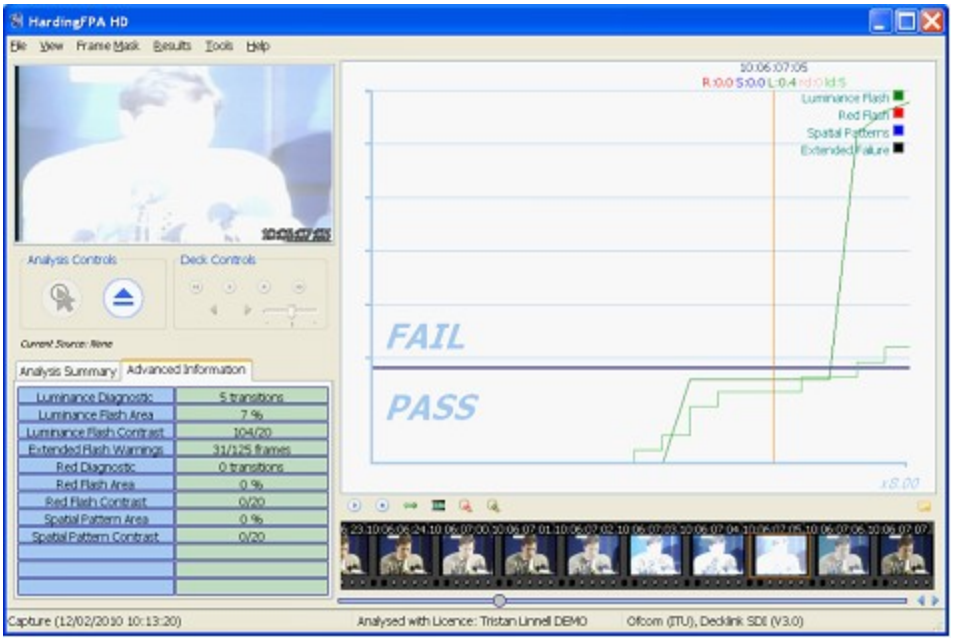
(3) Flash graph persisting after the flash.

4) The diagnostic transition count increased where no obvious flash had occurred – The diagnostic trace represents the number of transitions seen by the most active 25% of the screen over the most recent second. Therefore continuous image activity (e.g. localised flashing and rapid movement within the scene caused by camera pan or zoom etc) can steadily increase the number of transitions that individual pixels have seen, and when at least 25% of those have seen an extra transition will the diagnostic count increase. This can be quite tricky material to fix, and may only be possible by reducing the brightness of the image or cut down on the whole area.



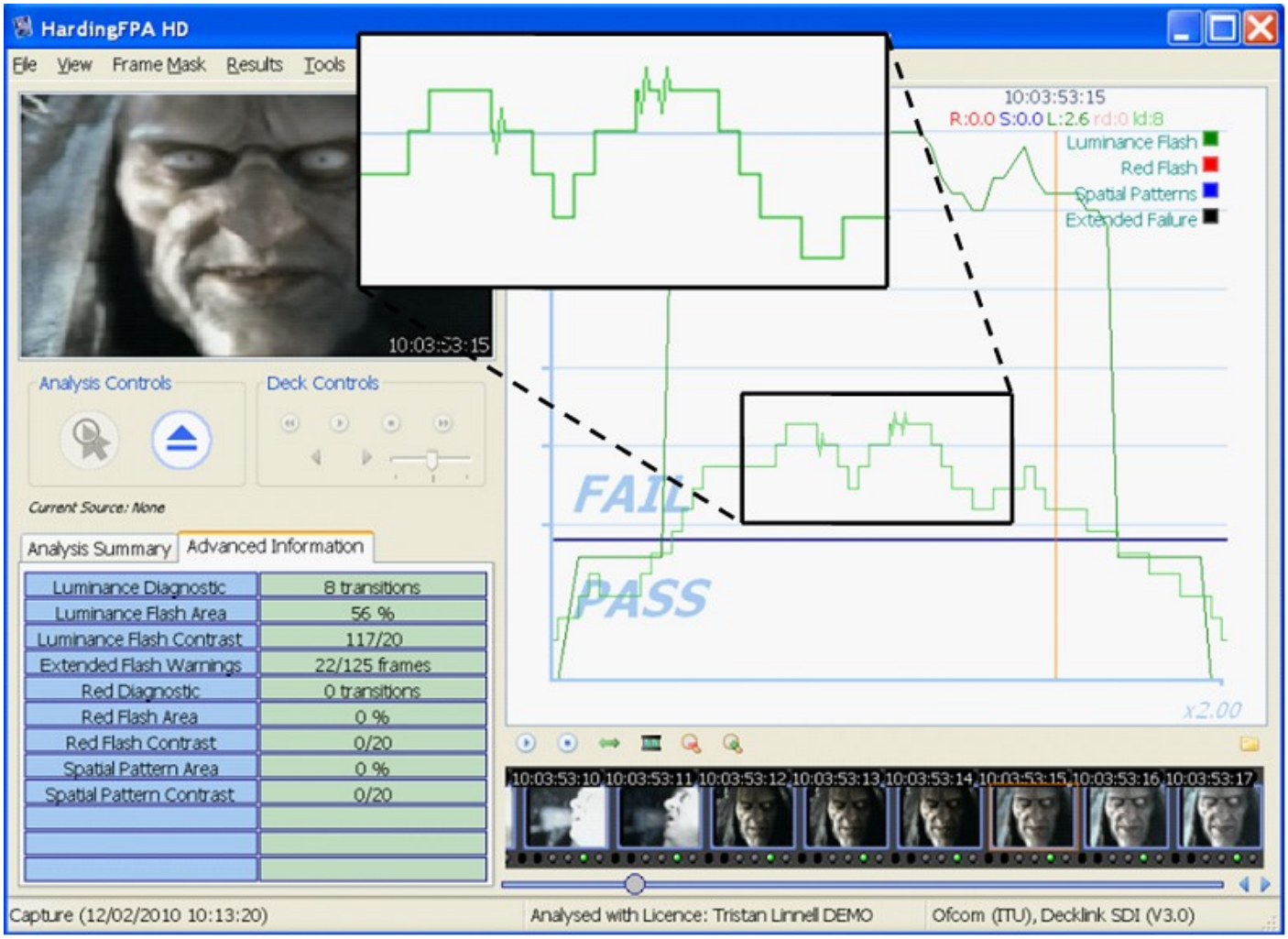
(4) Transition count (light green trace) increased without an obvious transition

5) A flash clearly occurred but the diagnostic trace didn't increase – The diagnostic trace shows the number of transitions seen in the last second of material, and transitions older than that will be discarded. This means that the diagnostic count may not always coincide with an obvious flash. For example, a visible transition in an image may not lead to a higher transition count if the pixels that see the transition are not part of the most active 25%.

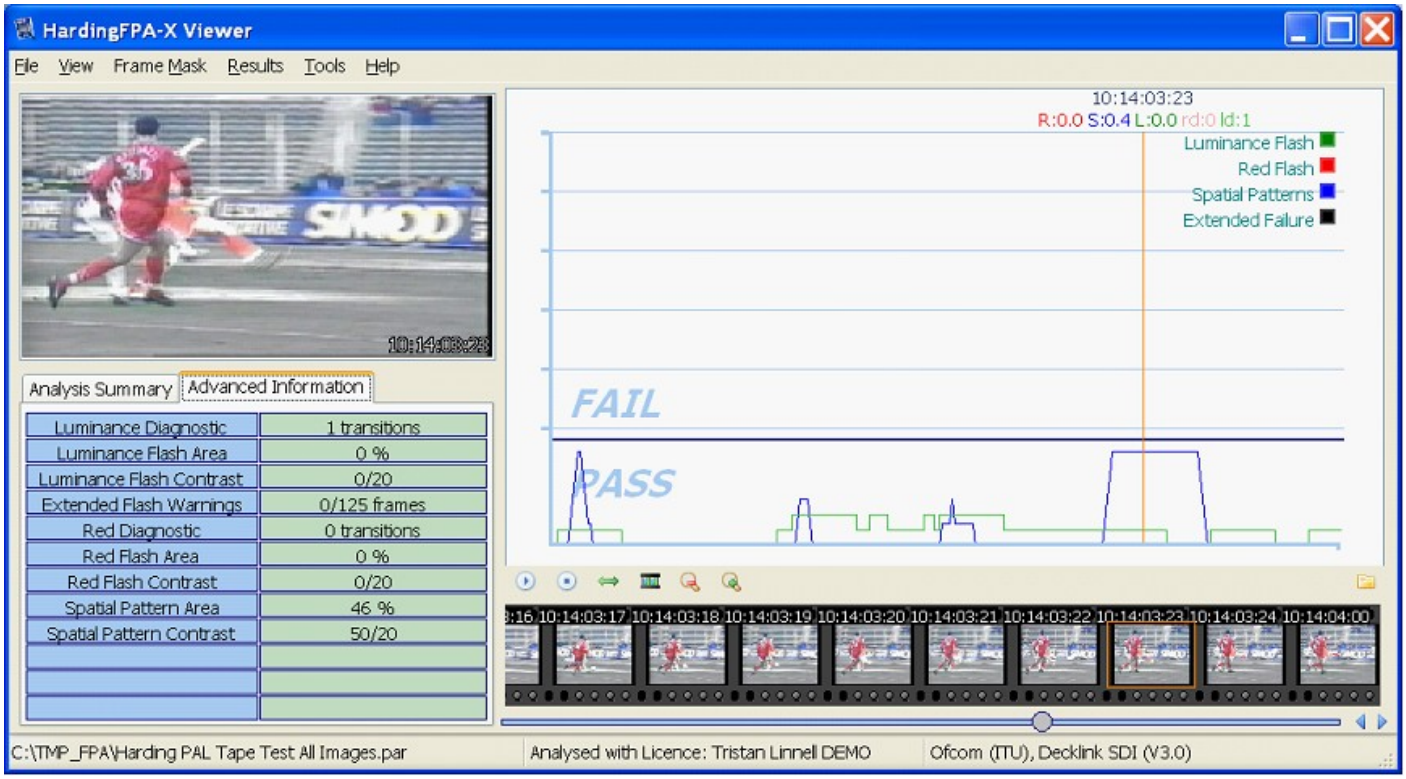


(5) A flash clearly occurred but the diagnostic trace hasn't increased.

Alternatively, an incoming transition may coincide with an outgoing transition from one exactly second earlier. When this occurs, the new version 3 analyser inserts a squiggle (see picture with inset) to indicate that the diagnostic trace has simultaneously gained and lost a transition over the most recent second between video frames.



6) The spatial pattern trace remains in the pass zone even though the detected spatial pattern exceeds contrast and screen area limits – A number of limits have to be exceeded before a detected spatial pattern can generate a failure. The Advanced Information tab in the example below shows that a spatial pattern has been detected with 50 cd/m2 contrast (limit 20 cd/m2) and covers 46% screen area (limit 40%). However, in this example, the system has not generated a failure because motion, caused by the camera pan and zoom, makes the detected spatial pattern exempt from failure under Ofcom rules.

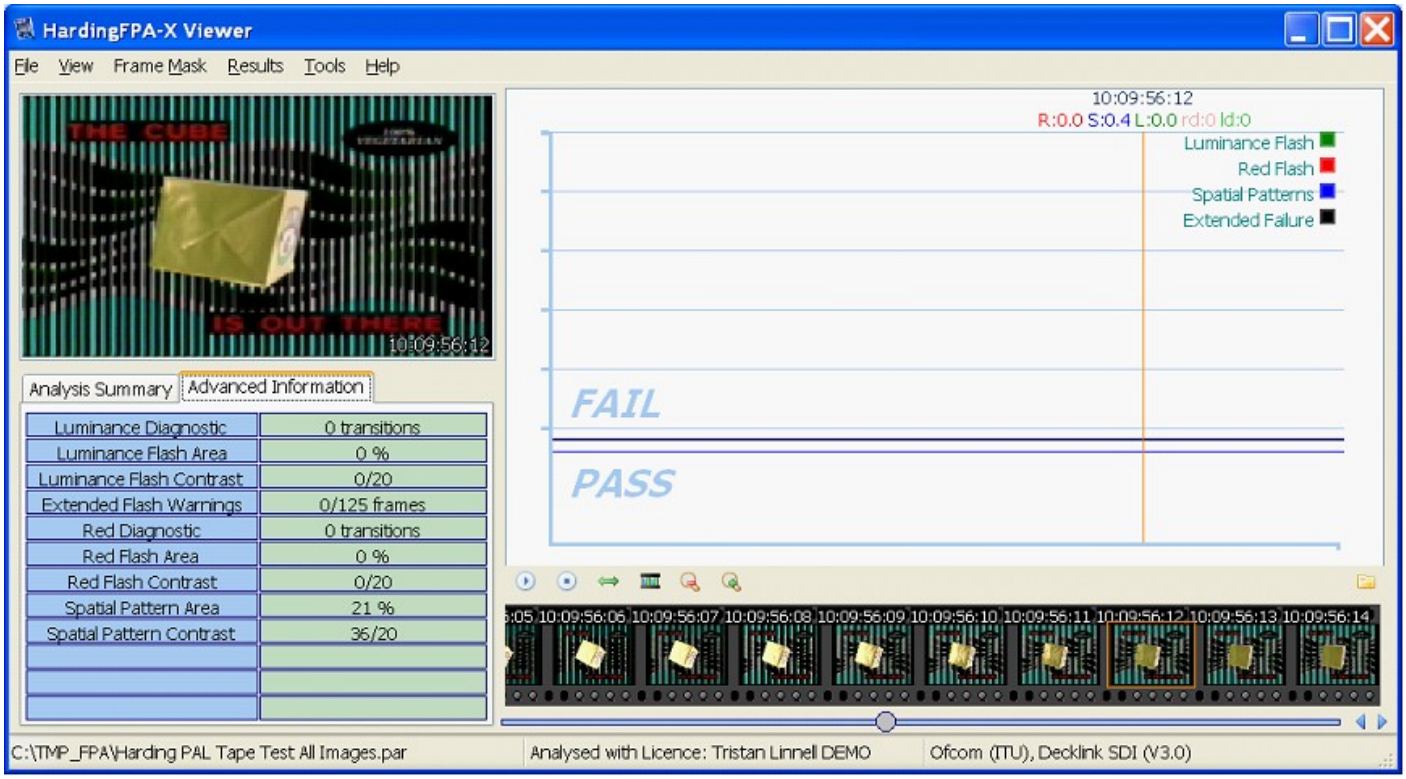


7) The diagnostic trace decreased within a few frames after it had increased. Shouldn't it have taken one second for the transition to flush out? -- Not necessarily. It is true that the diagnostic trace monitors transitions over the most recent second but the most active pixels that determine this diagnostic count are, in most cases, constantly changing. The diagnostic trace will only follow this one-second pattern if the most active pixels are changing together in phase.

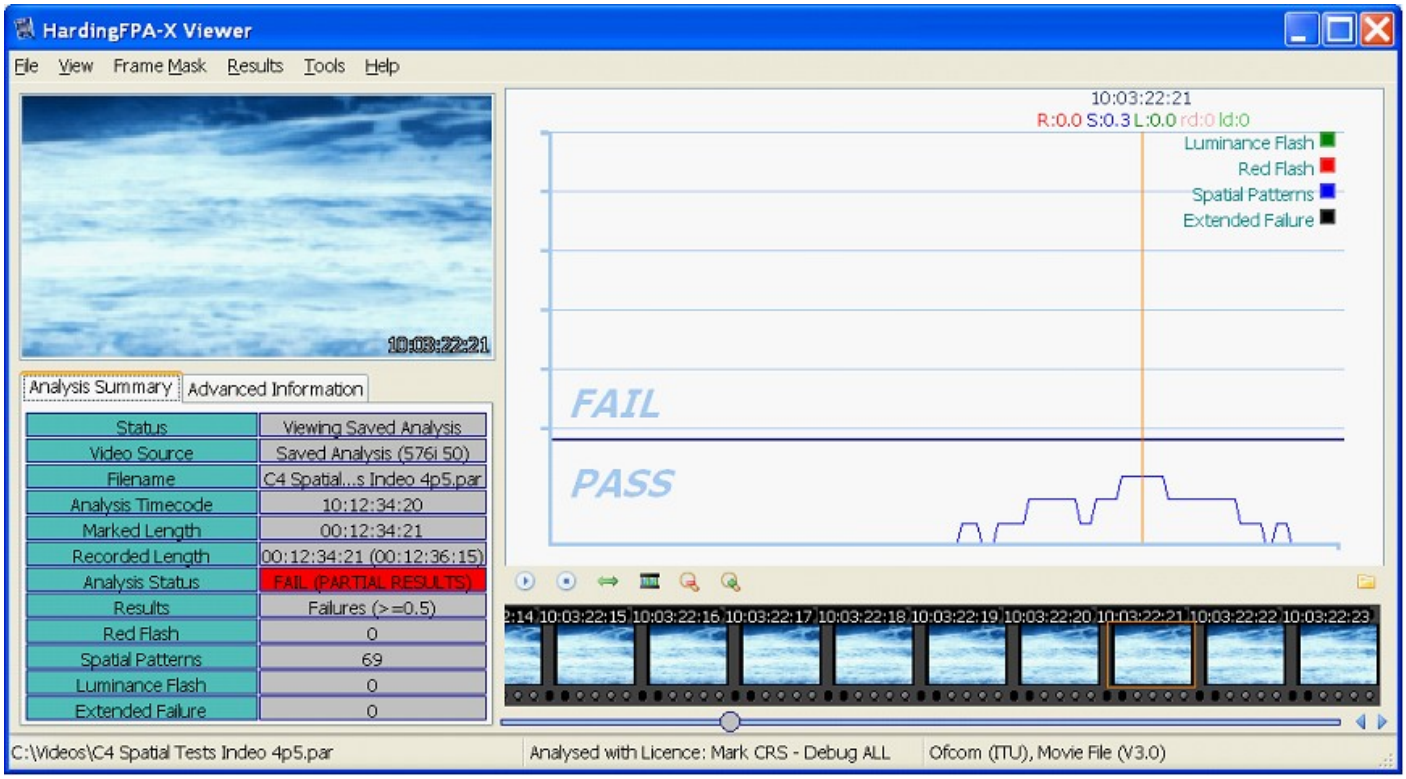
The example below shows the diagnostic trace (light green) increasing from zero to one for a period of only two frames (around the vertical amber current frame line) before returning to zero.

8) The system passes a stationary pattern that looks as though it should have failed – Some patterns that are clearly bar-like in one direction may also possess some local structure in the orthogonal direction. Alternatively, a pattern may not be sufficiently regular or may not have sufficient contrast throughout. Any such structure may cause the system to see fewer than 6 light-dark bars or may separate a provocative pattern into two or more regions. Either of these mechanisms can save a provocative pattern that would otherwise have failed.

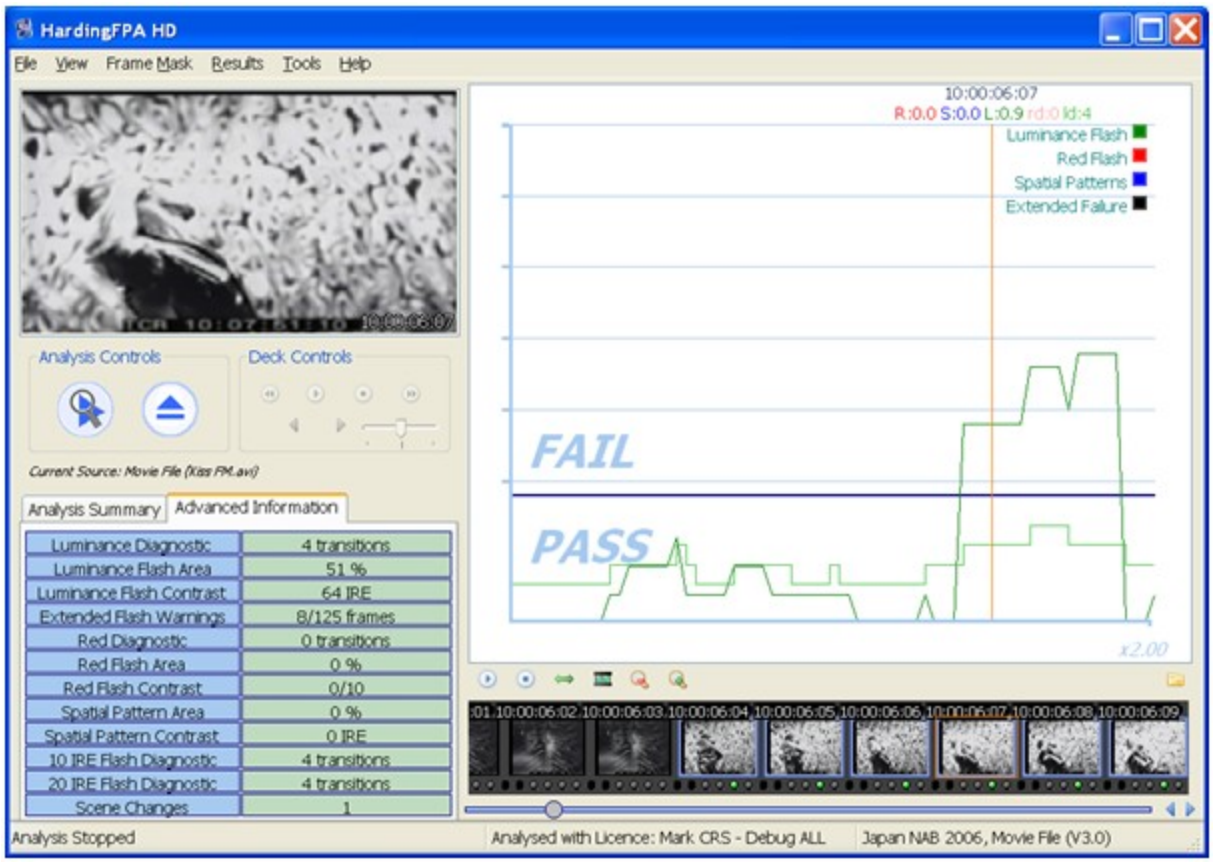
The spatial pattern in the example below passes because of text and foreground objects which break up the bar-like pattern into smaller irregular regions.



9) The analyser generates spatial warnings but it's not obvious where the pattern is! – Occasionally the spatial trace may appear when there is no obvious spatial pattern present in the video stream. The example below shows a picture of the sea generating spatial warnings caused by waves in perspective creating faint, repeating structure. Other candidates for generating unexpected spatial responses are: landscape in perspective, net curtains and reams of paper. However, it is highly unlikely that any of these scenes would actually lead to a spatial pattern failure.



10) Scene Changes (***Japanese NAB Analysis only***) - When analysing under Japanese NAB guidelines, it is possible for the flash risk trace to go into failure while the diagnostic trace is still in the caution zone (see image). This can occur if one of the transitions in the most recent second is classified as a "scene change" (see bottom entry of the Advanced Information tab) where 80% of the image has seen a significant luminance transition of 20IRE units or more. When this occurs, the maximum allowable number of transitions is reduced from 6 down to 3 and, in this example, failure took place when the 4th transition was detected.


HardingFPA HD
File View Frame Mask Results Tools Help
Analysis Controls
Deck Controls
Current Source: Movie File (Kiss FM.avi)
Analysis Summary
Advanced Information
Luminance Diagnostic 4 transitions
Luminance Flash Area 51 %
Luminance Flash Contrast 64 IRE
Extended Flash Warnings 8/125 frames
Red Diagnostic 0 transitions
Red Flash Area 0 %
Red Flash Contrast 0/10
Spatial Pattern Area 0 %
Spatial Pattern Contrast 0 IRE
10 IRE Flash Diagnostic 4 transitions
20 IRE Flash Diagnostic 4 transitions
Scene Changes 1
10:00:06:07
R:0.0 S:0.0 L:0.9
Luminance Flash
Red Flash
Spatial Patterns
Extended Failure
FAIL
PASS
x2.00
Analysis Stopped
Analysed with Licence: Mark CRS - Debug ALL
Japan NAB 2006, Movie File (V3.0)

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Some plugins use external libraries and makes extensive use of the following persons' or companies' code:

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The source and build instructions for the included FFmpeg libraries are contained on the HardingFPA-X installation media.

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its purpose remains meaningful.

(For example, a function in a library to compute square roots has
a purpose that is entirely well-defined independent of the
application. Therefore, Subsection 2d requires that any
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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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Section 6 states terms for distribution of such executables.
When a "work that uses the Library" uses material from a header file
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Whether this is true is especially significant if the work can be

linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

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