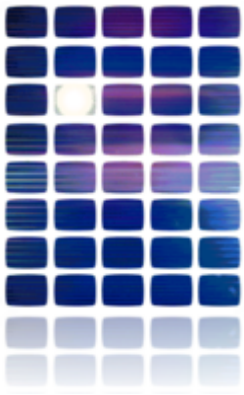
CAMBRIDGE RESEARCH SYSTEMS



The HardingFPA Viewer

User's Manual

Version 3.10.0

Cambridge Research Systems Ltd.
www.hardingfpa.tv

Help ensure video is safe to watch
for both diagnosed and dormant photosensitive epileptics

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Applicable Version:

This manual is applicable to the HardingFPA Viewer version 3.10.0 (31st August 2011)
Document Revision: 31st August 2011

Table of Contents

Overview

This manual describes the use of the *HardingFPA Viewer,* which allows for viewing of results files created by other HardingFPA software.

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

Version 3 Analysis Algorithms

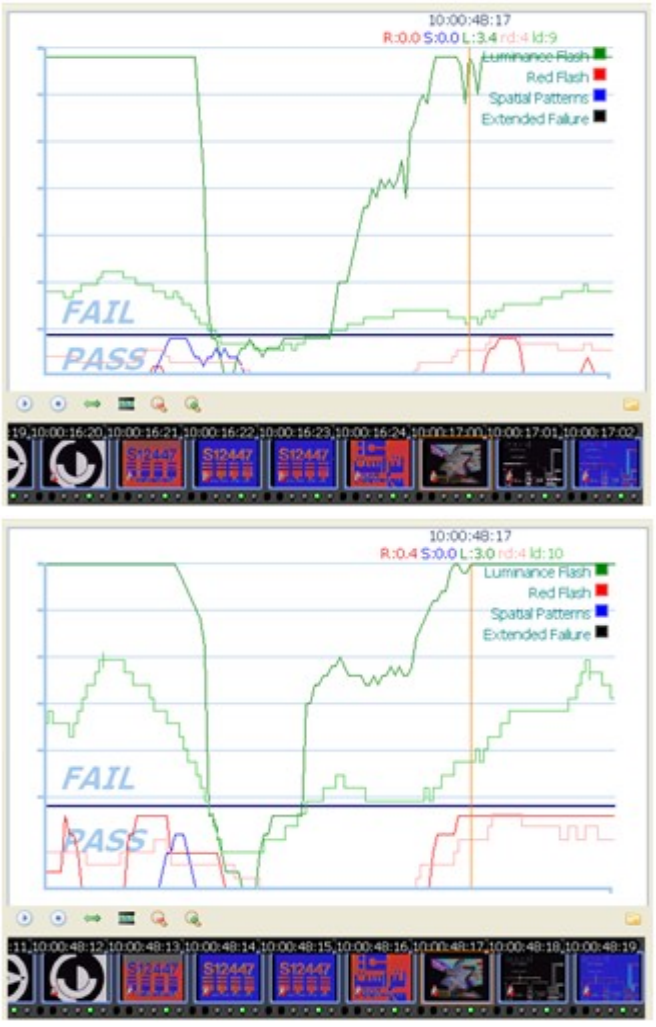
If the results files you are opening were created by a system running *HardingFPA-X Analyser* Version 2.0.0 or above, the analysis now features new analysis algorithms, which are better tuned to High Definition and File-based work.

They are better suited to 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 new ones are detailed below:

Differences Between v2.5 and v3.3

Different Graph Scaling

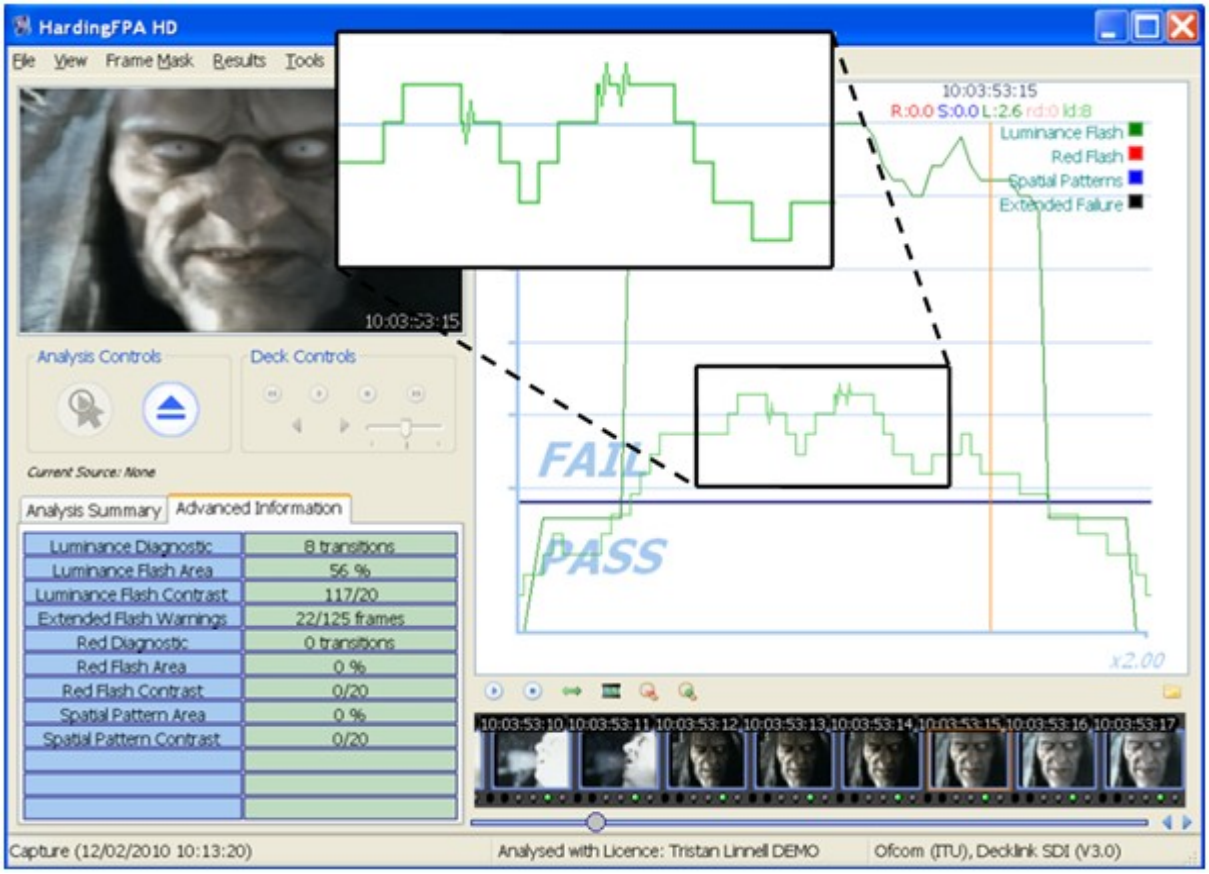
The *HardingFPA* generates risk values using the same range as its predecessor (i.e. 0 to 3.4) but displays the graphical data using a revised vertical scale. This modified scale allocates much more vertical space for risk trace warnings and diagnostic trace steps but only displays risk traces up to 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

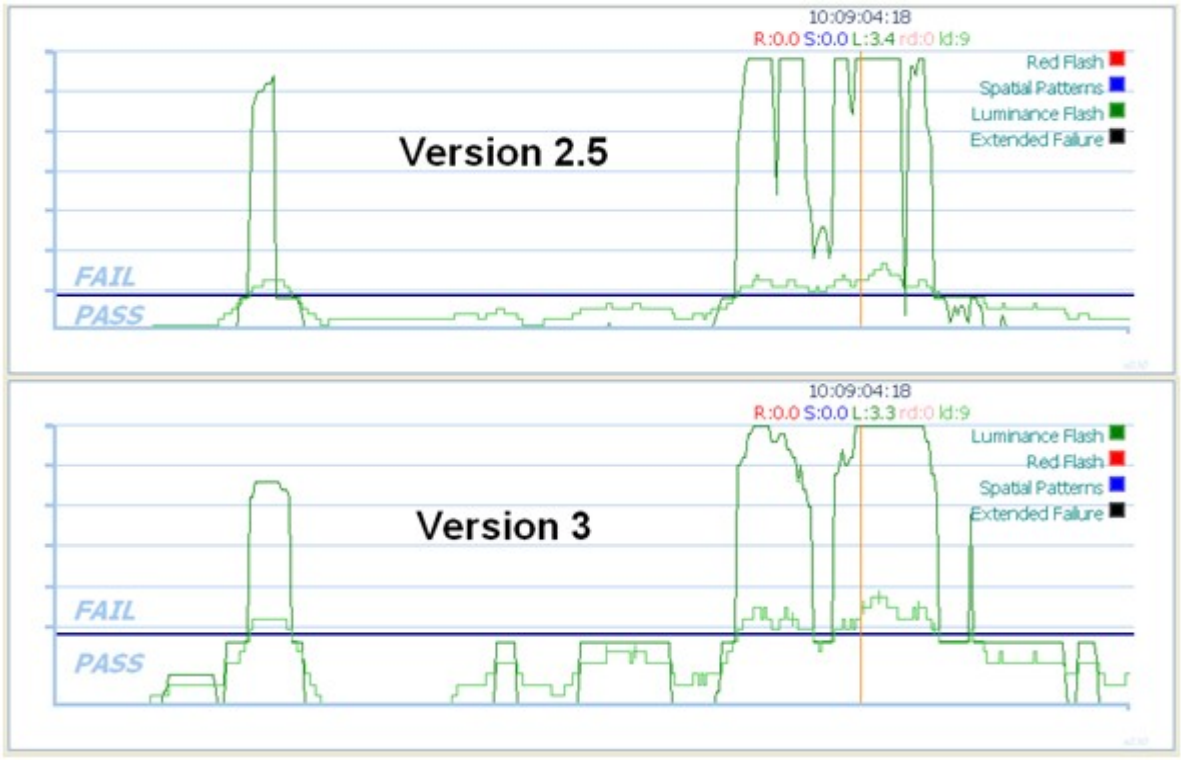
The Squiggle

The *HardingFPA* gives enhanced visual diagnostics when an incoming transition coincides with an outgoing transition from one exactly second earlier. The new 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.

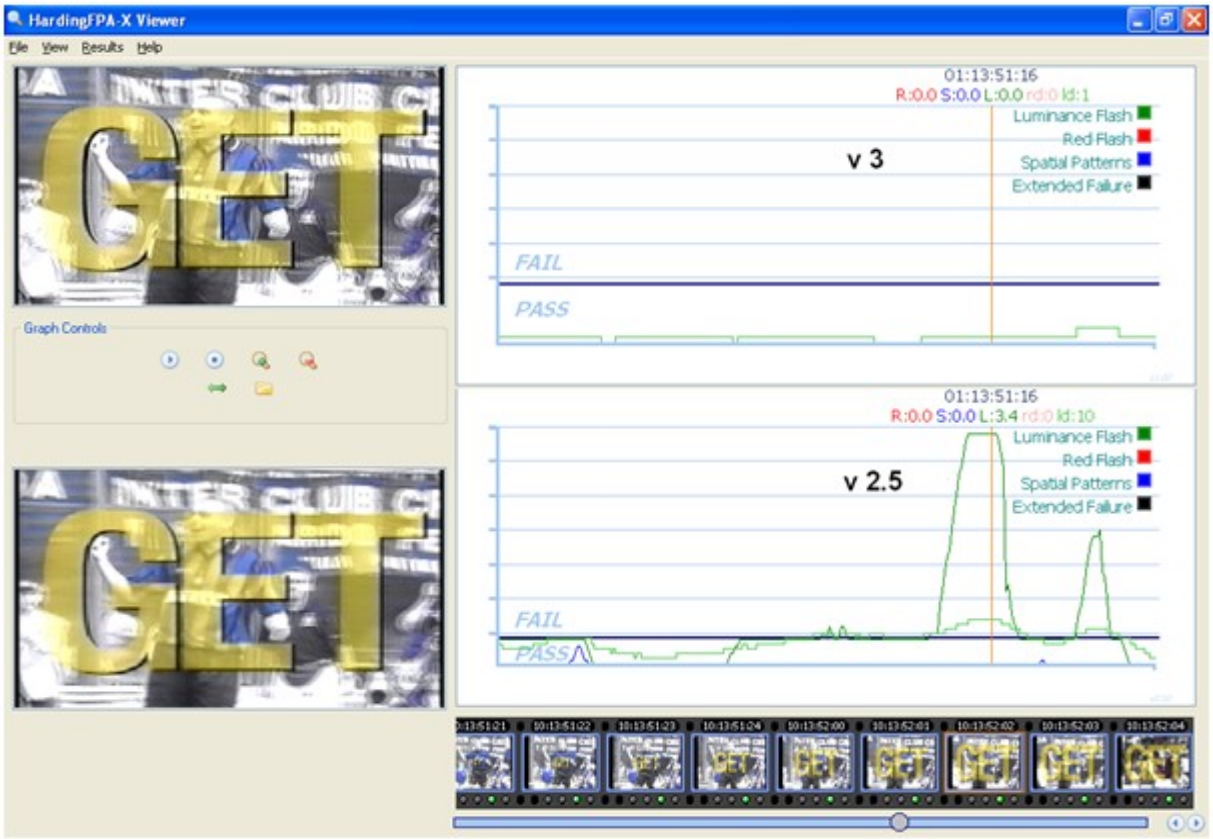


Analysis Results

The *HardingFPA* gives 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:

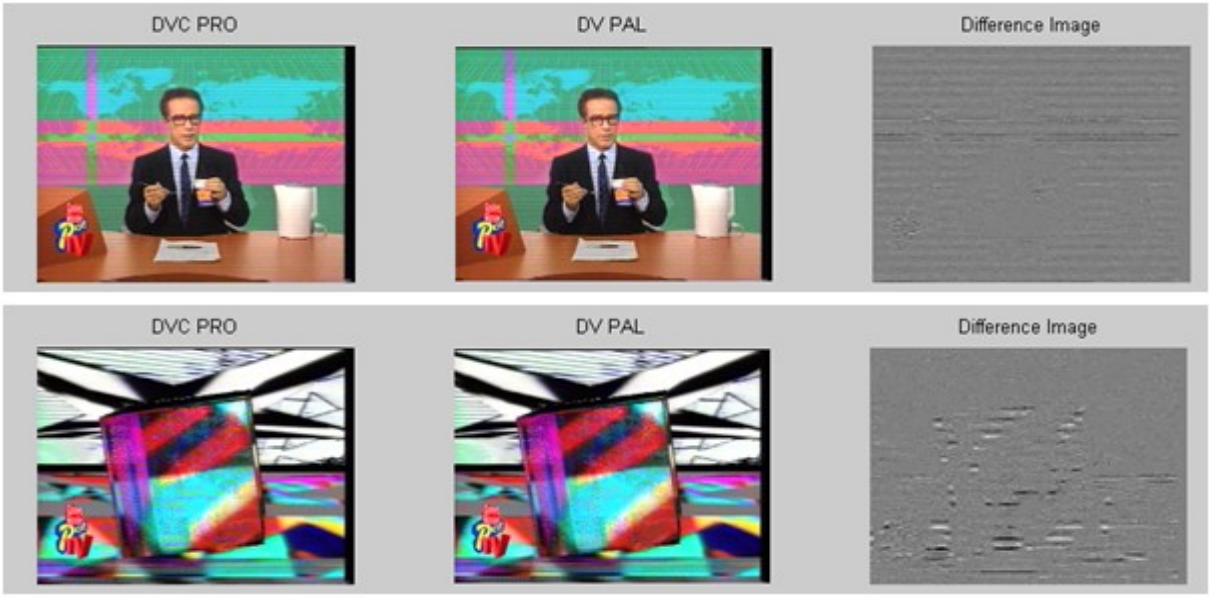


However, the results between the two versions will not be identical. The *HardingFPA* will, in general, be more lenient to complex, rapid motion:



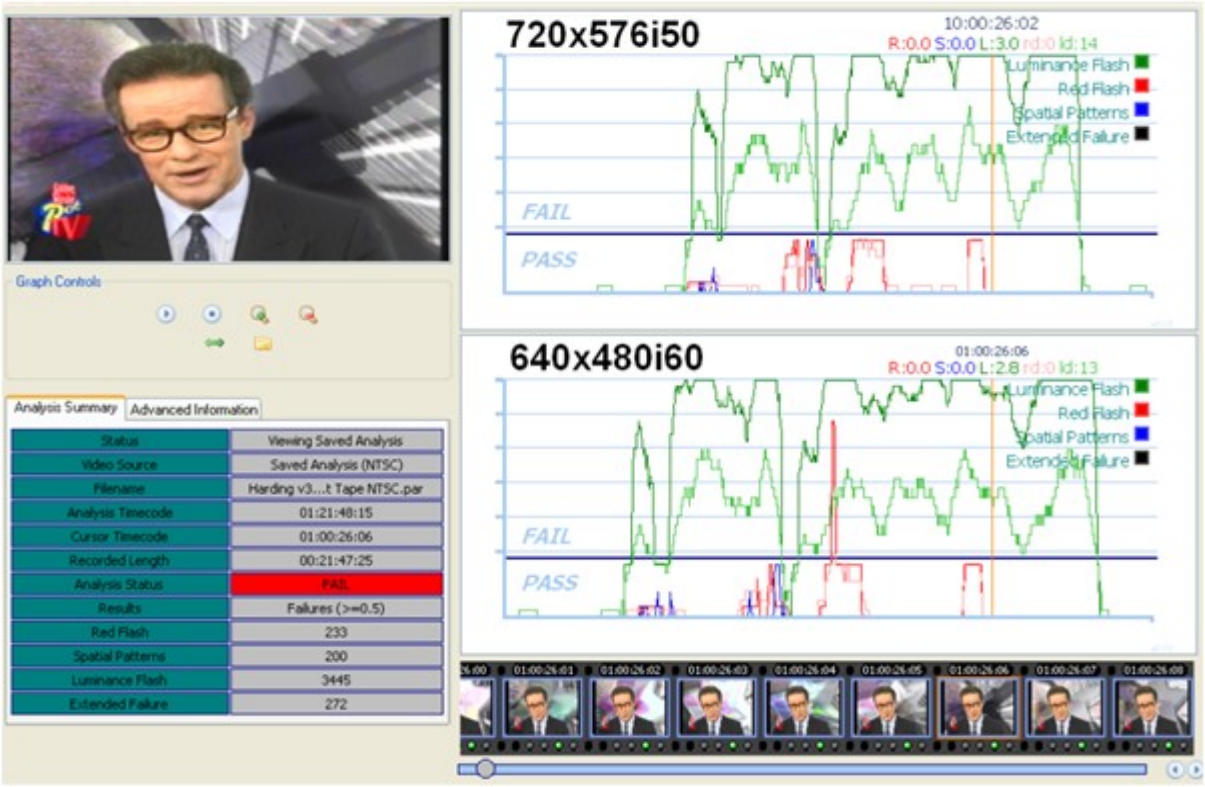
... but more strict to examples of powerful, localised flashing:

Most importantly of all, the *HardingFPA* has 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.

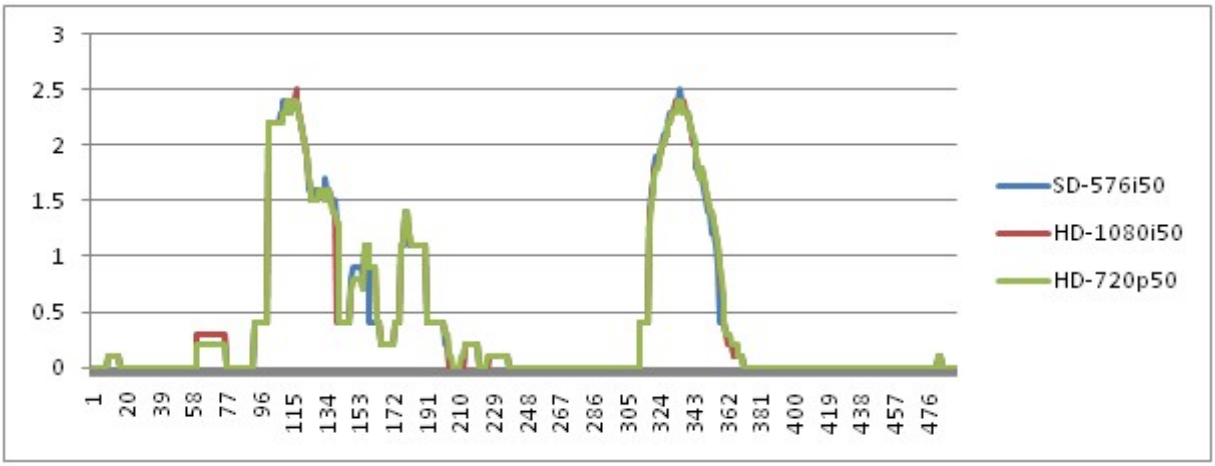


The new version 3 algorithms generate highly consistent results from different image resolutions and frame rates. Here, the same movie has been analysed in 720x576i50 and 640x480i60 formats with highly consistent results. The only noticeable difference is the different horizontal graph scales as a result of the

different frame rates.

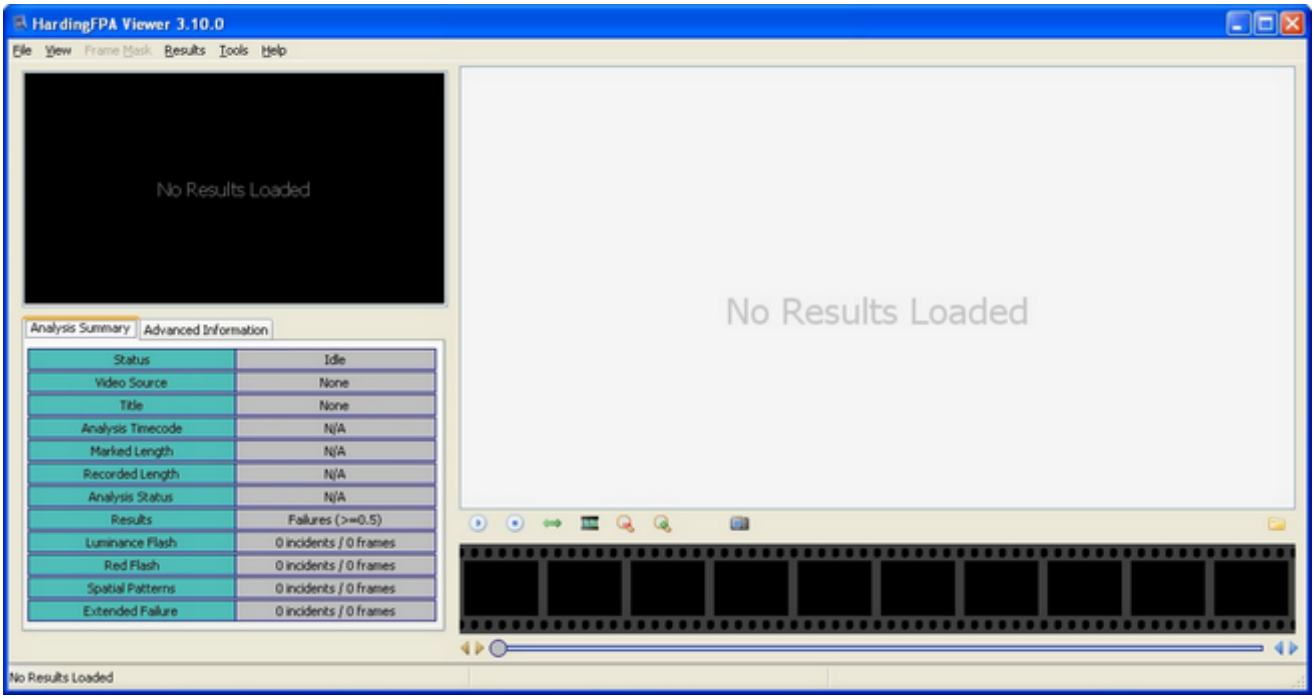


The graph below shows three sets of luminance flash risk results of the same movie analysed in **SD-576i50**, **HD-720p50** and **HD-1080i50** formats. The results are sufficiently similar it is difficult to see that the graph contains three separate traces:



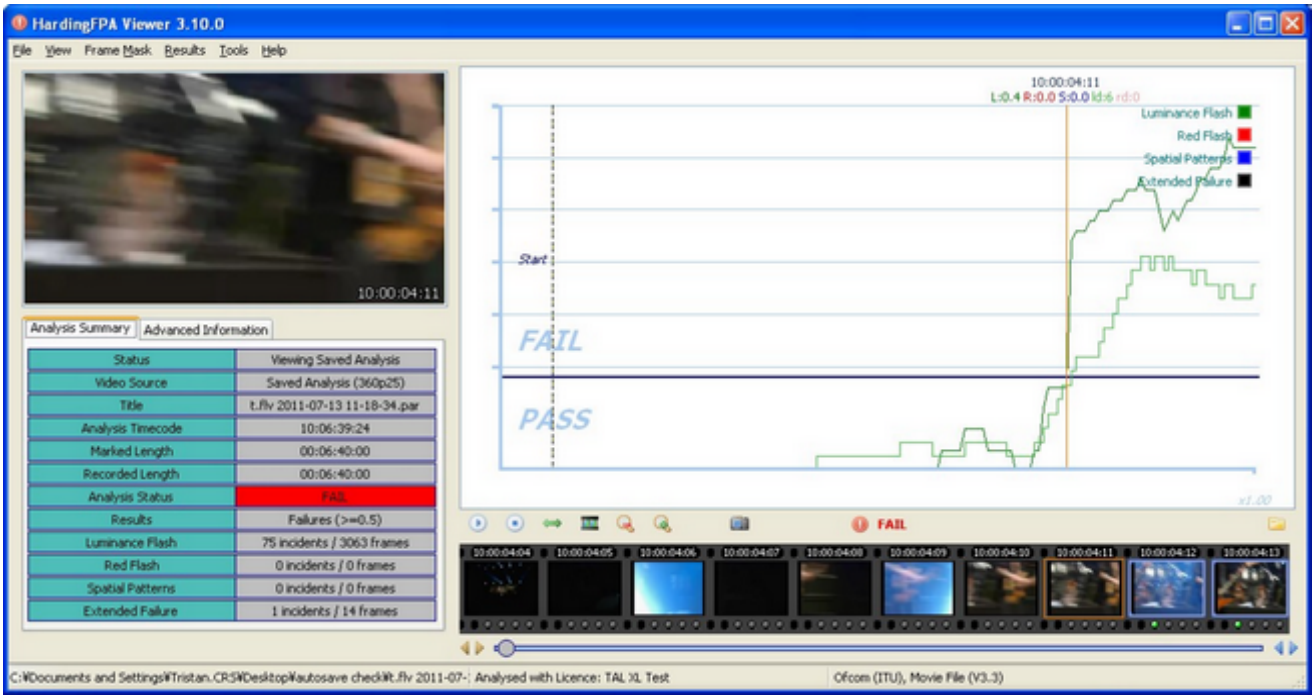
The Main Screen

The HardingFPA Viewer screen displays a graphical representation of the characteristics of the analysed clip, and some additional advanced diagnostic information. This allows the user to 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.



The main HardingFPA Viewer window

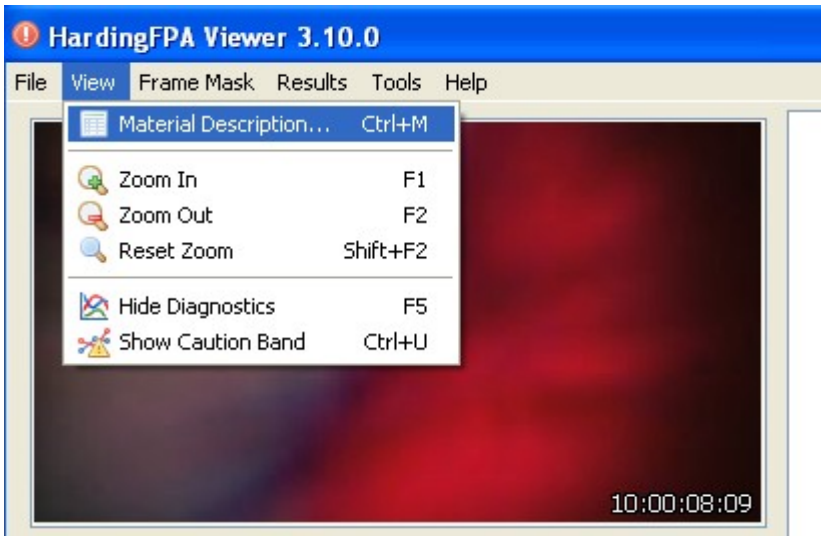
Once a set of results (PAR, PAP and PAM files) has been opened with the *HardingFPA Viewer*, the screen will appear similar to that displayed below. A timeline is displayed at the bottom of the screen detailing the timecodes of the corresponding frames and whether the frame is a failed frame. Failed frames are surrounded in blue. Please note that images are only displayed in certain circumstances around failure/caution regions and if no image is present then the frame will contain the text “No Image”.



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

The View Menu

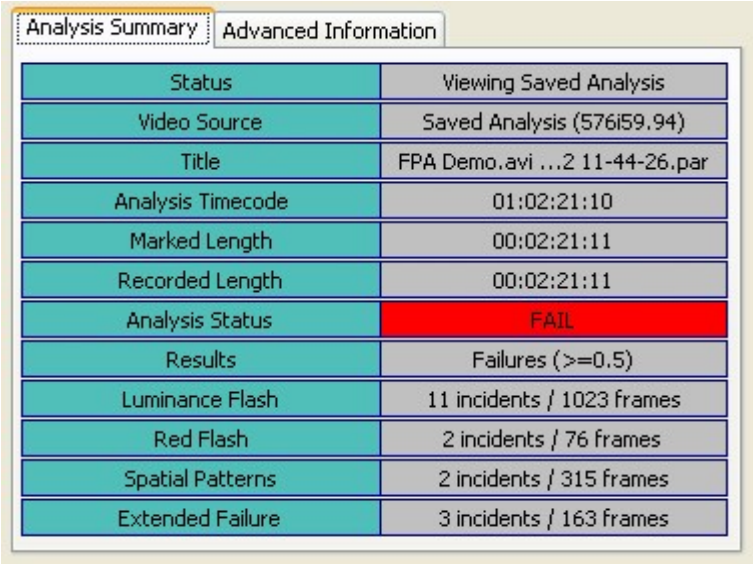


The Viewer's View menu

Within this menu are the options to zoom the graph in and out in order to focus on certain areas of the results, as well as the options to show or hide the diagnostic traces and the caution band from the graph. Zooming in and out may also be performed by the *Zoom In* and *Zoom Out* buttons underneath the graph or by pressing F1 and F2. The *Material Description* can also be viewed here.

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:



The Analysis Summary tab

Status: Shows whether the *HardingFPA HD* 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. The timecode in brackets is the amount of video stored in the disk buffer spoolfile waiting to be analysed.

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.

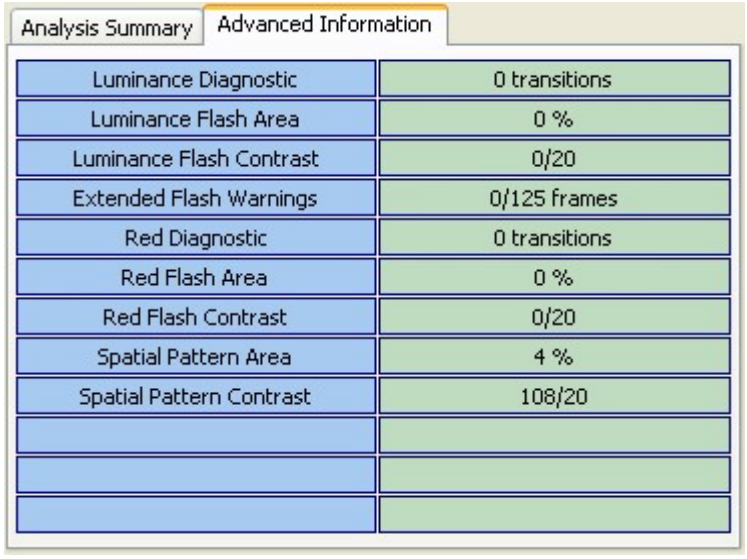
Luminance Flash: The number of incidents and frames that have exceeded the test guidelines for luminance flash.

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:



The Advanced Information tab

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

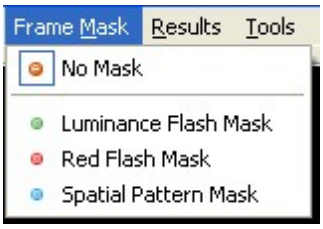
Guidelines.

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

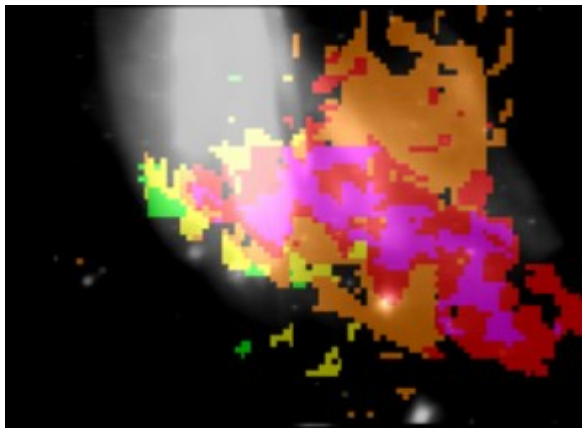
Frame Masks

The *HardingFPA* includes 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:

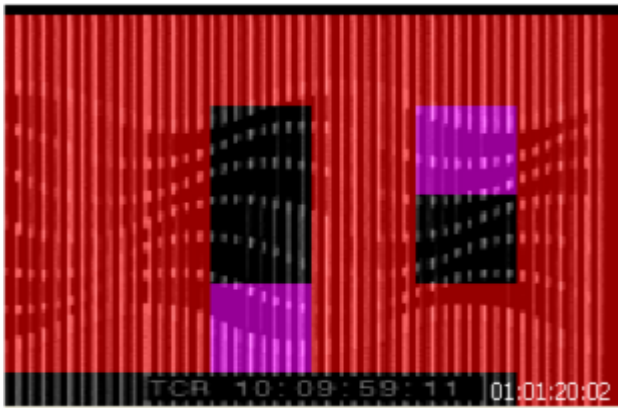


The colours represent the number of transitions which each pixel has experienced in the most recent second after allowing for motion. The analyser will issue a failure when more than one quarter of the image contains red or purple pixels. The same colour coding (shown below) is used for both *luminance*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

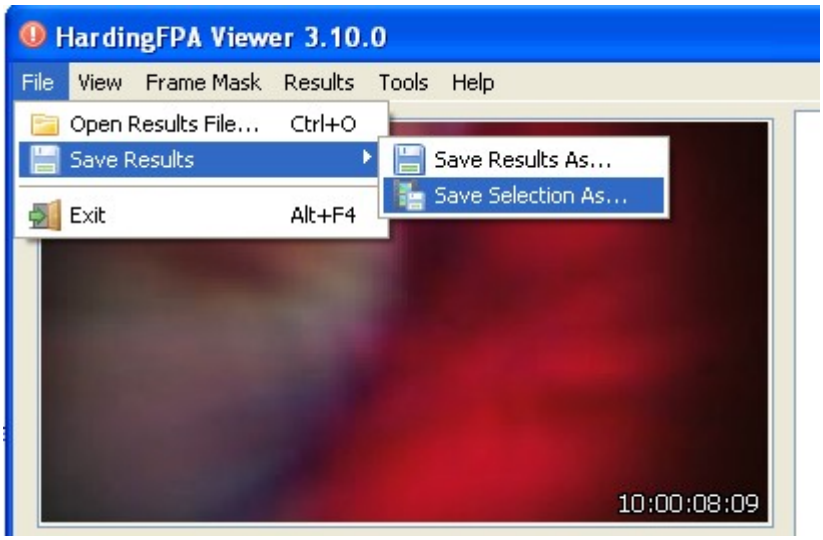
It is important to note that the *HardingFPA* **only** presents mask colours for pixels which ***will*** go into failure. This allows the editor to focus on the region(s) of the image which lead to the

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.

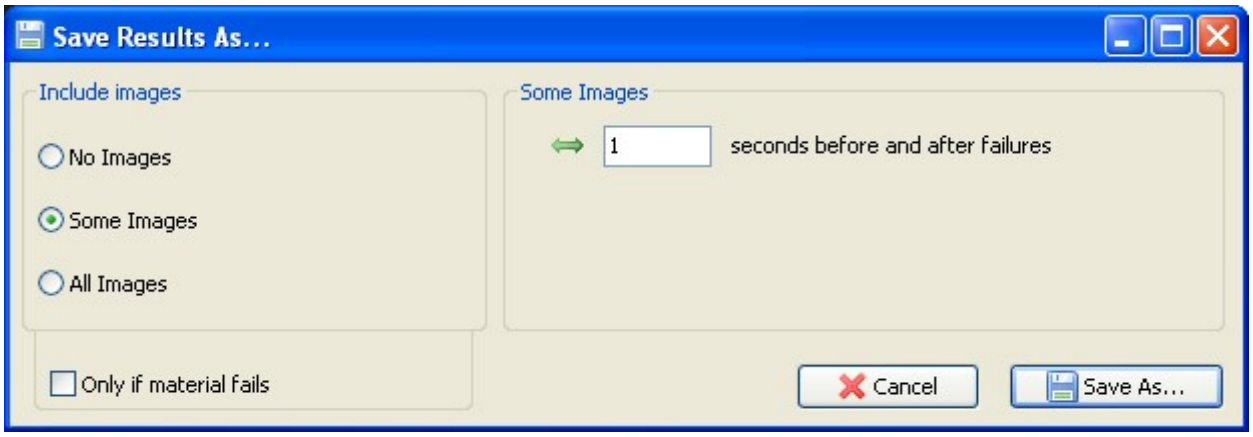
In addition, frame mask activity may suddenly disappear after an isolated failure sequence if the remaining pixel transition activity does not lead to a subsequent failure.

Saving a Selection

It is possible to save the marked selection of results as a seperate set of files in order to make transferring them easier. Set marker positions by either right-clicking on the graph or pressing the *Page Up* and *Page Down* keys or by clicking on *Set Results Start* and *Set Results End* in the *Results* menu:



In the *File* menu, the *Save Selection As...* item can be found. Click this and the following screen appears allowing the selected region to be saved.



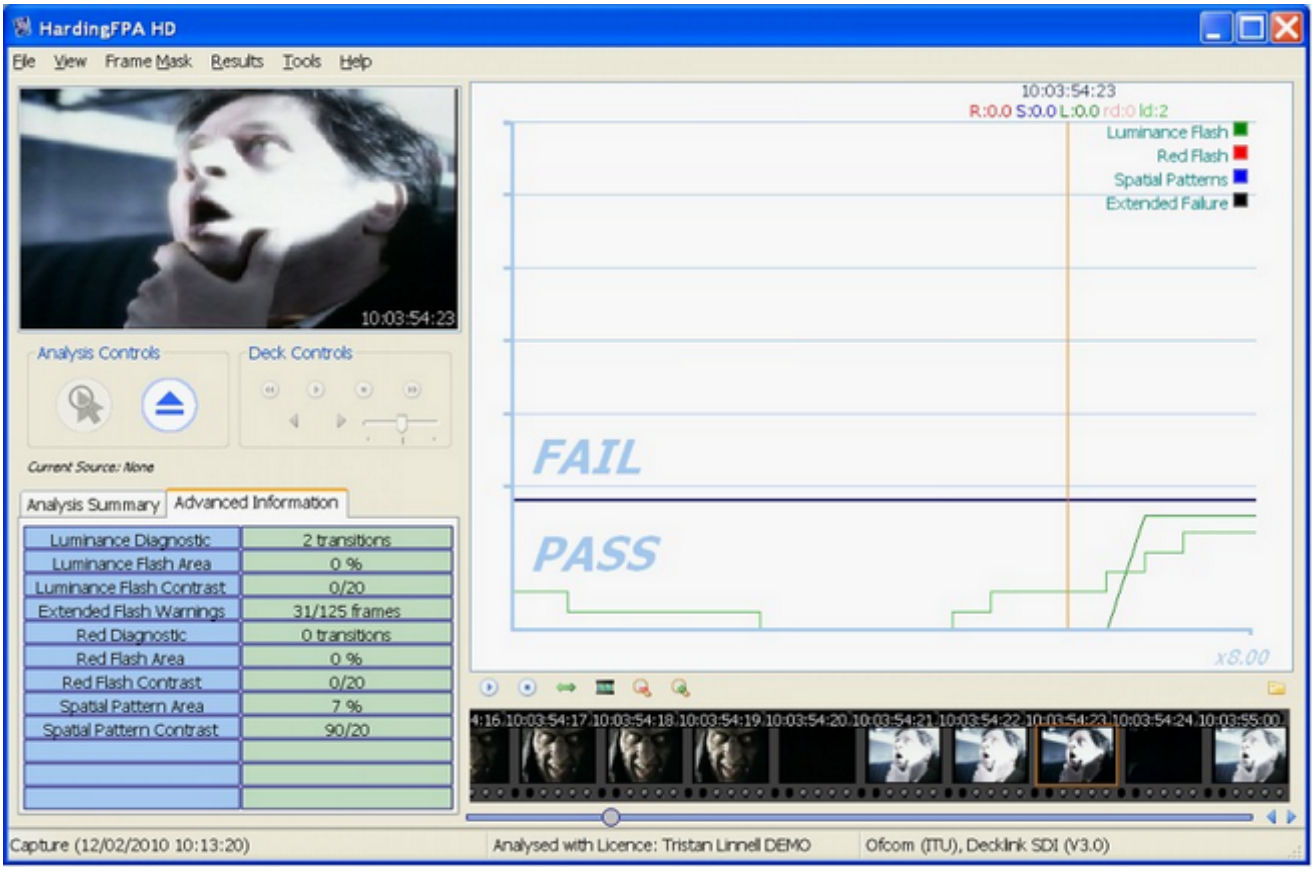
Images can be saved a configurable number of seconds around failures, and images can be omitted if the material passes (by checking the box *Only if material fails*). Note however that if the currently loaded results set does not have all images, then selecting *All Images* will only be able to save images where they exist on the currently loaded results.

It is important to note that when comparing results between material re-encoded at a different frame rate, then the number of failed frames will differ, and the results may differ as a result of the extra / 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.

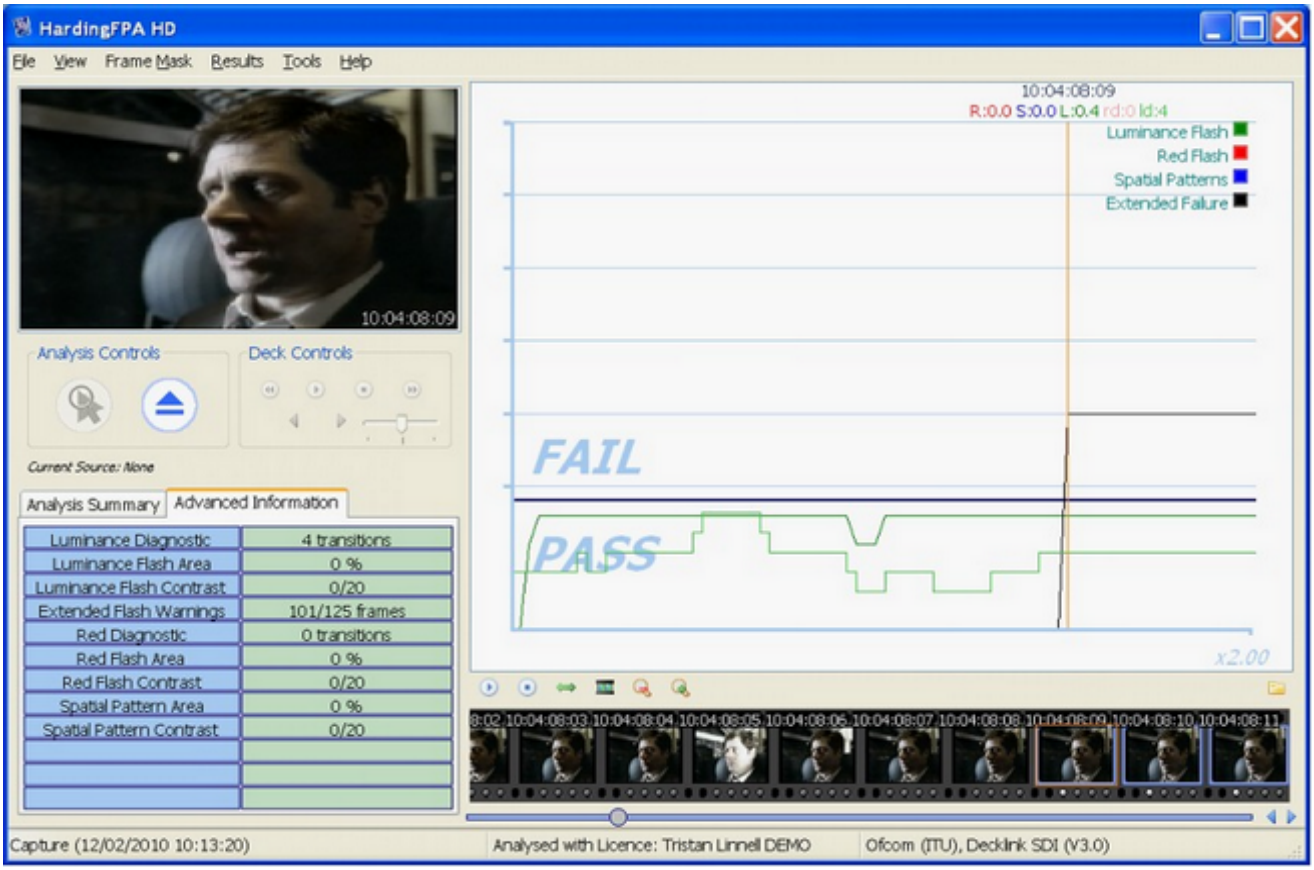
The example below shows that two transitions have been detected by the diagnostic trace (light green line) but that the main risk trace has not yet appeared because the flash frequency up to this point is not considered to be significant.



(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

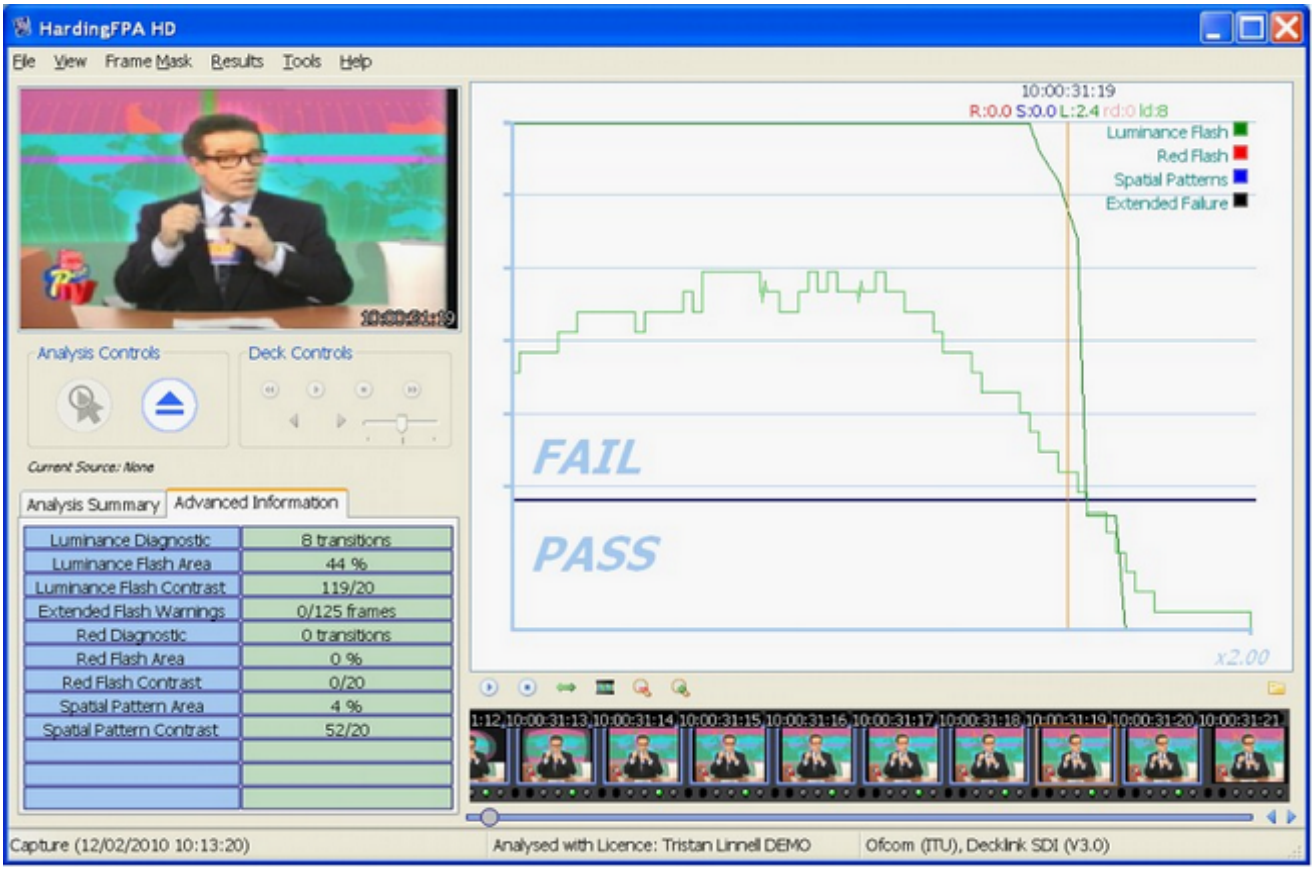
failure. Such a tiny change could be introduced when converting between formats, frame rates or codecs if this is not done carefully using professional grade codecs.



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).

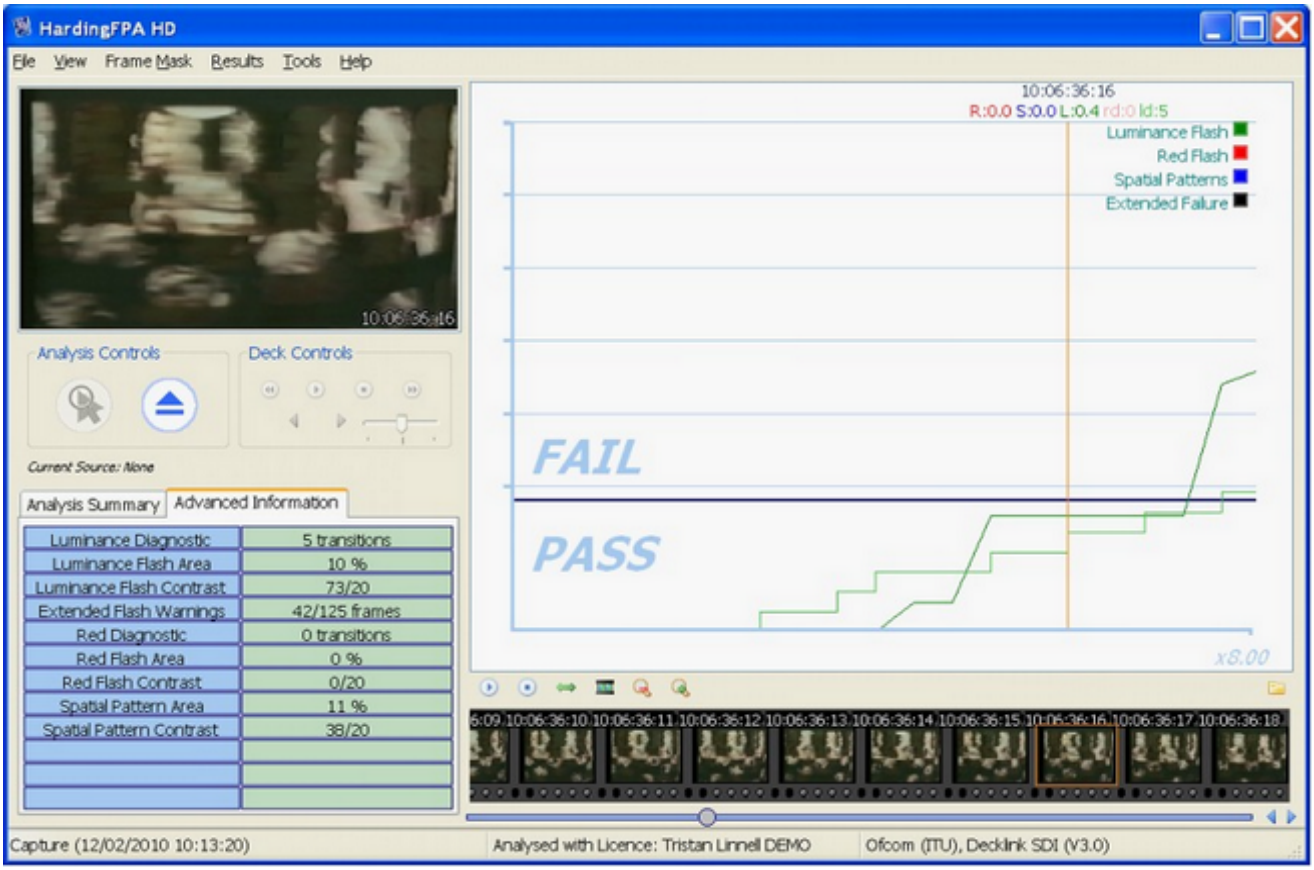
(2) Long sequence of flashing that eventually led to an Extended Flash Failure

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.



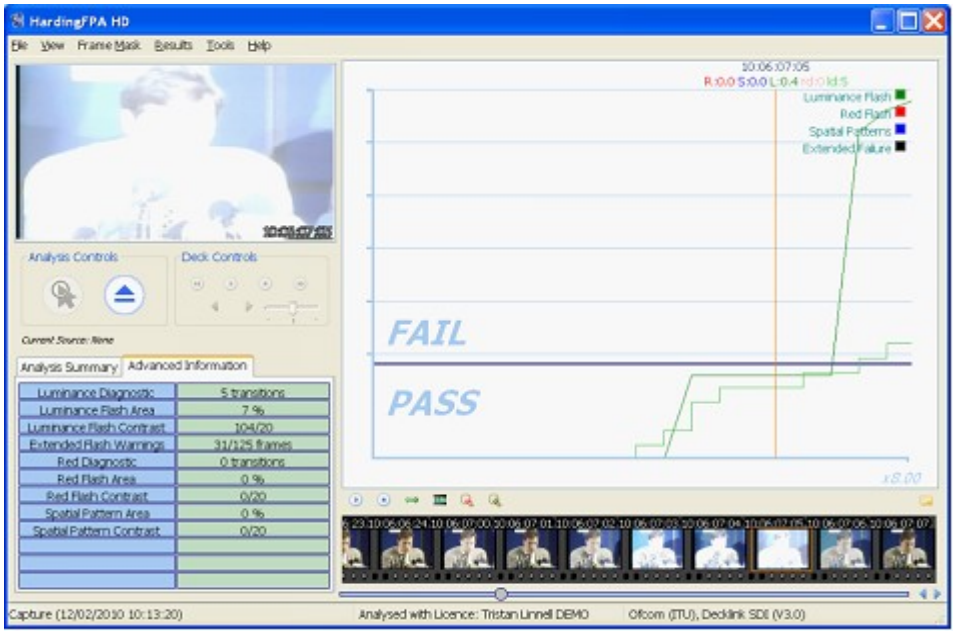
(3) Flash graph persisting after the flash.

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.



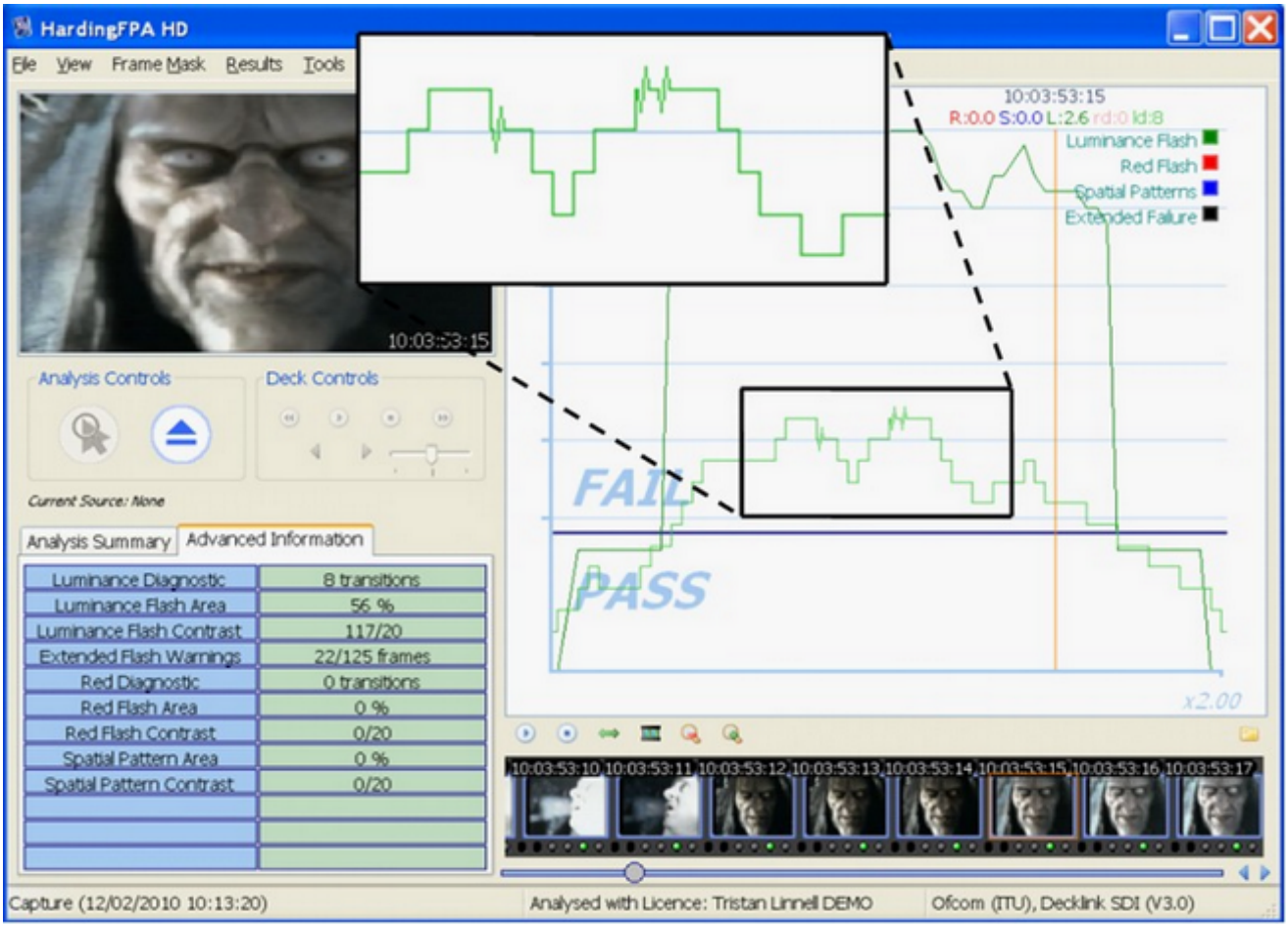
(4) Transition count (light green trace) increased without an obvious transition

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%.

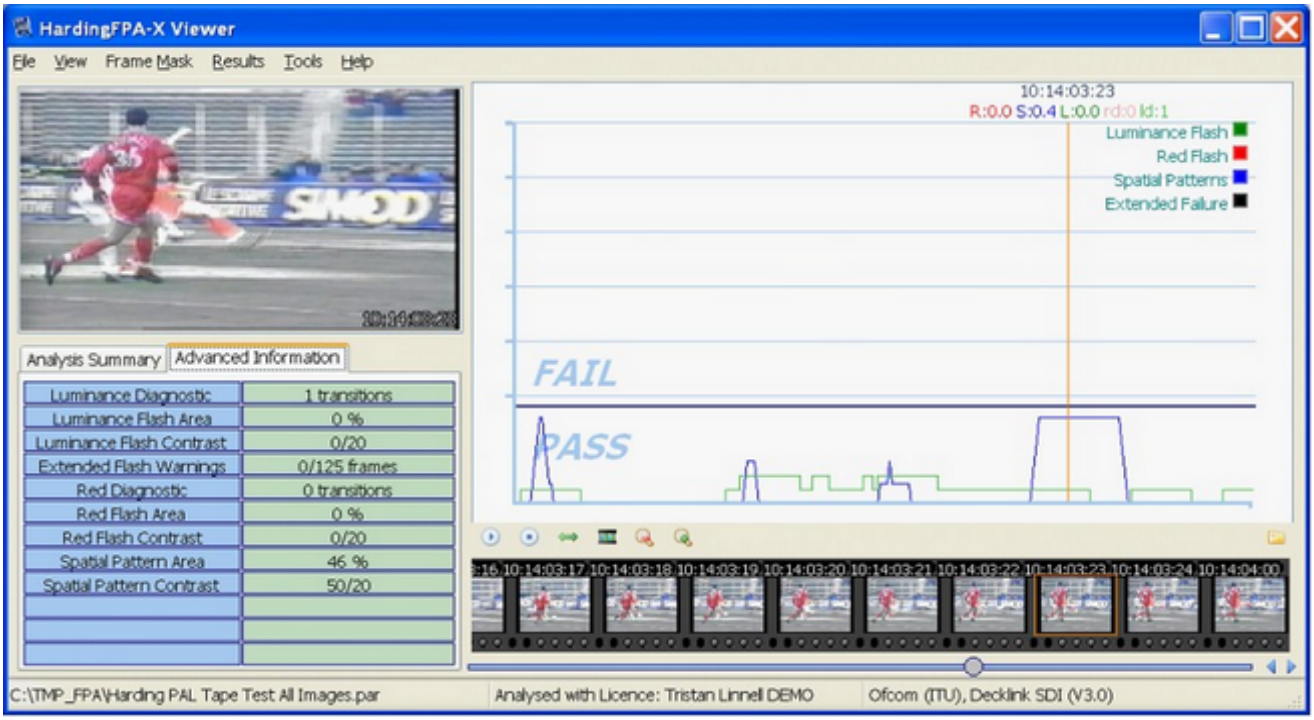


(5) A flash clearly occurred but the diagnostic trace hasn't increased.

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/m^2 contrast (limit 20 cd/m^2) 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.

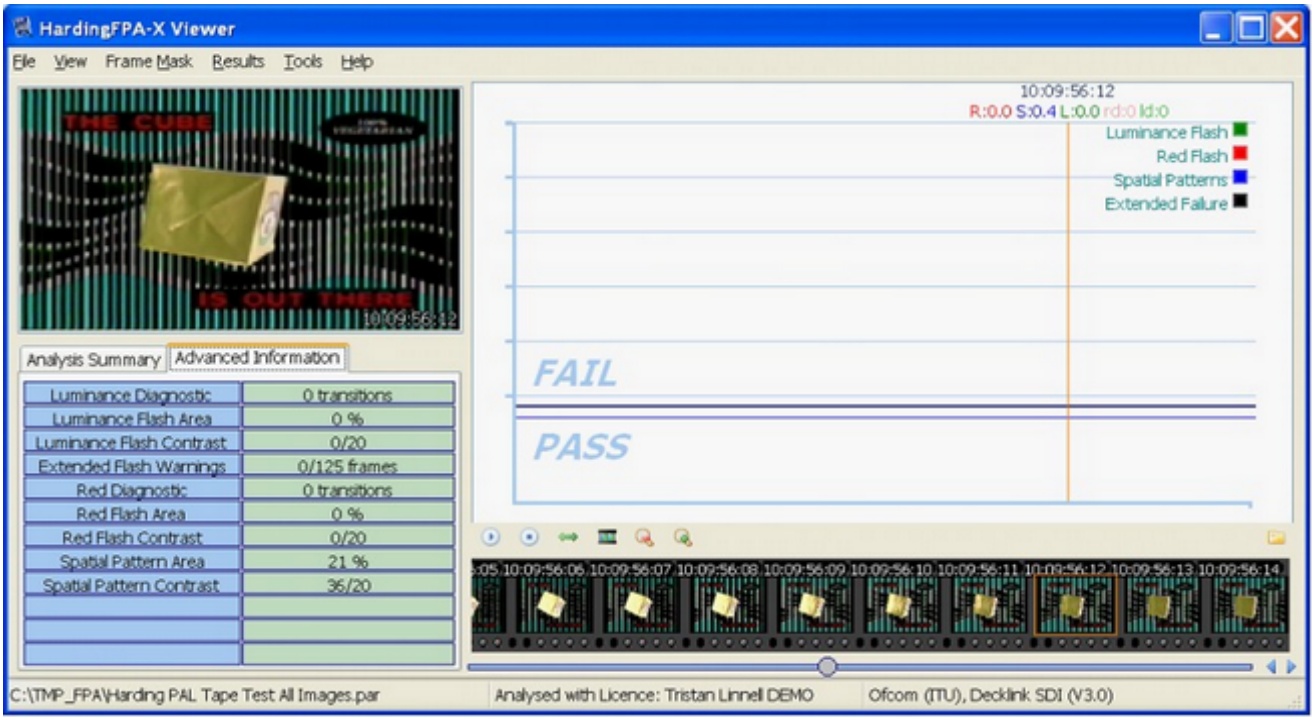


7) The diagnostic trace decreased within a few frames after it had increased. Shouldn't it have taken one second for the transition to flush out? -- Not necessarily. It is true that the diagnostic trace monitors transitions over the most recent second but the most active pixels that determine this diagnostic 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.

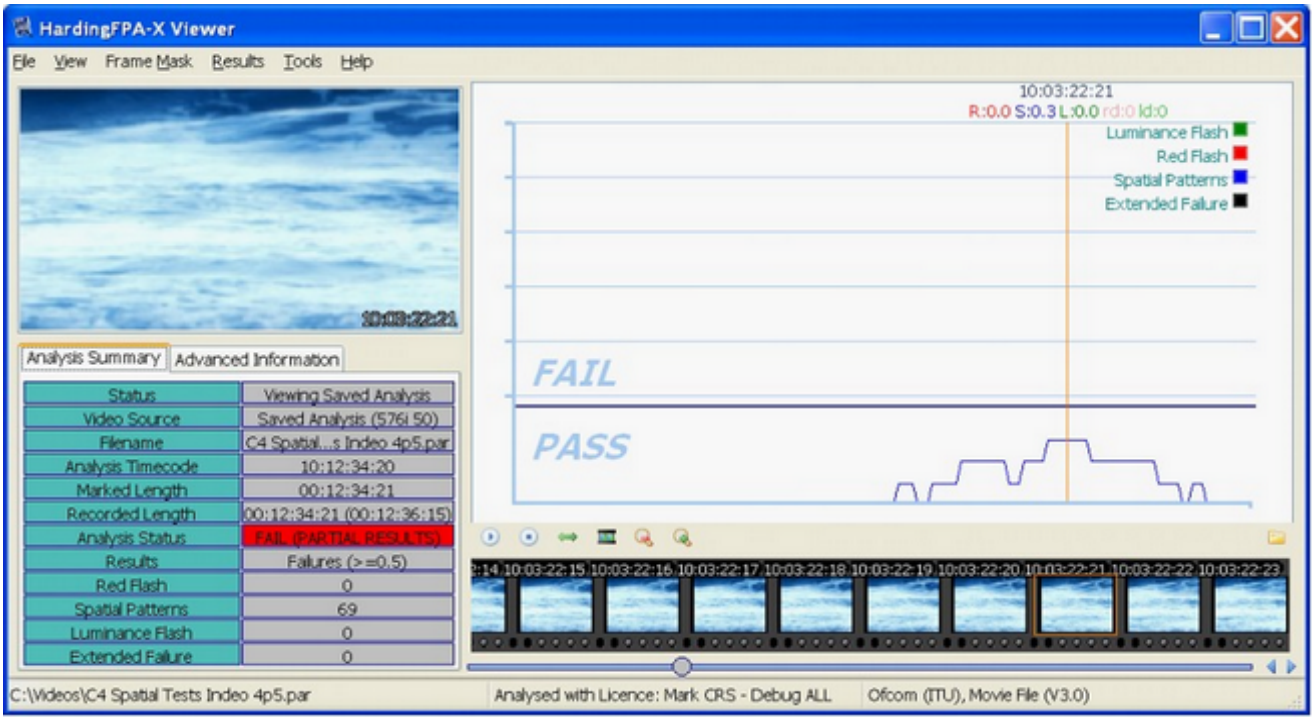
The example below shows the diagnostic trace (light green) increasing from zero to one for a period of only two frames (around the vertical amber current frame line) before returning to zero.

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.

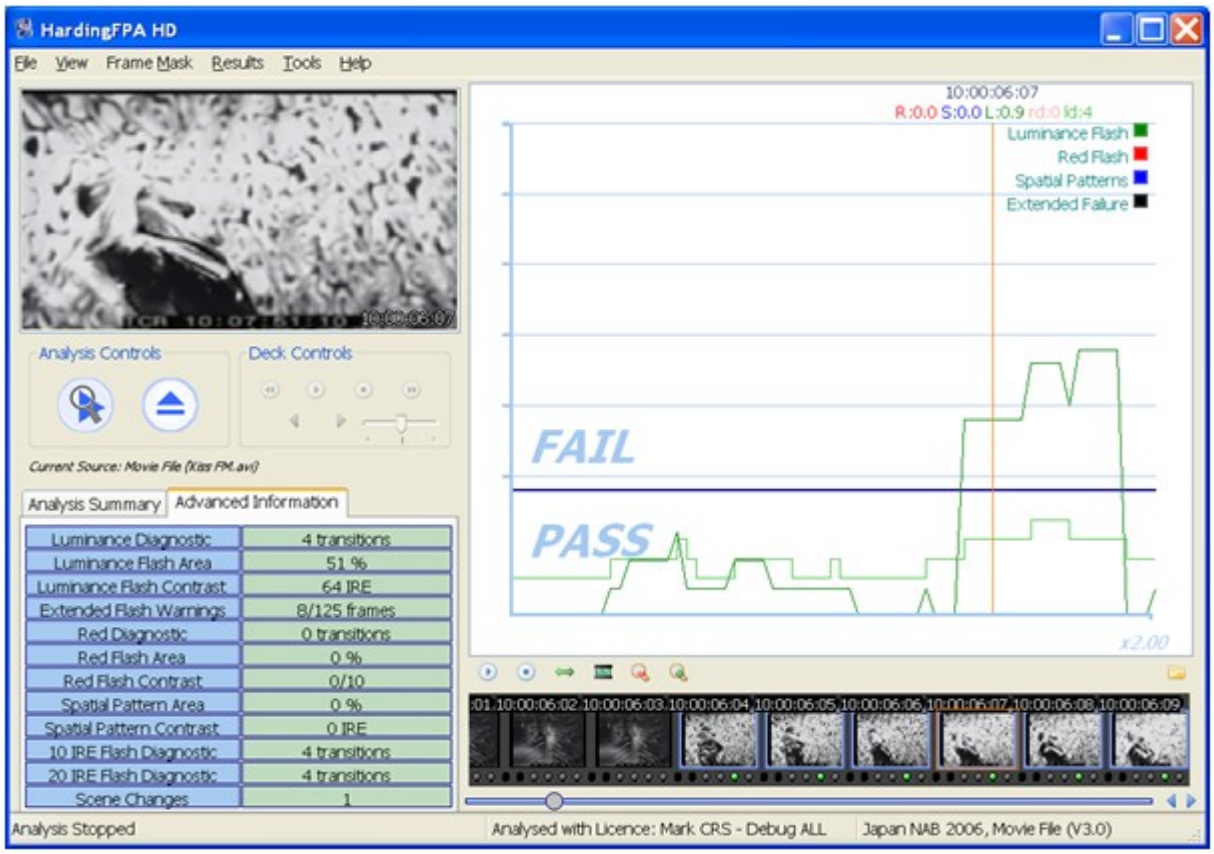
The spatial pattern in the example below passes because of text and foreground objects which break up the bar-like pattern into smaller irregular regions.



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.

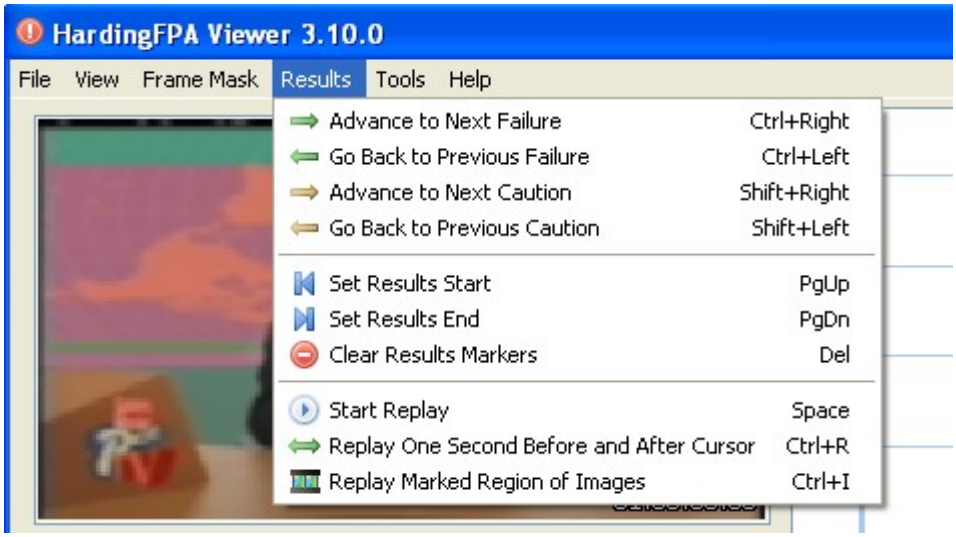


10) Scene Changes *(Japanese NAB Analysis only)* - When analysing under Japanese NAB guidelines, it is possible for the flash risk trace to go into failure while the diagnostic trace is still in the caution zone (see image). T his can occur if one of the transitions in the most recent second is classified 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.



The Results Menu

Within the *Results* menu are the controls for navigating the results graphs and thumbnails and playing back sections of video (only available where images are present – images are only written to the results files in areas of interest, for example around failures).



The Viewer's Results menu

Advance to Next Failure/Caution and ***Go Back to Previous Failure/Caution*** will perform the same action as the 'seek right' and 'seek left' arrow buttons under the graph, taking the cursor position to the next or previous failure/caution area.

The following menu items provide the ability to play back the images in various ways:

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

Stop Replay: Stops all playback.

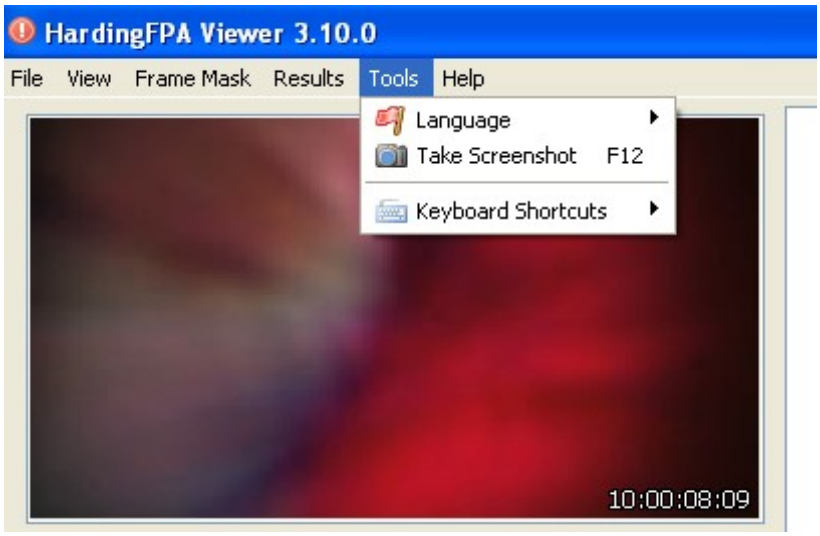
Replay one second before and after cursor: Animate the images for one second before and one second after the current cursor position whilst leaving the graph positioned at the current cursor position. This is especially useful when you are looking for the causes of a particular failure and need to look 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 or by clicking on *Set Results Start* and *Set Results End* in this menu.

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.

The Tools Menu

The *Tools* menu features the options to change the language, take ascreenshot or alter the keyboard shortcuts.



Licence Terms

The HardingFPA Viewer application uses the Silk icon set from http://www.famfamfam.com/lab/icons/silk/

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