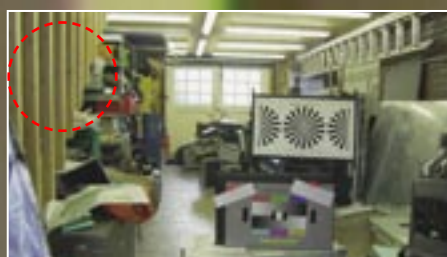




Four different lenses were tested – magenta and green fringing is apparent on verticals on left hand side only of full frames

Lens One enlarged 7X



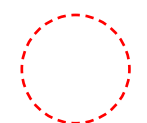
Lens Two enlarged 7X



Lens Three enlarged 7X



Lens Four enlarged 7X



enlarged areas

The Fringe Effect

Through testing of various wide angle lenses and cameras MIKE BRENNAN has found some alarming colour fringing artefacts

The days of colour fringing and registration errors were gone, we were told, in 1985.

The mighty CCD had arrived for professional cameras. I was so impressed I bought a camera.

Tubes had been around since 1920 but they had significant disadvantages. They wore out for a start. They could also be damaged by bright lights, they show lag and were sensitive to magnetic fields.

In 1985 CCDs began the true phase-out of tube cameras.

CCD have in theory a limitless life span, are not affected by magnetic fields and once registered need no day to day registration.

Registration, what is that you may ask? Until the advent of CCDs every time the camera was turned on a registration set-up was required to align three Plumbicon tubes. The three 'pick up' tubes were positioned behind an optical block, a glass prism then split and bounced the image around to provide three exact replicas of the image.

These days the process has developed and diachronic prisms are used to bounce the light around.

Diachronic surfaces reflect one of the primary colours while allowing the rest to pass through.

The glass filter on a news cameraman's camera light is usually a diachronic mirror, they are very accurate, do not fade with age and do not absorb much heat.

So three diachronic surfaces are arranged within three prisms, cleverly bouncing light around so that at the back of each prism pure Red Green or Blue light form three images.

The wafer like CCD sensors are permanently aligned to the back of the prism.

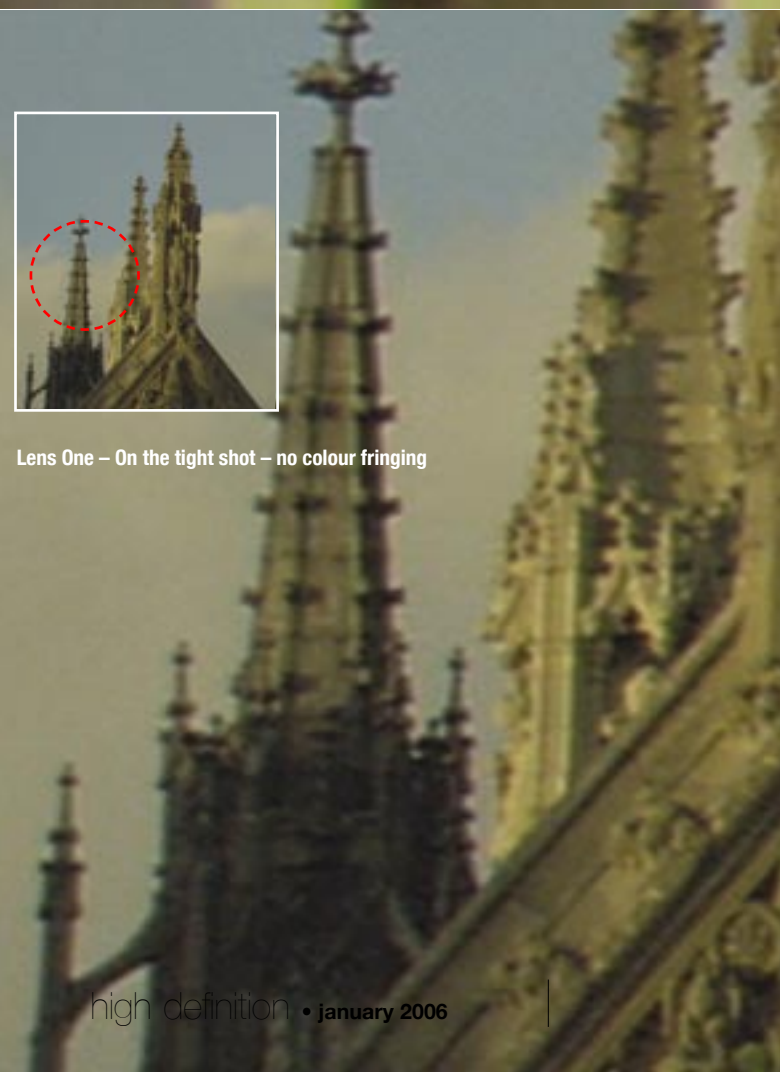
Each monochromatic CCD can now be considered to be sensitive to a primary colour.

>>

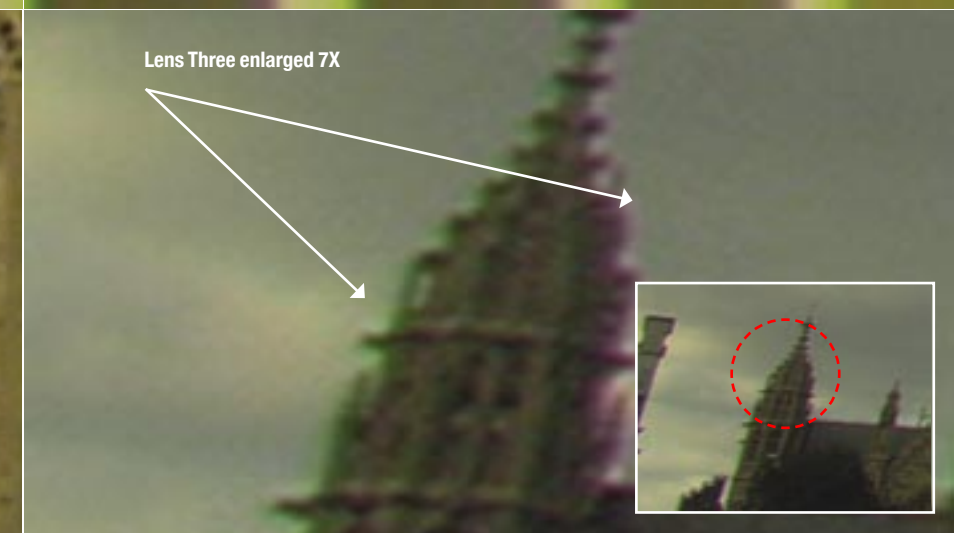
The fringing issue is evident across all lenses at focal lengths between 5mm-12mm and most noticeable 5mm-9mm. In this test we used regular HD lenses costing £20k and Digital Cinema zooms costing £50k.

The effect has been seen on all models of Sony HD cameras as well as the Viper since 2001 without detailed public discussion.

It can be seen live with the naked eye on a good LCD display



Lens One – On the tight shot – no colour fringing



Lens Three enlarged 7X



Lens One enlarged 7X



This is the basic theory for all three chip cameras. In some ways you can consider electronic cameras as three black and white cameras, each needing its own signal path to three recorders then to your TV set three black and white emitters, with the system perfectly aligned so that on the CRT or LCD screen each monochromatic signal hits the red green or blue filter to make colour where it should.

The plus side is that the CCDs are actually being presented with every colour in the scene. It is a pure system that if we have enough processing to digitise would output billions of colours.

We are stuck with 14-bits when we need more, that is a discussion for another day.

Trade-offs

But there are a few trade-offs with this optical block. One is that it absorbs light. Two is that we can only use lenses that are designed to focus on the image plane that is at a greater distance from the rear element than any other lens system, 35mm, still 35mm or 16mm movie.

So these lenses cannot be used without an adapter.

The block is made so the image planes are not at exactly the same distance from the exit pupil of the lens.

This helps the lens designers with the otherwise impossible task of making 100x zoom lenses where all wavelengths focus at the same point. One of the reasons there are no 30 to 1 film zoom lenses is one there is little need other than wildlife and two they are practically impossible to make so all colours focus on the film plane.

Each of the zoom lenses are designed with a 'sweet spot' where all colours come into perfect registration. Typically this is at a focal length that is most frequently used for that particular lens.

So there has always been technical collaboration between camera, optical block and lens manufacturers about degrees of sharpness.

High Definition

This was redefined for high definition with optical blocks that are different in design to standard def, so SD lenses are to be avoided on HD prisms for this reason alone.

When high definition came along we noticed that all shots taken with wide angle lenses looked a little soft. The lens took the blame for this, but there was more to it.

I thought it must be poor quality HD lenses (sorry Canon) and accepted it as part of the issues of bending light around the optical block. The very first frame grab I have in 2001 has a red fringe between a line of contrast on the left side of the frame. I assumed it was first generation HD lenses to blame. Yet when this was transferred to film I could not see it. It transpires that the resolution of even a show print, ie where the image has been scanned to neg and then printed without inter-positives the colour resolution of the process

and screening was not high enough to make the fringing an issue.

I was also distracted by seeing many test charts shot by the most paranoid testers around the world that were perfect. No fringing. So time slipped by...

In fact eight generations of CCD cameras after the first CCD camera I bought passed before registration-like problems once again became an issue.

It wasn't until full spec LCD became widely used just 18 months ago with the Decklink and Apple cinema screen combo that live testing of this phenomena was possible and it became clear that it was only apparent on wider lenses. The perfect registration of the LCD screen displayed live what we were seeing in frame grabs.

This coincided with uncompressed recording where the quality of recording brought the issue into sharpish relief in the edit.

It was a camera problem not a lens problem!

What was an interesting period we backtracked through all the frame grabs from the preceding years, like searching for signs of Alien life, there it is! – on some shots but not others. It had been hard to see on even a 24 inch CRT as the CRT has its own registration errors. It was across many different Sony cameras. I've seen it on a Viper too.

So for the past 18 months, dear reader, I have been nicely asking everyone in the business what they think this subtle problem is, why is it on one side and not the other, perhaps it is not solvable but we like to know don't we!

Camera manufacturers, lens and optical block manufacturers all seem to be not too bothered other than to say, "it's the lens or the block".

So do I have an real meaty technical answer? No. Does it matter?

To a producer or DP what matters is understanding that on wide lenses there will be fringing, regardless of aperture regardless of lens. Ouch.

How many composers have been cursing HDCAM compression when in fact it was a block issue that was also causing them grief. How many DPs struggling to get an extra stop to improve lens performance when it was undone by this effect.

Only one of my clients has noticed it as they should as they make HD resolution computer games.

So do not use lenses shorter than 9mm on blue screen and test your wide lenses for critical work.

We should have told you earlier, but I was hoping for 'closure'.

