A Log curve for Canon's EOS cameras

By Alfonso Parra AEC

Light Illusion has added one more curve of logarithmic structure to its set of curves for Canon's EOS cameras. The new curve is based on the Cineon one, but it does not follow it entirely, basically because the camera deficiencies regarding dynamic range, color and compression effects should do unfeasible the above mentioned curve. Light Illusion, through its web page, explains that LOG curve is not a simple copy from the Cineon one, because the dynamic range of the captured image has to be reduced into one image that has just 8 bits with a high compression degree. Due to the LOG curve is not a clone of the Cineon one, it has incorporated a group of LUTs, among them, which creates a real Cineon curve; as a result we can adjust the dynamic range from 8 bits up to 10 logarithmic bits. Combination of the LOG curve in camera with the LUT Cineon creates a real Cineon logarithmic curve.

Alfonso Parra AEC prepares to shoot on outdoor location

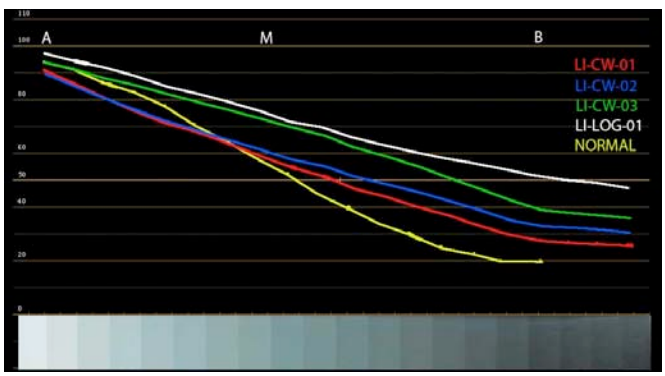
In order to make the following tests we have used the Canon's EOS 5D Markll camera; we have processed recorded material through Cut Color and Iridas' Speedgrade. We have exported frames without compression at Tiff format; and we have analyzed them through different programs as Imatest, ImageJ or Noiseware.

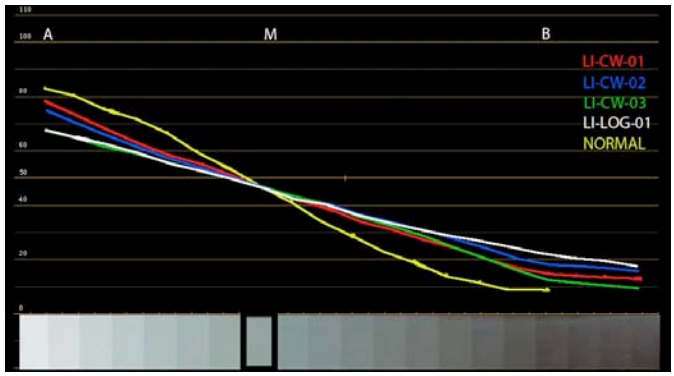
As we already knew we have found in the images all kinds of digital artifacts: banding, Moire, blocking, lack of color resolution, etc. Therefore; we are going to draw a thick veil over this fact, and we are not going to point out again.

Images used in this article are merely illustrative; they were converted into CMYK spaces to print.

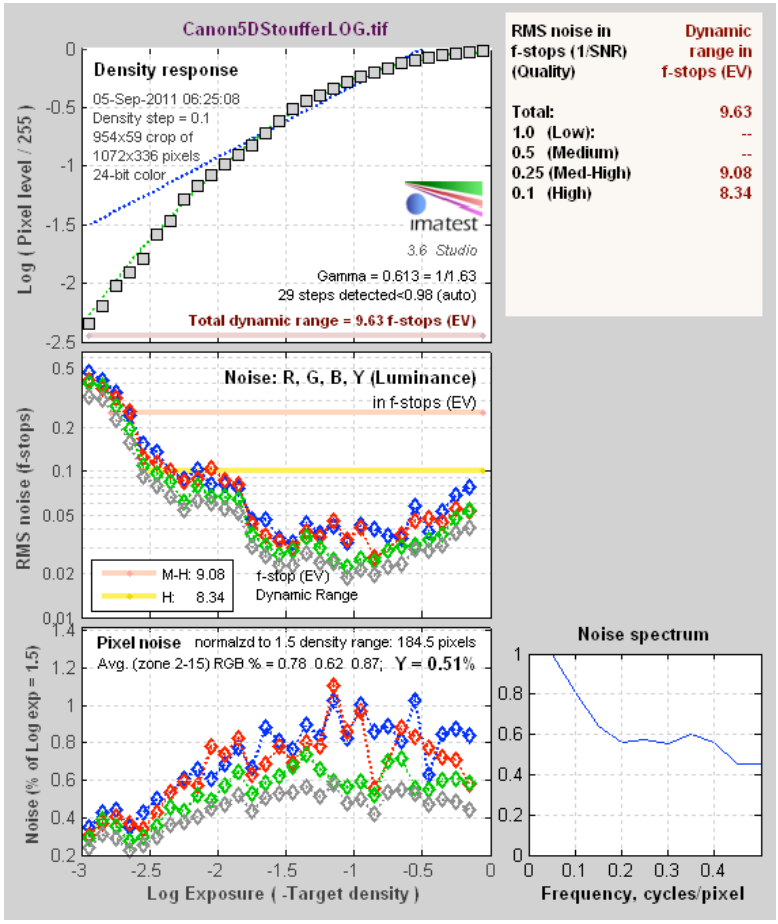
DYNAMIC RANGE.

We have begun shooting a Kodak's gray scale; we have adjusted the first exposure of white regarding the camera histogram, then; we have standardized the curve with the middle gray value as we can see on next graphs.



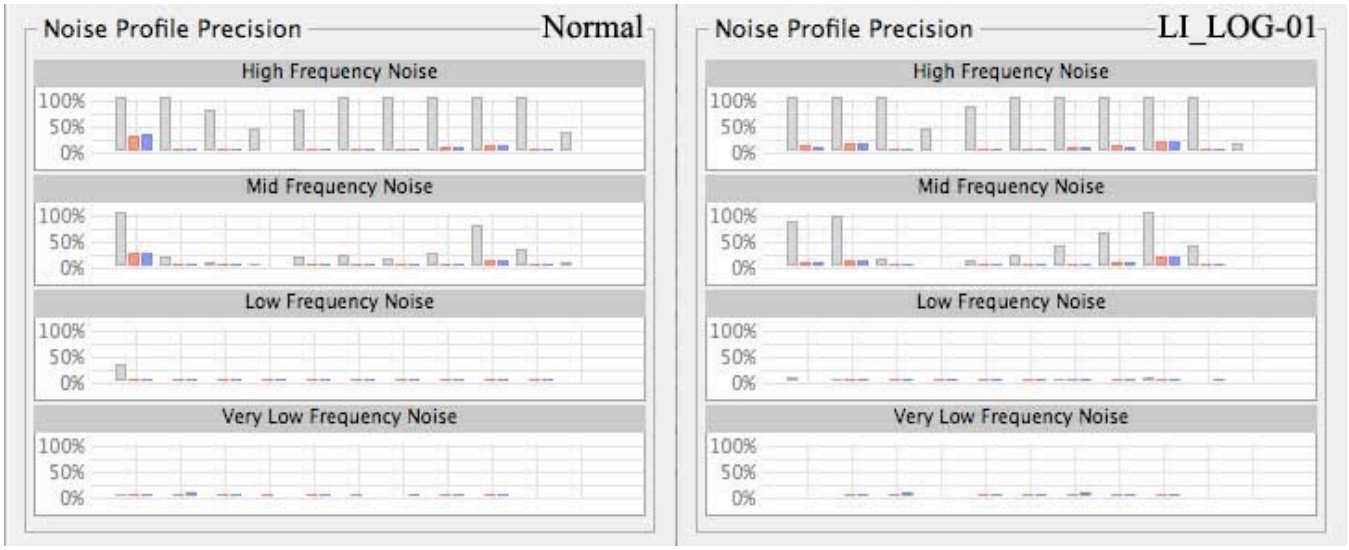


The LOG curve has less contrast than the other ones we have checked. It keeps white more compressed as well as the LI-CW-03 one, and it shows more detail at shadow than any other curve. We have used the Normal curve as reference. The Normal curve is the most contrasted one; moreover it is which gathers less information at both high lights and shadow. As we will see bellow, it has to be pointed out that despite the LOG curve shows more detail at shadow; it does not mean that we will be able to recover there. That is owing to the fact we can clearly see the artifacts from both the compression system and the tight information from the 8 bits. When we expose "to the right", in other words, we locate white on the right end of the histogram without clipping; the LOG curve modifies middle gray more than the other ones: it gives 75% value opposite to 55% from de Normal one. According to this outcome, when we expose regarding middle gray, we will be able to recover the largest quantity of detail at high lights without losing too much at shadow. In fact, the LOG curve gives the largest range dynamic as we can see checking the Stouffer strip.



The total dynamic range.is 9.63. It is 8.34 regarding 0.1 (high) value of noise.

As we expected, there is an increase of noise regarding the other curves as it shows more brightness at the middle tones and shadow, although it is not significant owing to the good response of the camera regarding the noise. We can see the noise outcomes in detail with the still-life profiles through Imagenomic's Noiseware (it checks the noises at different frequencies along the tone range). The gray bar shows the luminance and the color bars the Cb and Cr components. The largest noise level is at high and middle frequencies; it affects usually the luminance. The LOG curve gives a bit more noise at shadow and middle tones than the Normal one. Differences in practice are barely perceptible, when we are working with ISO values scale between 320 and 640. The noise is not significant from the chrominance values.



Noise profile from the still-life through Noiseware 4 (http://www.imagenomic.com/)

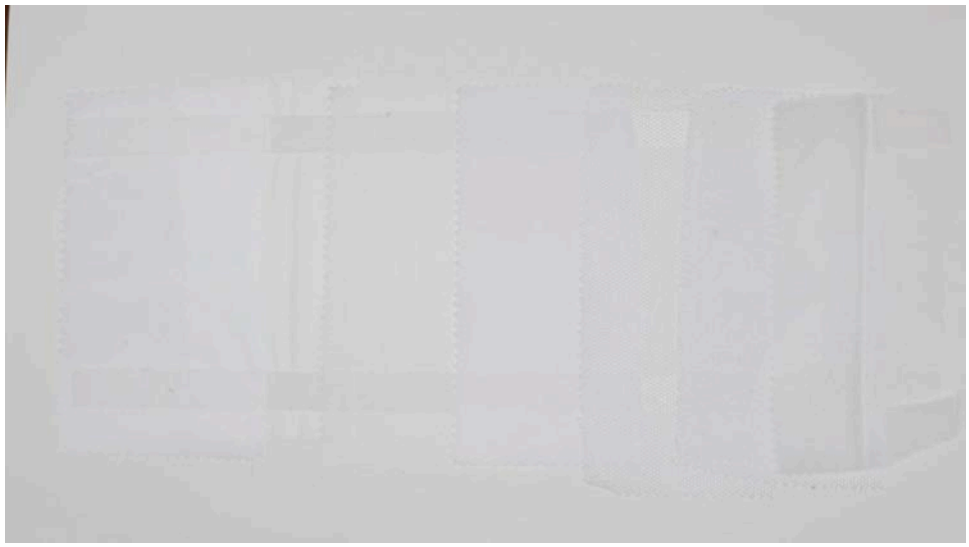
Next, table shows comparatively the RD and noise with the different curves through the Imatest program.

Gamma Curve (Scene)	Total dynamic range in F-Stops (Imatest)	Pixel Noise average on Y (Imatest) %
Normal	7.48	0.30
Light_Illusion_CW-01	8.82	0.31
Light_Illusion_CW-02	9.05	0.31
Light_Illusion_CW-03	8.72	0.32
Light_Illusion_LOG-01	9.63	0.51

Shooting on outdoor location.

We have made an exposure strip through the *Death Chart,* then we have graded. We have exposed at 45% value of the middle gray. In order to balance the gray value of the different exposures we have corrected exposures. So, the LOG curve gathers all of the texture from white at base exposure; it usually is 2 1/3 above the middle gray. White are not still clipped with one point overexposure, it keeps all of the texture. Even if we overexpose ½ more point, we can recover white, although it is already at clipping limit. It means that we can consider until 4 stops above gray. It is really amazing to camera with such features. Nevertheless; we have conducted a test more precise with just a set of white fabrics in order to evaluate texture at high lights. Here, it is the Chart. We have been able to precise much better the clipping limit with it.

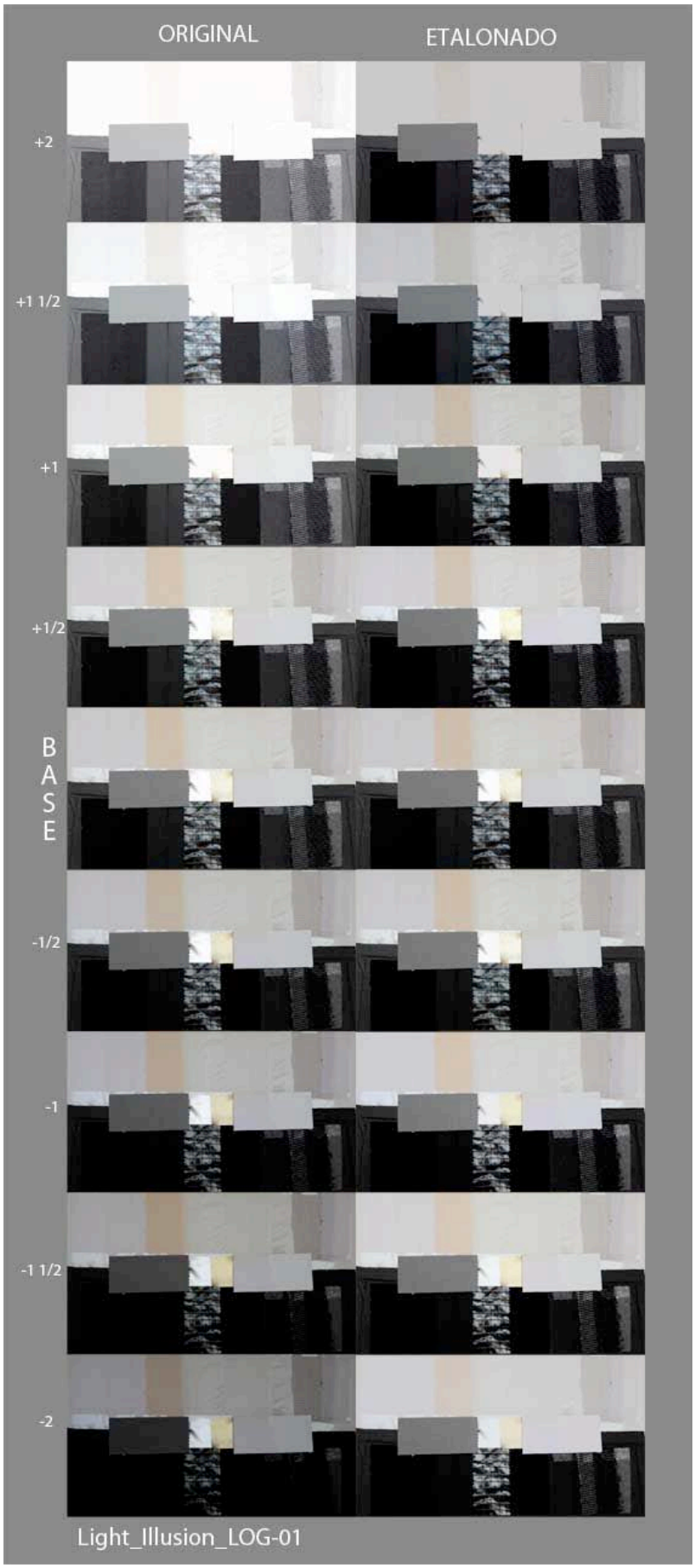
Original from the camera, overexposed 1 1/2



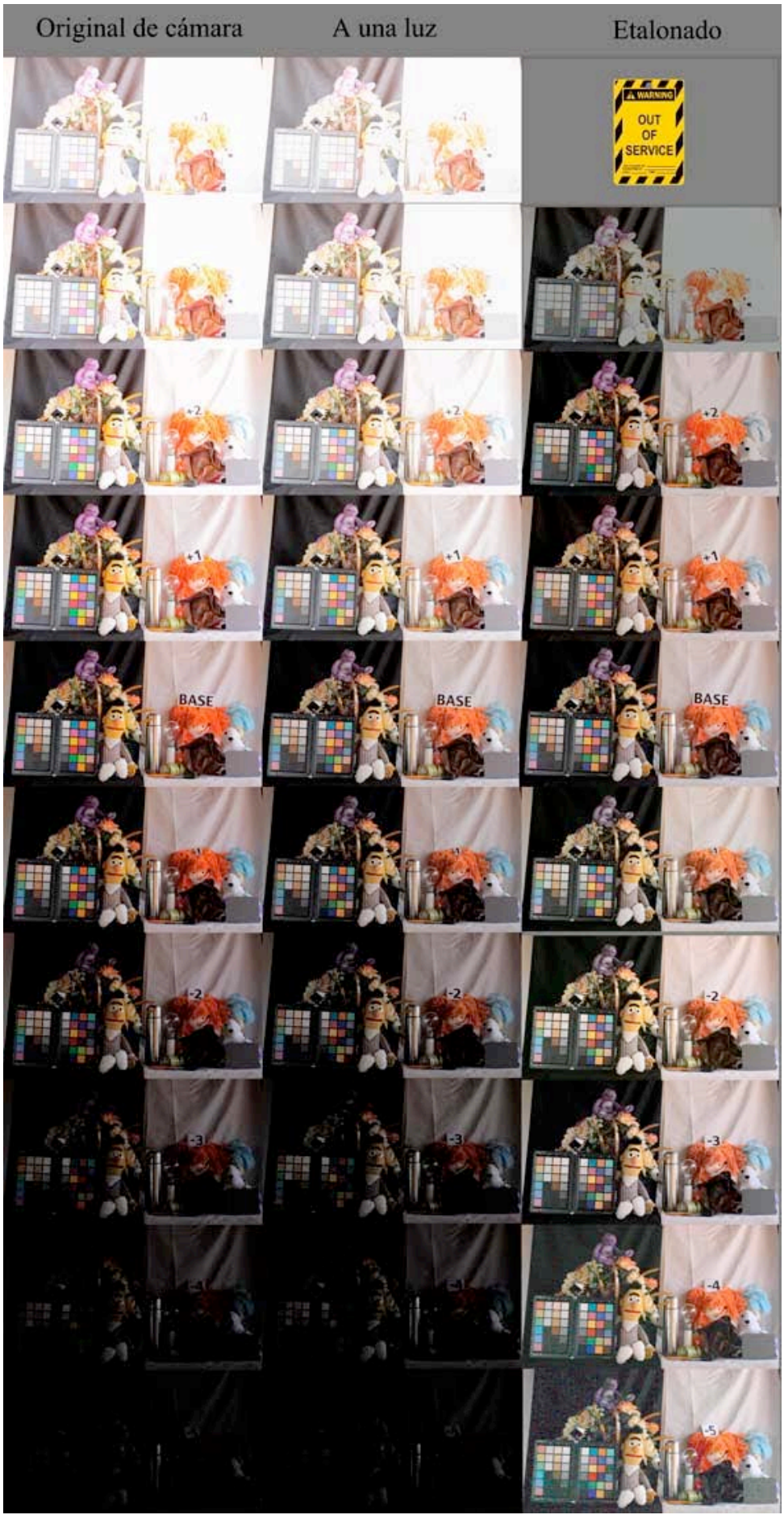
Corrected in order to show the texture and detail

The finest textures, as silk, disappear with more than 3 ½ stops; although white is not still clipped, it will be practically clipped with 4 stops. Finally, in the absence of still-life and outdoor observations, we can conclude that we can handle until 3 ½ stops above the middle gray with the LOG curve; it means practically 1 more stop than any other one, moreover it is quite a lot above the manufactured curves.

Let us check black. We can see all of the texture from different fabrics at the base exposure; even the Moltón, the darkest, which is 3 stops below the middle gray. We can see still the Moltón PN5's texture, whereas the other ones with one point underexposure. From here on, detail recovery is practically impossible owing to the compression effects, Moire, banding and the rest of the delights provided by this photo camera. According to this fact, we can point out that the range below middle gray is close to 4 stops. From now on, we can see the brightness differences among different blacks until 5 ½ stops. This information will help us to get black less plane, denser and with deepness at grading.

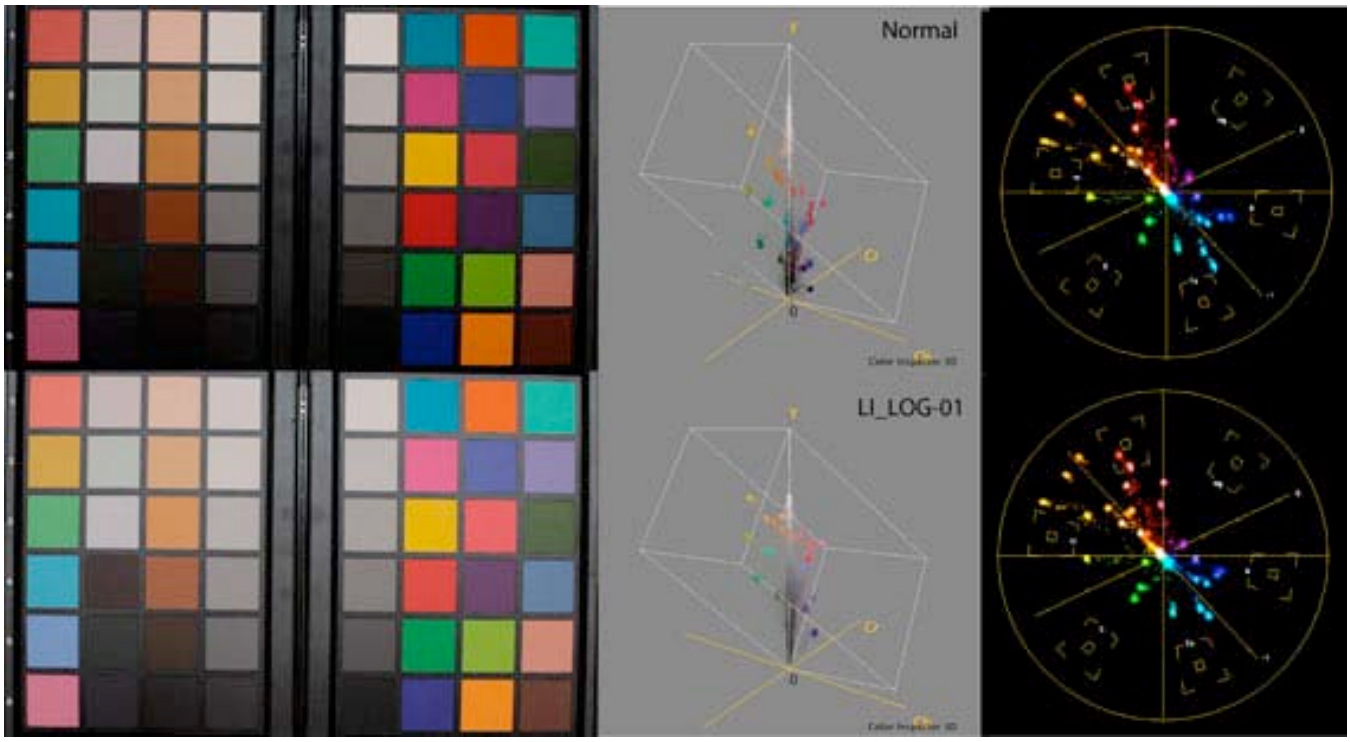


Let us see now our still-life besieged by the crisis: a one-eyed bear, two poor dolls and a discouraged Epi rebuked by the violet frog.

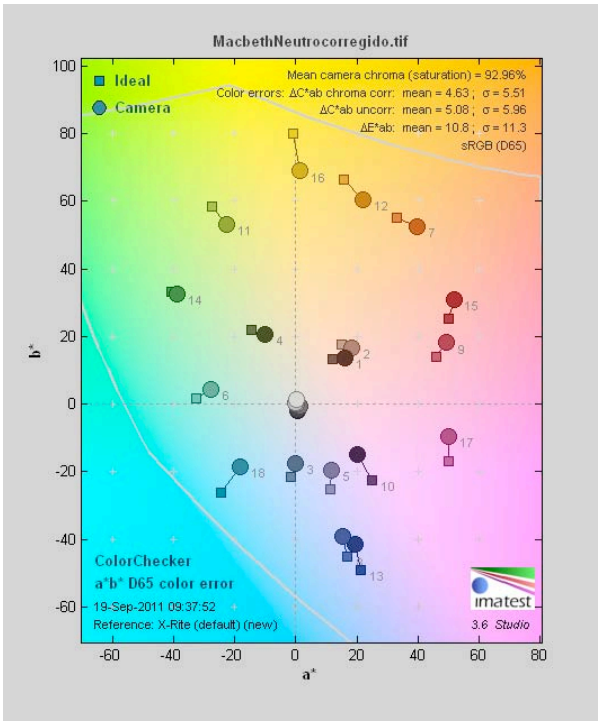


We have not find anything new regarding the dynamic range in the exposure strip from the still-life. White is lost from 3 ½ stops, and black loses details a bit above 4 stops.

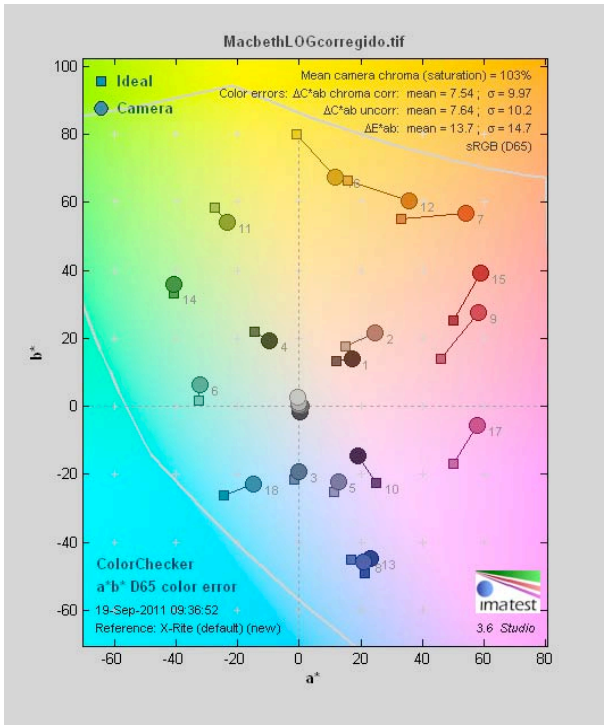
We make the same considerations to the LOG curve as to the other ones regarding color: slight deviations at shadow and high light under large degrees of over and underexposure. Let us see comparison between the Normal curve and the LOG one at the SyperCheck chart.



We have exposed both charts to the middle gray. Colors are represented at Y Cb Cr color space in 3d, it is also at the vectorscope. The only observation we can point out is that green and cyan tones are less saturated with the LOG curve than the Normal one; the orange tones are more red-like with the LOG curve, whereas the Normal one shows more yellow-like. We can see also this deviation with the analysis of the Imatest's Macbeth chart; above all if we compare the LOG curve with the NEUTRO scene (manufactured profile), which gives the best color representation.



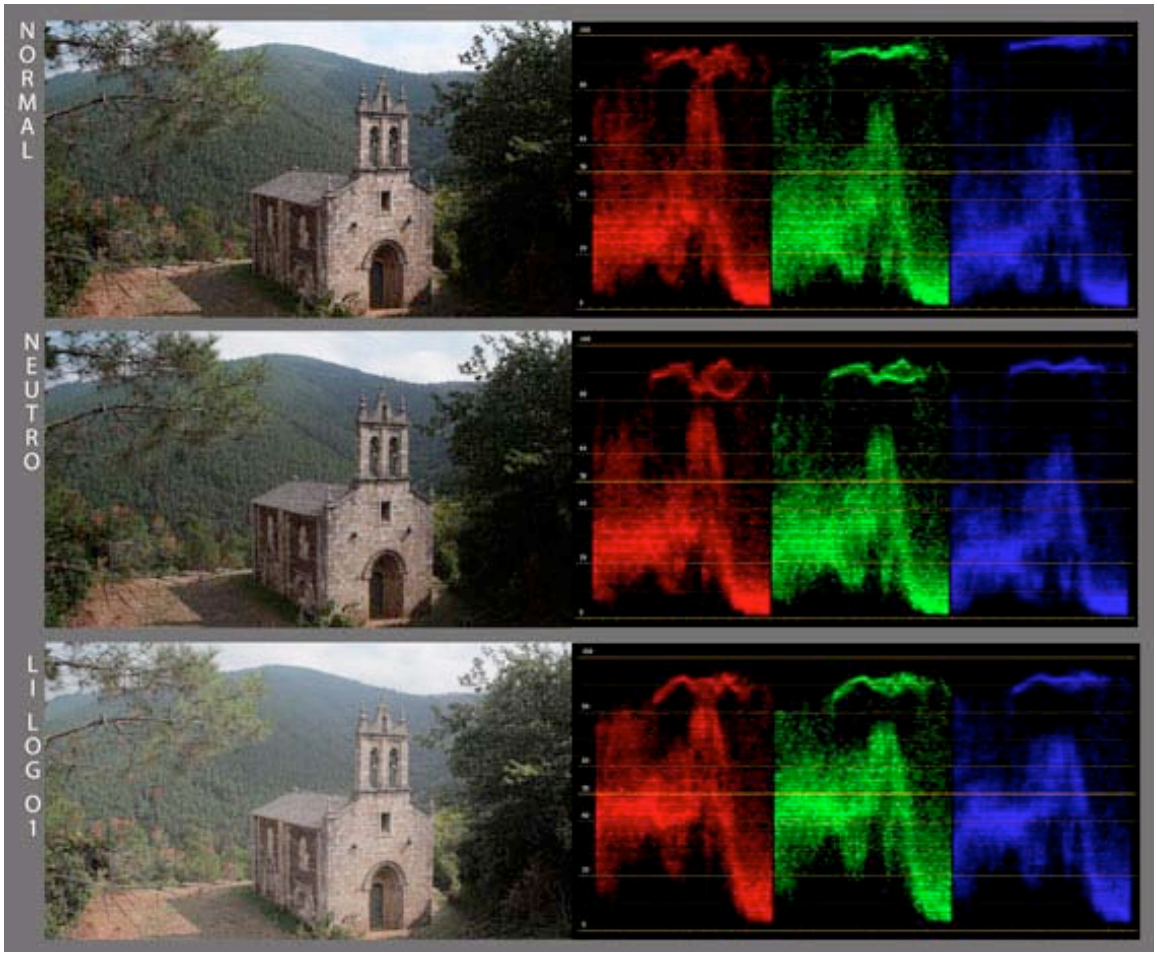
NEUTRO curve



LOG curve

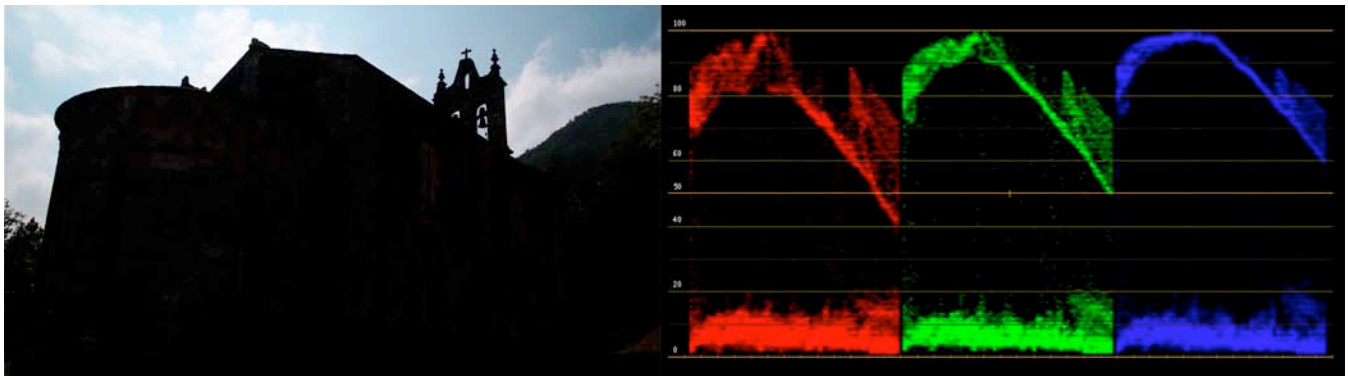
The orange color patches (12 and 16) go well towards red with larger saturation. This effect was already seen in the still-life, especially in the orange hair of the doll, and in the Epi's face. Anyway, these slight deviations can be corrected in postproduction. Finally, let us watch some frames shot at outdoor locations.

Church of San Xoán da Cova. Romanic temple, end of XIInd century, which was a monastery to Benedictines nuns in the ribeira sacra. Concello de Carballedo (Spain)..

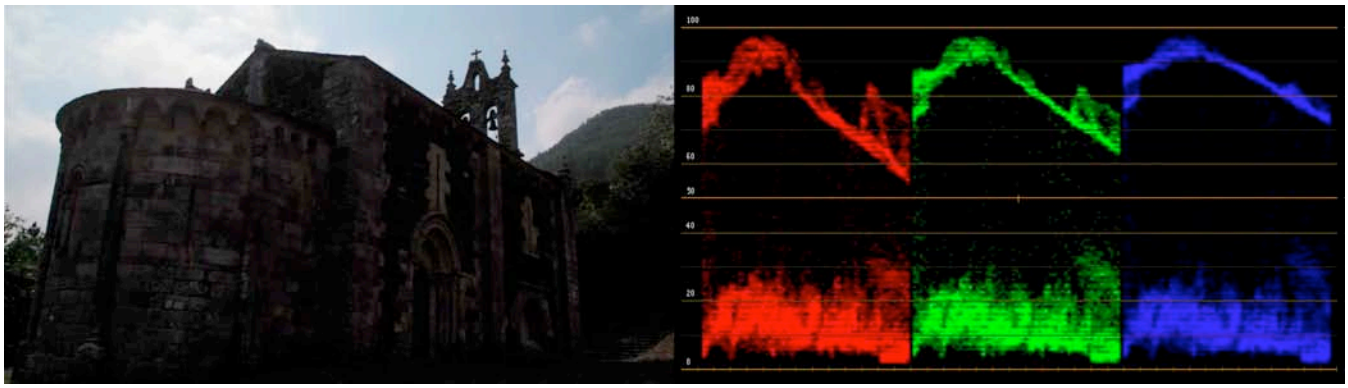


Sky clouds are at clipping limit with the Normal curve, and it does not appear any texture opposite to the LOG one. The LOG curve deals without problem the clouds; it shows more detail at shadow, above all on the wooded area on the right side, next to the stairs. We can see more detail on the facade in the shade opposite to the other two curves. We can check it through waveform monitor: shadow and middle tones by the Normal and NEUTRO

curves are more compressed. We can observe also the same outcome on against the light of the church; here the contrast range is 64:1, i.e. 6 stops



Canon's EF 28-105mm zoom. ISO320 1/50 25fps T 22. ND 0.9 filter. Exposure with the Normal curve (manufactured), adjusted at high lights on the right of the histogram.



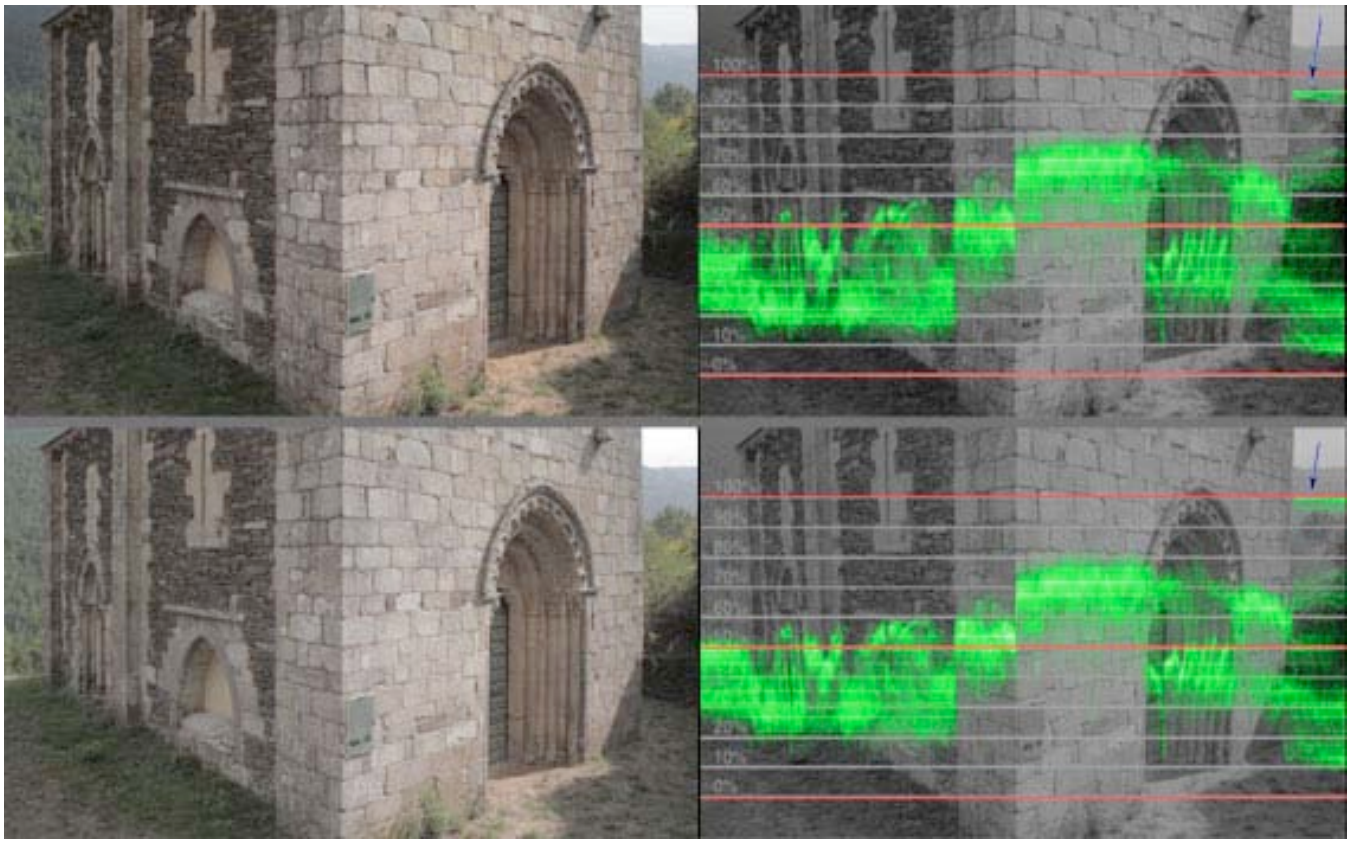
Canon's EF 28-105mm zoom. ISO320 1/50 25fps T 22. ND 0.9 filter. Exposure with the _Illusion_LOG-01 curve, adjusted at high lights on the right of the histogram.

The LOG curve not only gathers the best clouds texture, but it shows more detail on the church facade in the shade.

Finally, let us compare the LOG curve with the Light_Illusion_CW-02 one. I have chosen it because it is the one I most appreciate. I believe that it gives a good result at the majority of circumstances with high contrast.
Sky area is around 92% with the LOG curve, whereas it is at the limit with the Light_Illusion_CW-02 one, it has a slight clipping, although it shows a bit more brightness at shadow and a bit more detail too. The middle tones are much alike to both curves. (Lower image with the MO value superimposed).

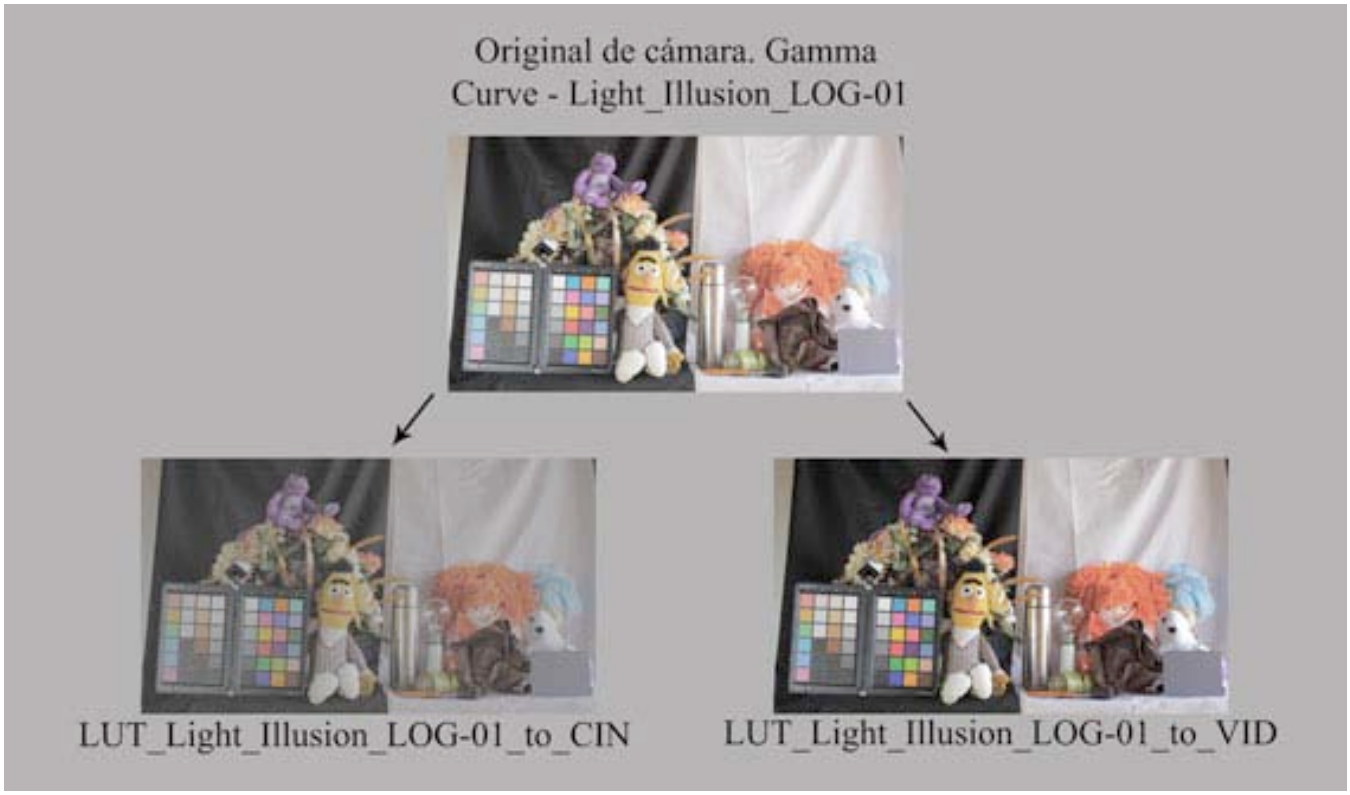
My camera assistant David Panizo enjoys with the middle gray

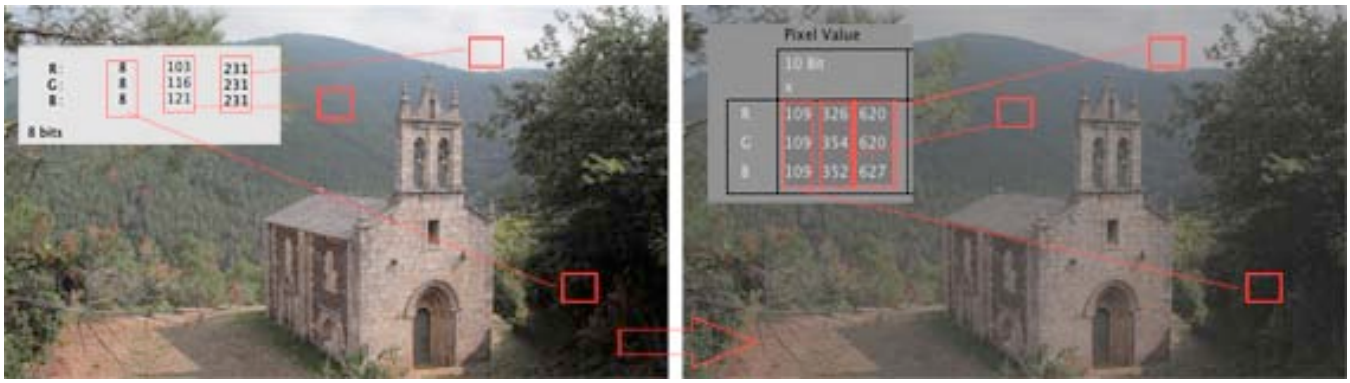
We can generally say that the two curves are the best option to carry to the limit the photo cameras abilities or the non professional video, whatever its name is. As professionals, although we are sometimes compelled to use this kind of devices, it does not mean that they reach the professional category. In order to reach this status, it has to follow certain technical specifications collected in a lot of international regulations; in addition, we should consider the experience along more than a hundred years about evaluation of the images quality for the directors of photography from all over the world.



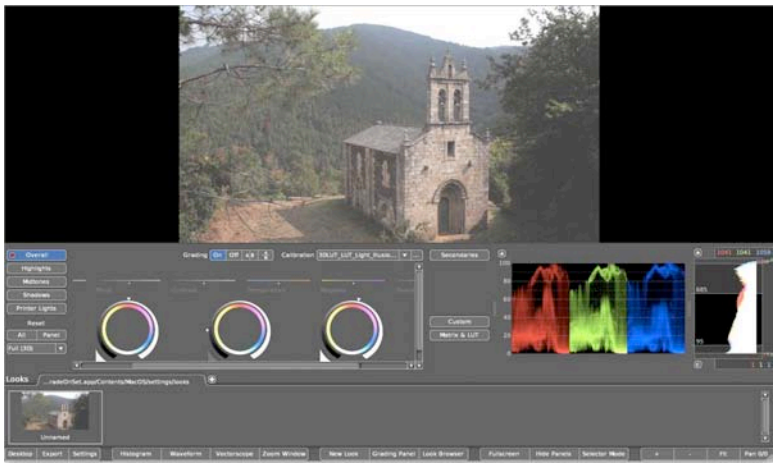
Top image. Canon's EF 28-105mm zoom. ISO320 1/50 25fps T 1. ND 0.9 filter. Exposure with the curve Light_Illusion_LOG-01.
Lower image. Canon's EF 28-105mm zoom. ISO320 1/50 25fps T 1. ND 0.9 filter. Exposure with the curve Light_Illusion_CW-02

As we have pointed out above, both curves need grading. We can use a group of LUTs in order to transform the original material to any space; in practice, we can work with near all of the current software to color correction. Next image shows only two curve transformations: first one to Cineon values, second one to standard video709.





On the left, original image with the LOG curve. On the right, original image after using the LOG-01 LUT to CIN. We have included the pixel values in order to see the exact transcript from values of the 8bits system to values of the 10bits one. We have to remember that the minimum density value in the Cineon system is 95, the middle gray is LAD 445 (16% gray), and white is 90% 685. As an example, sky clouds are close to 230 at 8 bits, and 615 at 10 bits. In spite of that we are not going to get ever more information than provided by the camera; the LUT help to place the information in a handier system to work in postproduction. Above all; if our project demands good color correction.



Color correction through Speedgrade starting from the Cineon LUT.

Conclusions

Curves designed by Light Illusion to Canon's EOS cameras carry their abilities to the limit to capture images. I believe that these curves are essential in order to get the best possible images with the EOS photo cameras; in addition, for an actually affordable price.

I would choose the **Light_ Illusion_CW-02** curve, and the **Light_ Illusion LOG-01** one (to which the article is dedicated) out of the four.

In short, I propose next chart:
Light_Illusion_CW-01: Scenes with a moderate contrast
Light_Illusion_CW-02: Scenes with a high contrast
Light_Illusion_CW-03: Scenes with a low contrast that require larger detail at shadow and middle tones
Light_Illusion_LOG-01: Scenes with very high contrast. Specially recommended if it has to work at Cineon format, 10 bits Log in postproduction.

Finally, next table shows the Dynamic Range regarding middle gray of the curves I usually use, in comparison with some manufactured ones.

Curve	Dynamic Range regarding middle gray		
Normal	-3 2/3	0	+2 1/3
Neutro	-4 1/2	0	+2 1/2
Light_Illusion_CW-02	-5 1/2	0	+2 2/3
Light_Illusion_LOG-01	-4 1/3	0	+3 1/2

References:

http://www.lightillusion.com
http://www.imatest.com/
http://www.imagenomic.com/
www.alfonsoparra.com