Test of the Sony F55 camera

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Throughout this article we are going to show the results of some tests we have made with the Sony F55 camera, which are not very long; but nevertheless allow us to have a clear idea about how it works. Tests began before the last update, in which the S-Log3 curve and its color space were installed, and ended with the aforementioned update in Cartagena de Indias (Colombia), which is why we have used either the S-Log 2 or the S-Log3 curves with their respective color spaces. But, clearly, we believe that the results can be transposed from one curve to another under just some considerations. We have recorded in both the new codec XVAC and Raw format, then we have compared some aspects as color, resolution or dynamic range.

As usual, we have used the ISO 12332 resolution chart, as well as the Putora one and our charts of fabrics Prêt à Porter and ArcoIris, both of them appropriate to watch texture and color. We have analyzed the frequency charts through Imatest and ImageJ. In addition we have used a strip Stouffer and multi exposures to make the theoretical analysis of the dynamic range.

Postproduction was made on Scratch and Davinci by 2-35 postproduction studios in Bogotá (Colombia).

We have shot indoor and outdoor natural locations in Cartagena de Indias during the film festival, which served to promote the camera in such event. The city itself is a very nice place to shoot outdoor locations plenty of color and indoor ones prettily illuminated by natural light.

Article images are from the original frames but converted, so they should be used merely as a comparative reference.

RESOLUTION

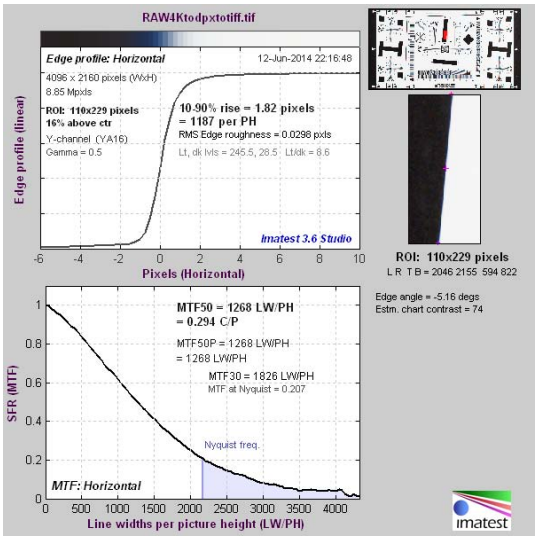
We have to remain again that it should not be associated format and resolution, no matter if format size and consequently the number of pixels affect the resolution because they are not the resolution itself. The resolution of our image depends on: sensor, electronic processing of the signal, recording system, lens, viewing system, and obviously the distance how long we are seeing the image. Thus, images with similar formats can show different resolution/sharpness, whatever the unit in which we are measuring, TV Lines, lp/mm, cyc/píxel or other usual ones.

In these tests we have used the 4K format, on both SxS cards with XAVC and Raw format, through the AXS-R5 recorder on AXSM cards.

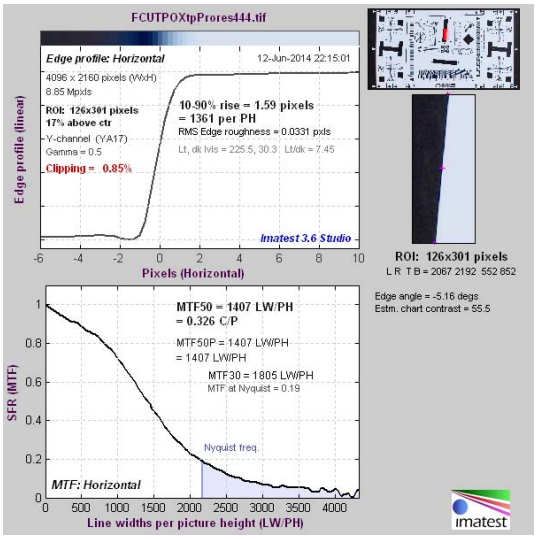
In order to evaluate the resolution we have firstly used the ISO 12232 chart analyzed through Imatest and ImageJ; we have also watched texture on our fabrics charts, as well as on the still-life. Finally, we have reviewed shots from different locations.

MTF curves that we have got from our charts are attributable to the all fore mentioned processes and serve as a reference about the camera features. Any change of the conditions entails results lightly different.

Next, we show the horizontal resolution read on the chart through Imatest.



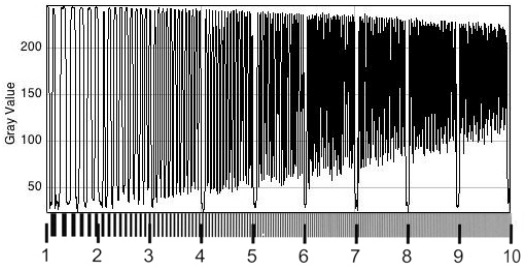
4k Raw to DPX through RawViewer



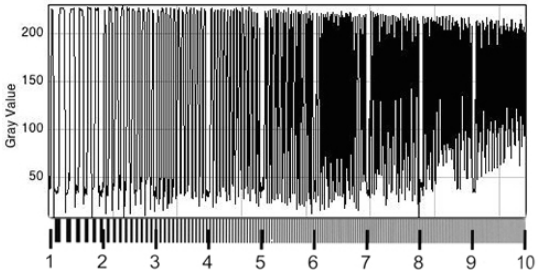
4K XAVC to Prores4444 through FCPro

Raw format was converted into DPX through RawViwer, whereas 4K from SxS cards with XAVC codec was imported to FCPro with Prores 4444; in the case of the latter we have wanted to use an usual workflow through the program and the codec Apple so common among professionals.

Of particular interest is the resolution with the Raw format at 50% that is 1268 Lw/ph, whereas with the XAVC codec, recording son on cards such resolution, is 1407 Lw/ph. The difference can also be seen in the profiles of the resolution lines:

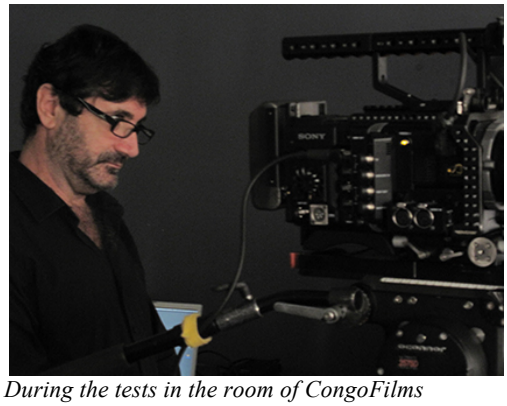


4K Raw to DPX through RawViewer



4K XAVC to Prores4444 through FCPro

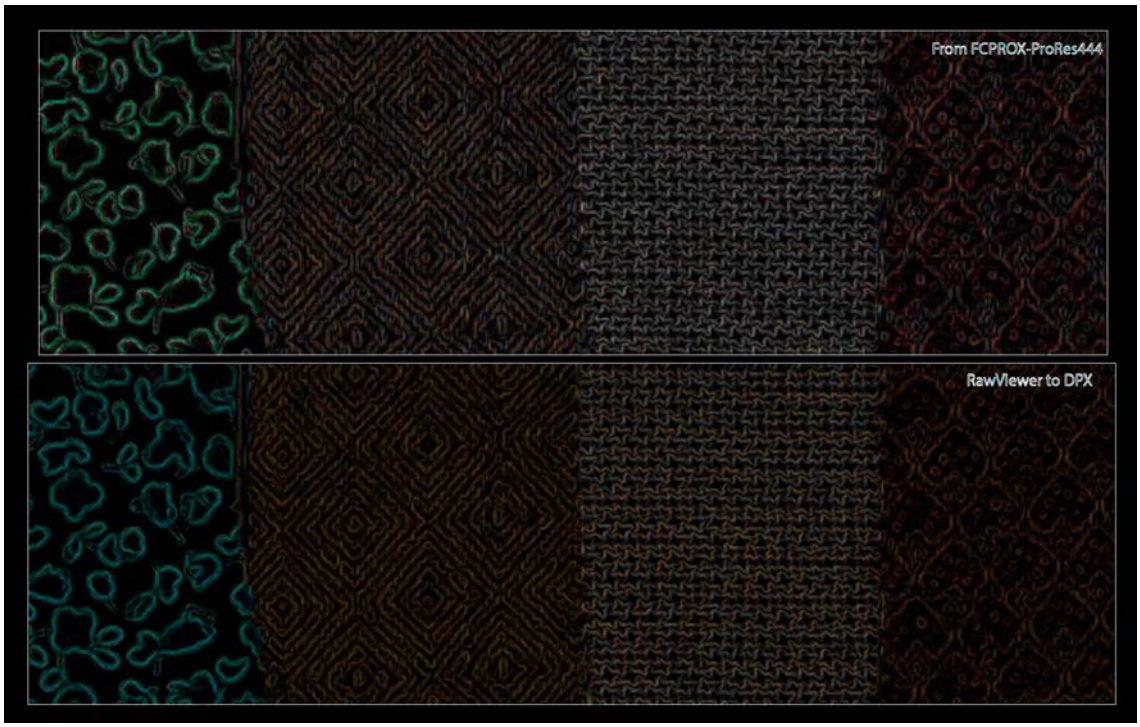
How should it be interpreted? We have tried to export the XAVC card with Content Browser without going through FC, and we have got the same results. We know the different processed of the two images: Raw format are 16 linear bits and it is not processed by the camera in any case, but in post-production, where Debayer is done in order to create the RGB; cards format with XAVC is coding at 10 bits signals from Debayer, then they are coded through gamma curve and additional electronic processes, where we can work through the camera menu options.



During the tests in the room of CongoFilms

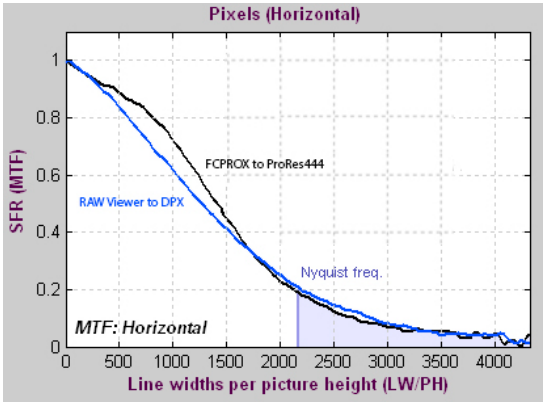
We have ensured during the recording process that the different parameters which could affect the resolution were properly suited, as is the case of the detail circuit that we handle at Off.

We can also see such difference of sharpness in our Prêt à Porter chart.



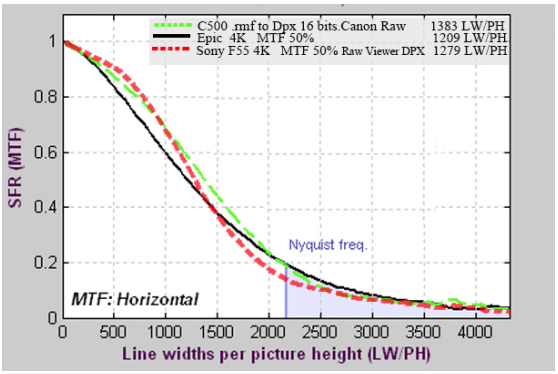
We can see, above all over tiny flowers, the greater sharpness of the image coming from the XAVC.

If we put in comparison the two MTF curves, we can see the difference between both files. However, as we have already asserted, processed of the signal of both images differs, and therefore it should not be put in comparison; we did it because it is often we have to know what happens when we choose one or another format.



From the images of the fabrics chart we can see the greater "natural way" from the Raw format opposite to the XAVC, which shows an appearance more "clipped" as if it had been applied a slight electronic detail on it. However, as we will confirm below, the XAVC codec shows a very good quality.

In order to get an insight into the resolution of the camera at Raw format, we show a comparison with the Canon C500 and Epic cameras, all of them at 4K. We can see the difference of resolution: C500 shows the greatest one, and close to it we find the resolution of F55.

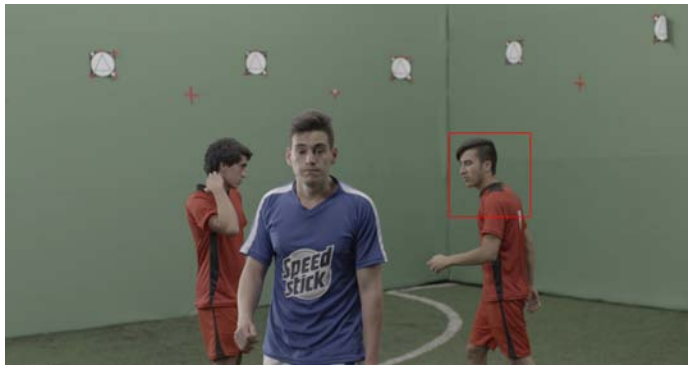


We have used one more chart, our ArcoIris, to see texture as well as sharpness. If we do a carefully observation of our chart, we can see that 4K XAVC is very sharp, a bit more than the DPX from the Raw, although it does not show better texture. When we see texture of the different fabrics, Raw, as we can expected, shows more nuances in tones and a more natural texture. Of course, Raw shows less artifacts and more ability of handling at post-production.

Although differences on both files without any handling at post-production show alike, this demonstrates the great quality of the XAVC compression codec.

A brief description of the codec can be done here. The XAVC compression codec belongs to the family H.264/MPEG-4 AVC, level 5.2, nowadays the highest one. This codec works at IntraFrame mode although its implementation in cameras for consumers works at LongGOP. The F55 camera uses it between a difference ratio of 300 Mbit/s for 2K to 30 fps and 600 Mbit/s for 4K up to 60 fps, with color sampling of 4:2:2 and 10-bits depth. However; the codec can handle 12 bits and color sampling of 4:4:4 alike.

XAVC compression algorithm makes two processes in real-time: the firs process analyzed intelligently the image to classify the image in blocks and macroblocks, then the second one decides the distribution of the bit rate needed to each block; the reason to do this is because our images have clearly parts more uniforms or parts that show more sharpness or detail, thus we need different ratios regarded with each circumstance. Having analyzed the image and decided the bit rate by the algorithm, the compression comes. The compression is encapsulated in mxf files. The structure of the bytes of XAVC is based on standard of KLV traditional codification. A key element of this bit flow is the integration of the SPS (parameter sequence set) and the PPS (picture sequence set) square by square into the chain of bytes.



Courtesy of 1-1-ONCE POST LAB

However; it is a codec with a strong compression which in some cases can be inefficient and it is not recommended to works that need high depth and sharpness, as occurs with the chroma keys, above all if we shoot at high speed and resolution lower than 4K. Next, we show an example of chrome recorded are 120fps for 2K XAVC. OLFP filter, as we already know can be changed in this camera, is from 4K. During the process of pixel binning that camera applies to change from 4K to 2K with the OLPF of 4K and at high speed with the compression XAVC,

outlines and backgrounds of the chrome look very damaged, making more difficult working at post-production.

Blue channel of the color frame with green chrome. We can see the compression artifacts in both the green chrome and the cutting from football player. Courtesy of 1-1-ONCE POST LAB

We have again seen on the still-life cutting how the XAVC image shows more sharpness in the background where melon and watermelon are. Raw format shows more texture and appearance more "natural".

Next, we show a couple of frames we can see a nice result of the camera regarding sharpness and texture.

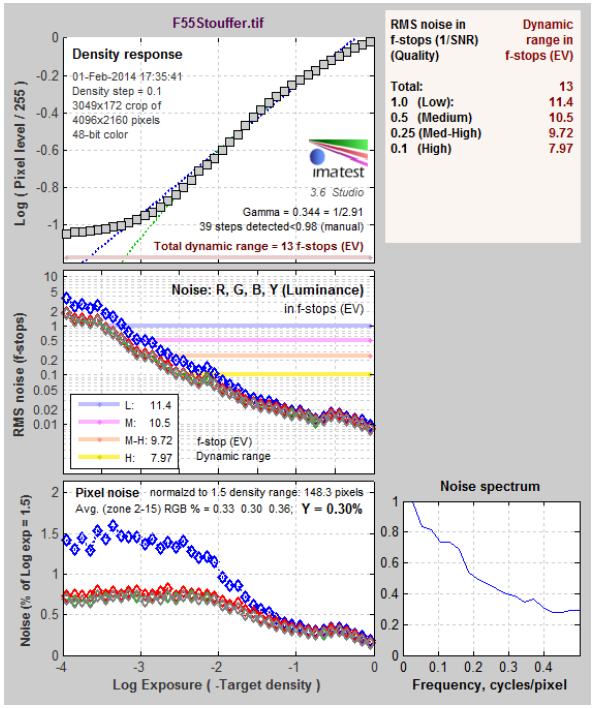
4K XAVC on SxS cards. Curva S-Log3

4K XAVC on SxS cards. Curva S-Log3

Conclusion:

With regard to resolution the F55 camera shows great sharpness and texture, with a natural look at Raw format and, for my liking, slightly more "electronic" with the compression codec. Resolution is equivalent to the cameras of other manufacturers for the same 4K format.

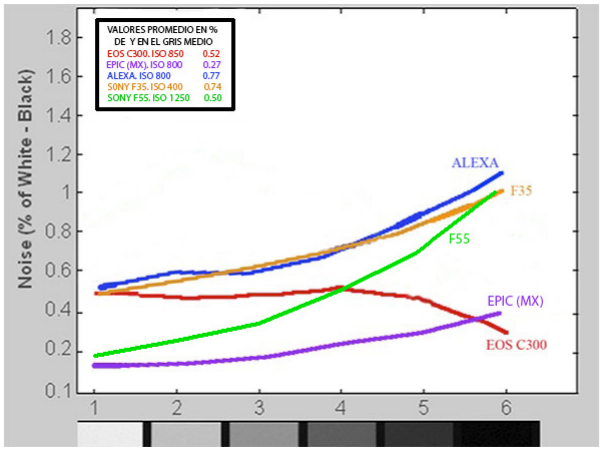
DYNAMIC RANGE AND SENSITIVITY



To evaluate the dynamic range we have used the S-Log2 curve because we still had no the S-Log3 to make the technical tests, although we could use the latter one when we were shooting in Cartagena de Indias. Differences between both curves are explained in detail in WP of Sony "Technical Summary for S-Gamut3.Cine/S-Log3 and S-Gamut3/S-Log3". Basically, S-Log3 best fits for distribution of the bright values to the Cineon curve than the S-Log2. The former curve show middle zone and shadow brighter than with the latter one.

We can see with the analysis of the Stouffer strip how the camera is able to see up to 13 stops, that is, 39 steps out of 41 of the strip; it means high latitude. With regard to the noise in a middle level, which is usually confirmed with our following tests, the effective dynamic range is around 11 stops; it depends on what is acceptable to us regarding both noise and the lost of details in the deepest shadow or in the brightest white.

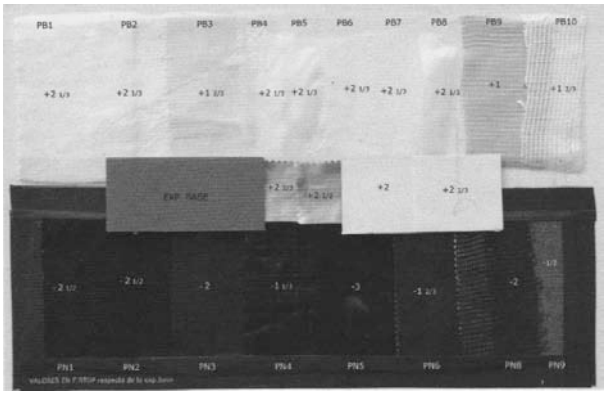
We can see in the graph of noise that Y-value is 0,30%, it means a good behave.



In order to get an insight into the noise we have compared this result with other cameras existing in the market using their respective ISO values provided by their manufacturers. It should be pointed out the excellent response of the F55 camera which shows lower noise with a larger ISO than the Alexa or theF35, even in the middle gray shows less than the Canon 300. Nevertheless, in the darkest zones, both Epic and Canon show quite less noise. Epic remains the camera less noisy. Level of noise will determine the dynamic range as well as the effective sensitivity that we can use with the camera.

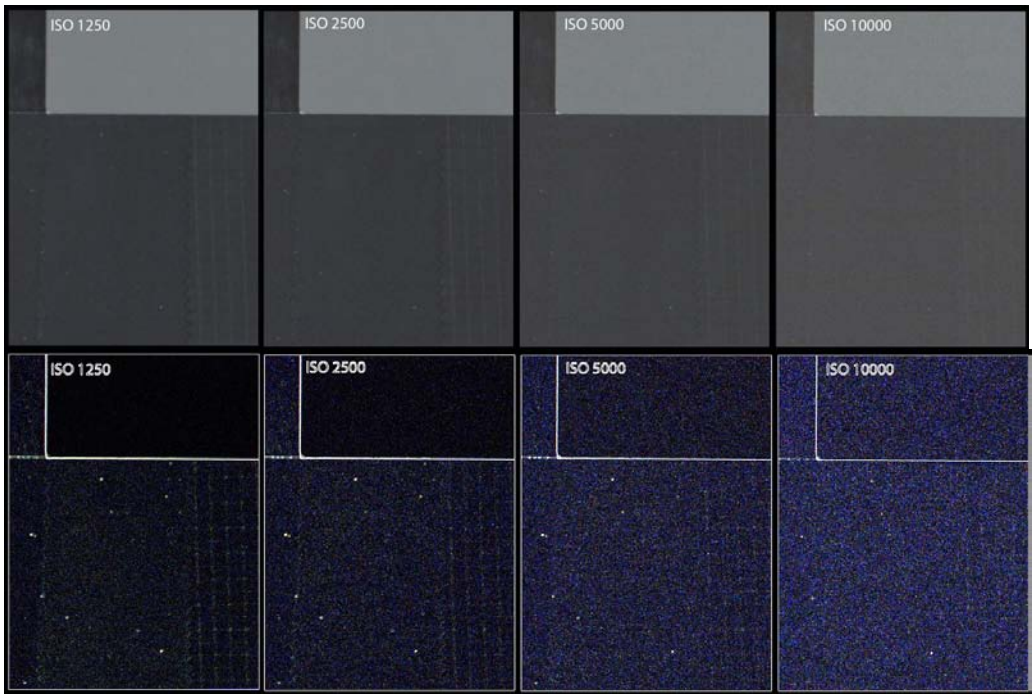
To see how different ISO values mask the detail, I have analyzed the Death chart, selecting a part of it which contains the 18% gray as well as three samples of black fabric with different textures.

With the reference value ISO 1250 pointed out by the manufacturer we can still see textures as well as the different fabrics; with ISO 2500 we continue to see textures and differences of brightness; with ISO 500 textures begin to disappear although we can still see the differences among fabrics; with ISO 10000 textures have totally disappear.



Death chart with reflectance values in T-stop regarding the middle gray

Based on this test as well as the analysis of both the still-life with candles and the nighttime pictures that we have shot, we can state the limit of effective exposure around ISO 3200.

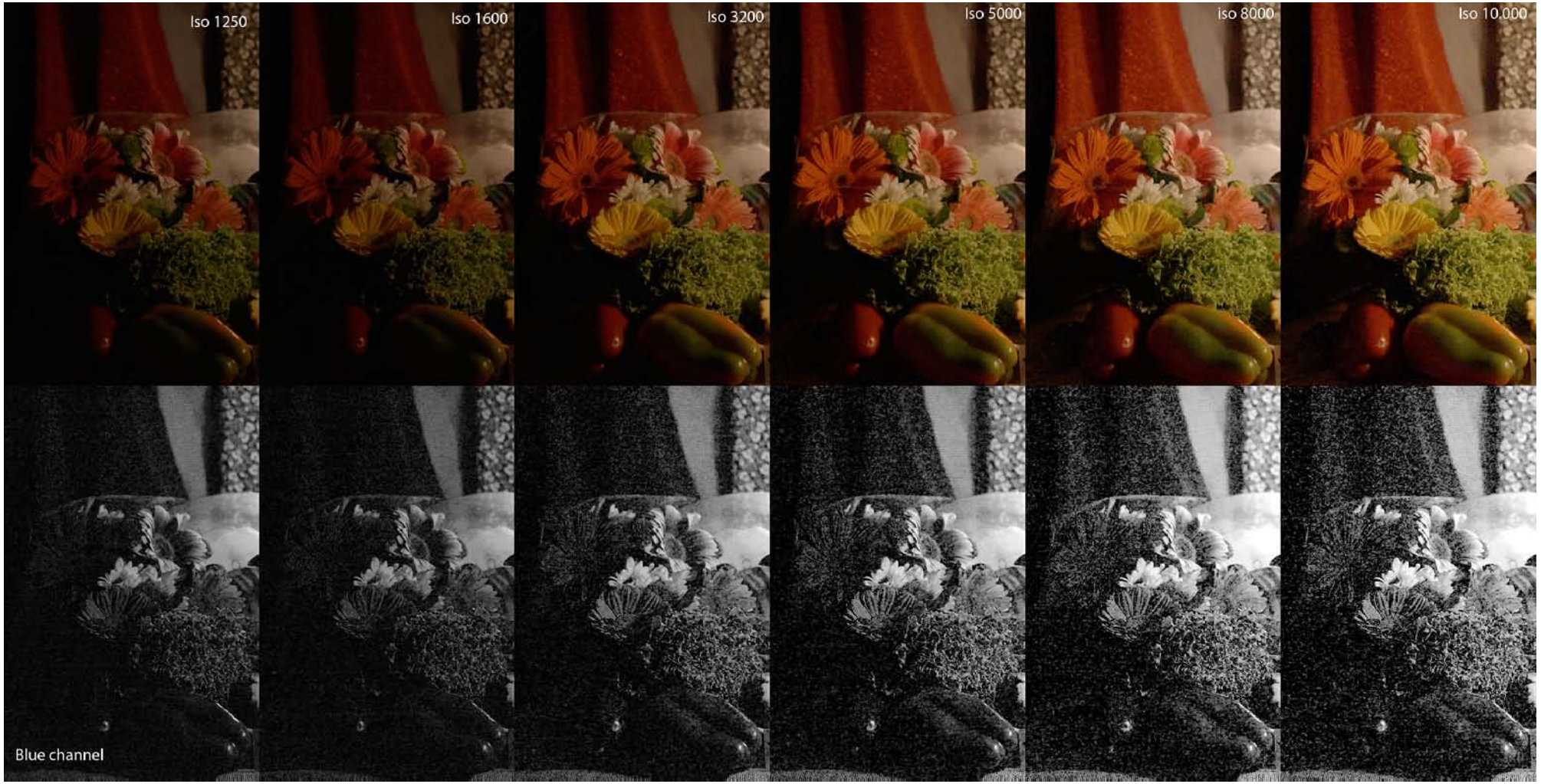


Next, we can see the still-life under different ISO values.

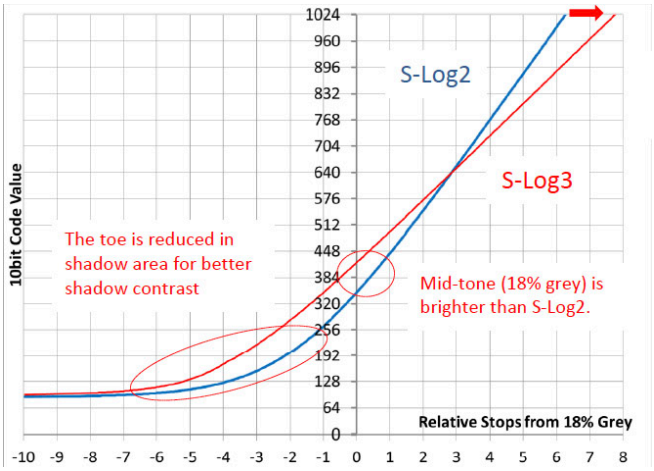
From the analysis of this frames we have checked that noise is acceptable up to ISO 3200, although we can use lager ISO values accepting the lost of texture.

Shooting at Cartagena with Sony staff.

Next, cutting of the still-life and its blue channel.


Iso 1250
Iso 1600
Iso 3200
Iso 5000
iso 8000
Iso 10.000
Blue channel

Previous tests have determined the effective sensitivity "above", and we have also studied which is the base exposure of the camera. To this end, we have used as reference the 18% gray Cineon value. If we expose with ISO 1250 pointed out by the manufacturer, we find that the middle gray with the S-Log2 curve is below the reference value, as we can see in the graphs published by Sony, where S-Log2 and S-Log3 curves are in comparison. To reach a value close to the reference one with the S-Log2 we have to overexpose around 2/3 stops and so the base ISO value is close to 800. If we use the S-Log3, the value best fits to the reference one, ISO 1250, but we can see a bit more noise in the shadow. Therefore; my range of ISO effective values are between 800 and 3200, although at the time I use 1250 I used to overexpose as ISO was 800 in order to improve the noise level in the shadow, provided that the dynamic range of the scene allows.



Technical Summary for S-Gamut3.Cine/S-Log3 and S-Gamut3/S-Log3. Courtesy of SONY

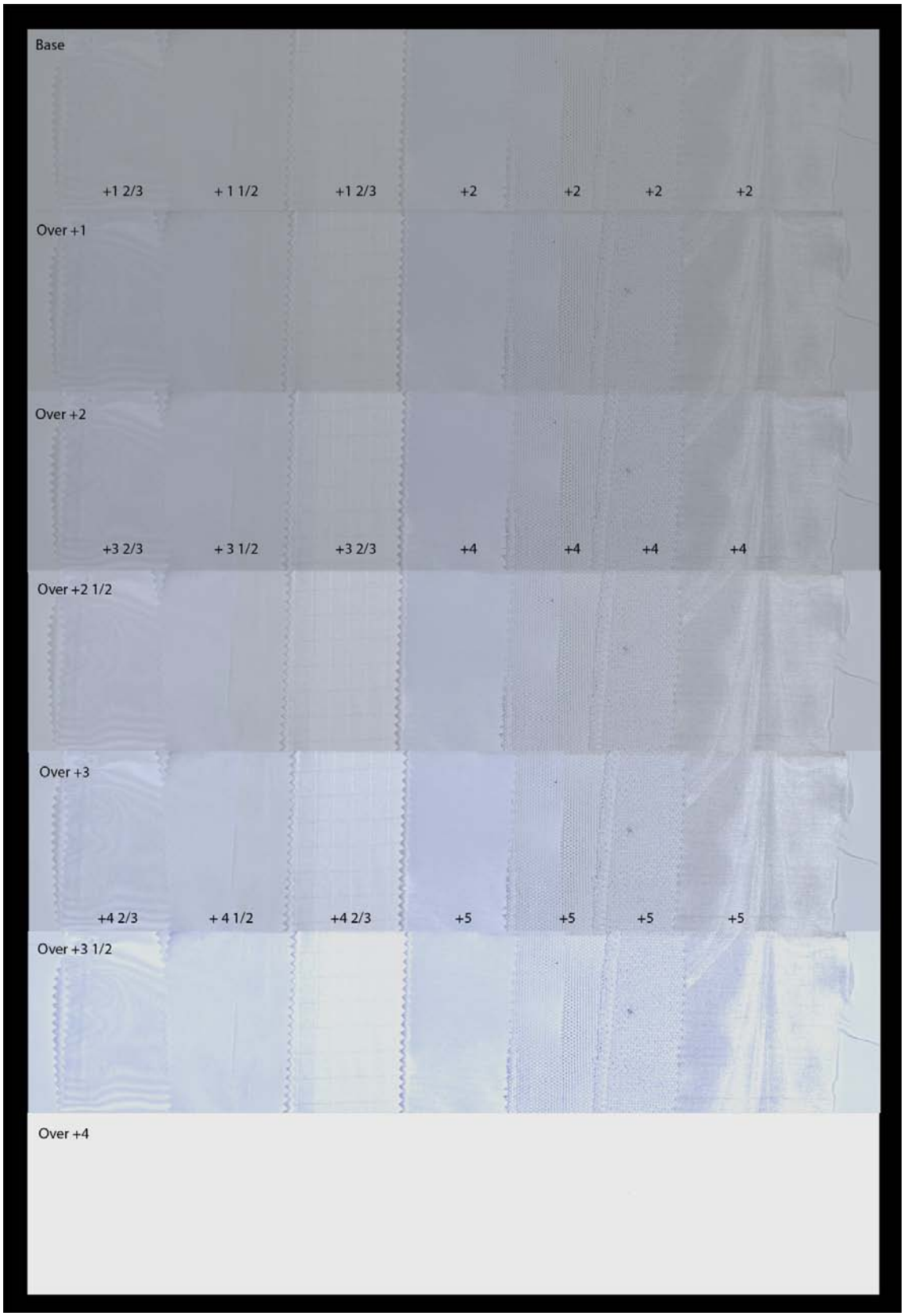
Let us be back to the analysis of the dynamic range to look for the effective range, to this end, I have shot a multi-exposure strip of the chart of blacks, whites as well as the still-lif. Next images are from RAW format converted into DPX.

In the white chart of whites we have seen that the camera keeps texture and detail roughly up to 5 ½ stops, and certain degree of clipping appears close to 6 stops. With 3 stops overexposure fabrics keep textures and detail, but they begin to lose them with 3 ½ stops and they totally disappear with 4 stops. Although it seems that there is no clipping in the white up to 5 ½ stops above the middle gray, I chose to limit of the upper range until 5 stops in order to keep the whole detail.

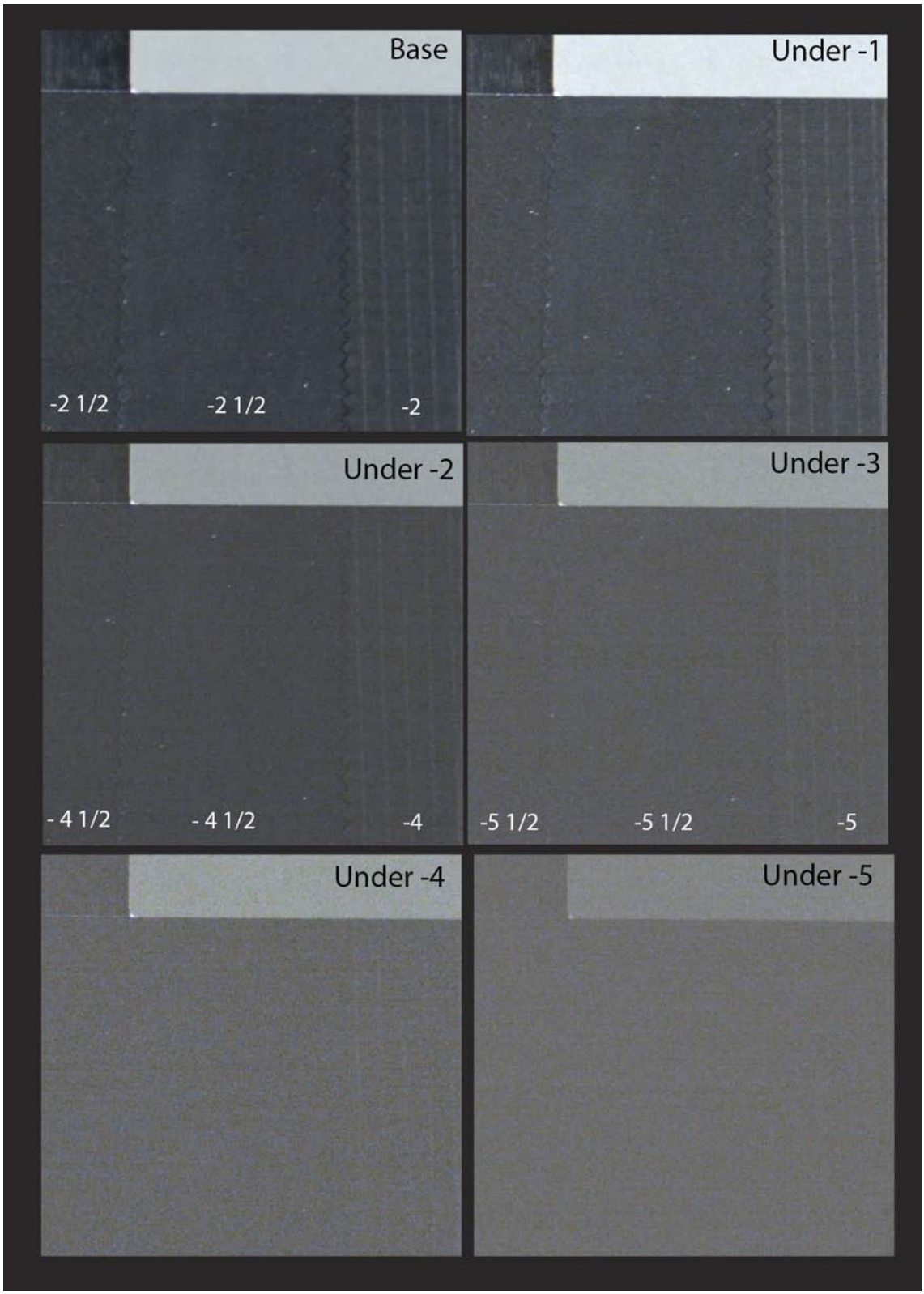
With regard to the shadow we can see analyzing the same charts that detail and texture are kept up to 5 ½ stops, although it is still seen up to 6 stops below the middle gray.

Finally, before shooting in outdoor locations we have studied the images from the still-life.

In the next graph we show certain values of the still-life on the S-Log2 gamma curve.



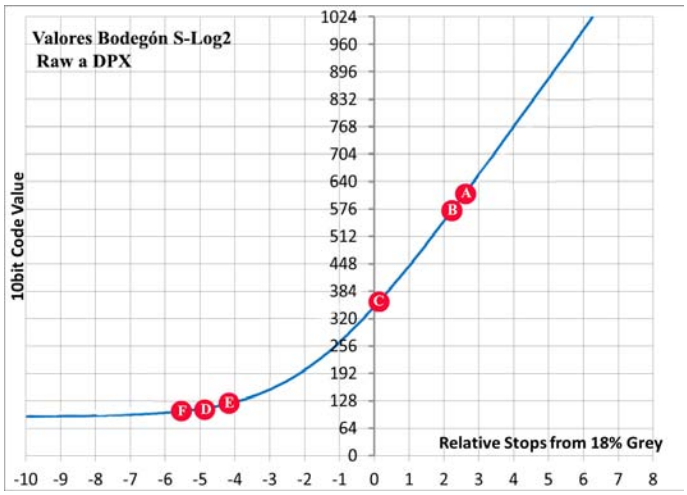
Multixposures strip of the chart of whites. Values of the samples are T-stops above the middle gray. Raw converted in DPX through Sony Raw Viewer. S-Log2 curve



Multixposures strip of the chart of blacks. Values of the samples are T-stops below the middle gray. Raw converted in DPX with the S-Log2 curve through Sony Raw Viewer

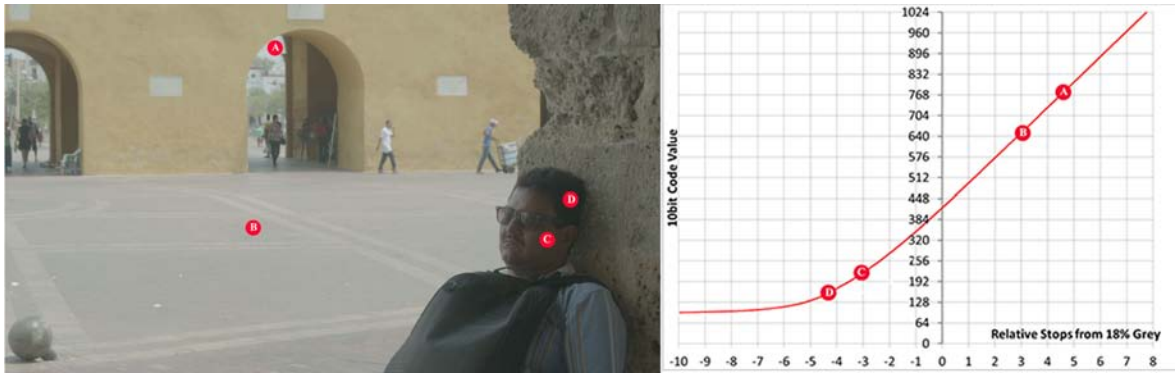
Raw converted in DPX with the S-Log2 curve through Sony Raw Viewer

We have checked in the still-life how indeed, whiter fabric, which is at +2 ½ stops above the middle gray, keeps its detail and texture with +3 stops overexposure, that is, it is at +5 ½ stops; the pineapple also recovers the whole detail. With underexposures we can see details and textures in the deepest black up to 5 ½ stops. The value marked as E shows already many noise with 3 stops underexposure and it loses texture; it occurs the same with the F and D values: with -1stops underexposure can still see some texture of the glass and pottery but with too much noise. We can also see certain difference of brightness up to –7 stops.



Some values from the still-life averaging the three channels inthe base exposure.

Let us see next some images from outdoor locations.



Cartagena de Indias (Colombia). Format XAVC Intra QFHD 29.97 fps 180º. S-Log3 curve - S-Gamut3. 5600ºK

Above image; the part more illuminated, the sky through the arch, is around 4 ½ stops, and the darkest one, the hair, is around 4 ½ stops. In this case, the camera can show with no problems details everywhere, we can perfectly see the texture of the skin as well as the detail of the hair.

Cartagena de Indias (Colombia). Format XAVC Intra QFHD 29.97 fps 180º. S-Log3 curve - S-Gamut3. 5600ºK

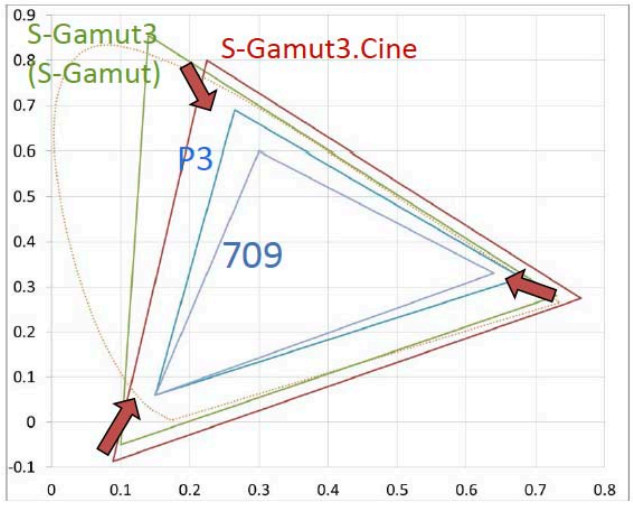
In the other imager we have analyzed the darkness regarding the sky which is within the range. The darkest parts show still some detail with too much noise, however we have been able to see the black deep and solid, never flat.

Conclusion.

We can say that under the above configuration of the camera, its latitude is around 13 stops, its effective dynamic range around 11 stops, some 5 ½ stops above the middle gray for the high lights and between 5 ½ and 6 stops below such gray. As we have already explained this range is distributed slightly in different ways according to whether we use either the S-Log2 or S-Log3 curves, and there is no difference with the high-end cameras in the market, although it is below the Alexa regarding the high lights.

COLOR

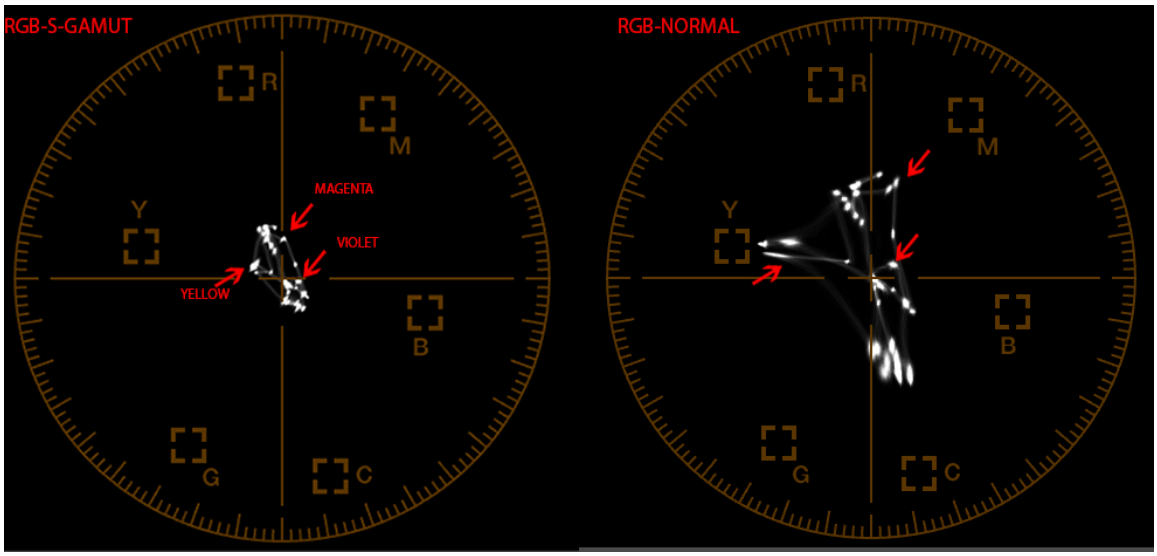
The F55 camera shows different color spaces with different codifications, thus we can use that color structure what we need for each production. As we can see on the right graph, the color spaces that camera built up are S-Gamut 3, S-Gamut3.cine, P3 and the conventional 709. S-Gamut3 is the largest color space and it shows the whole ability of the camera to pick up the color, that is, the native color space of the camera. S-Gamut3.cine is a log color space which is similar to the analogical negatives and fits to the Cineon systems works; as we can see this color space is larger than DCI-P3, which is the color space for cinematographic digital projection, it is more flexible to correct in post production. The camera also provides S-Gamut connected with the S-Log2 and S-Log3 curves. Finally, we can find the conventional space HD 709. These color spaces can be recorded on XAVC, HDcamSR, MPEG50, RGB, or YPbPr..



Technical Summary for S-Gamut3.Cine/S-Log3 and S-Gamut3/S-Log3. Courtesy of SONY.

When we are recording in Raw format, we do not apply the color spaces, but in the debayerization process with the related softwares.

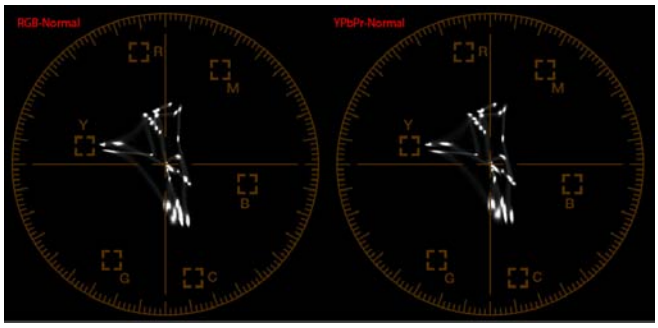
To see the differences of color codification we have photographed our Arcoiris chart, it is a fabrics chart with several colors and significant textures that allow us to see the color compression efficiently.



We show the comparison of the vectorscope from the RGB-Normal codification, that is, no Log, and the S-Gamut color space connected with the S-Log2 on XAVC. In addition to the obvious difference with the saturation, we can see that with S-Gamut, magenta hues are more red-like and yellow ones are less orange-like and far less saturated than the rest of colors; red-

like hues are alike, as cyan and green ones; violet hues with S-Gamut are less magenta and colder. Without a doubt, the appearance of the colors is also showed more “natural” with S-Gamut on RBG than with the Normal. Next, a cutting from the chart with the magenta and violet hues.

Let us see another comparison, on XAVC too, between the RGB-Normal and YPbPr Normal. As we can see there is not any difference neither in hues nor saturation colors (graph on the right).

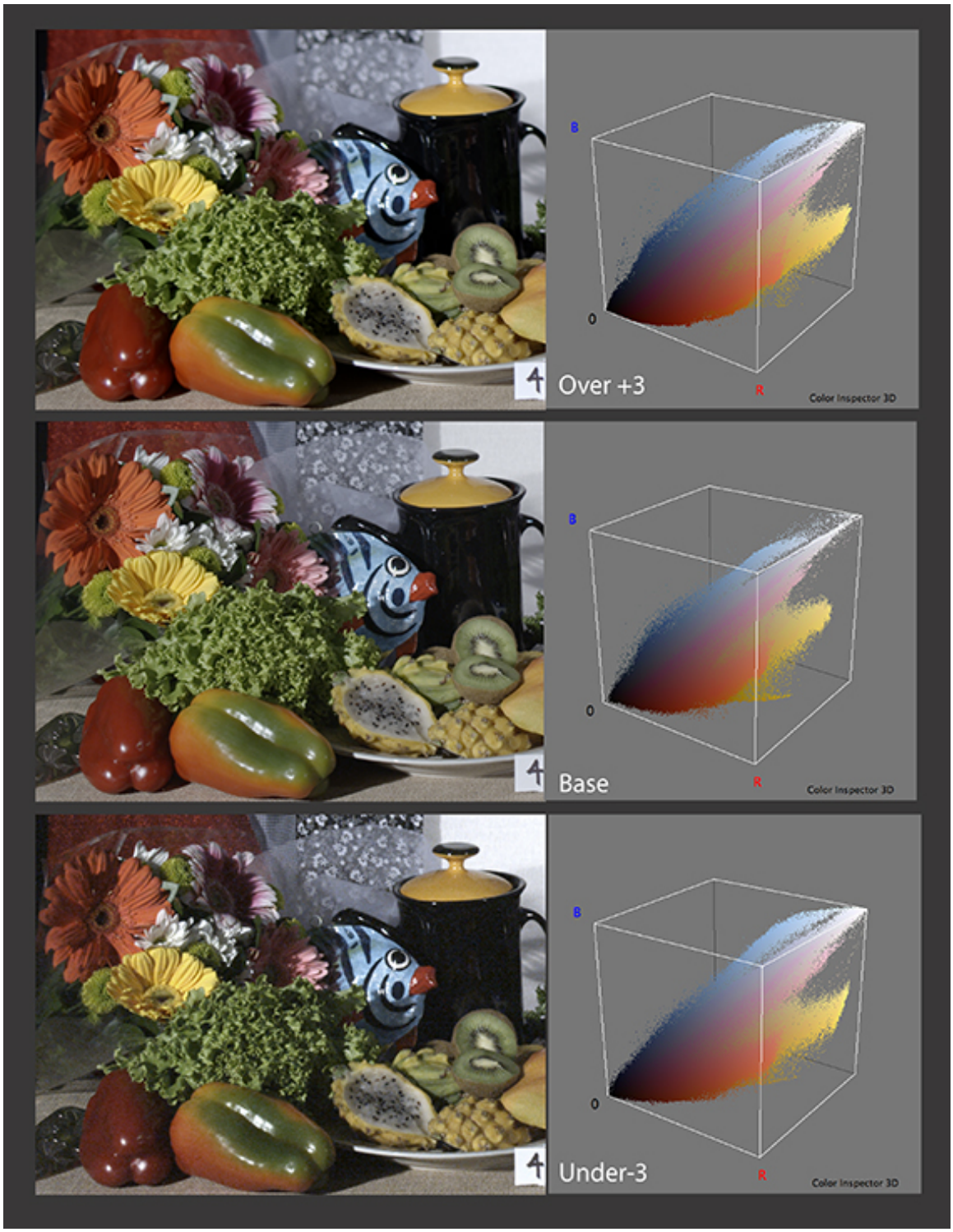


The codification on YPbPr with S-Gamut have the same considerations than the codification on RGB.

Without any doubt, we have seen the largest difference regarding “texture” and “naturalness” of the color in the 16 bits Raw format, by far, gives the best quality of image. With this format colors show deeper, different in hues and textures, and with a possible use in post production extraordinary. If we put in comparison with a conventional color space, we can see how loses texture, above all the yellow hue; the cyan, violet and blue hues are “deeper” if they are from Raw. Red and magenta are artificial with the YPbPr in compared with the Raw. In

short, if we need a color expression with the whole depth we have to use 16 bits and the processed from the Raw. Differences can also be seen under other configurations as RGB format with S-Gamut.

We are not going to extend more regarding this point and we are going to watch how the color can be seen in the world beyond the charts. We have begun with the still-life recorded with the RAW format, then exporting material on DPX.



Above, we show a part of the still-life corrected to different exposures, all of them adapted to the middle gray, as well as their RGB color spaces respective with the distribution of color regarding each correction.

We have seen that color hues are generally kept. Colors seem very natural in both overexposures and underexposures. However, the yellow of the daisy under slight changes of luminance and hue is slightly pasted in the underexposure. Moreover, we can see in the overexposures a slight increase of saturation, and white show deviation to blue. In the semi-darkness, black are solid without significant deviations of color For my liking is without any doubt one of the better features of the camera, the depth in black, totally balanced, with density.

In the deepest underexposures the noise of the chrome mask a little the quality of the color as we will see following. As we could see in the paragraphs about sensitivity and noise, in my opinion it should be appropriated to use the camera with ISO 800 to improve the level of noise in the shadow, and so to get the better reproduction of color if the dynamic range of the scene allows.

Filming in Cartagena with ambient light in the early morning market

Next, let us see the skin tone. We have photographed our model with both HMI light and tungsten, accommodating color temperatures of the equipment and their color deviations to the camera. We have corrected the slight deviations of the middle gray for the purpose of being neutral. As in other cameras, we have seen that the skin tones change depending on light source, either it is “cold” or “warm” light. With the tungsten light skin shows warmer, slightly more red-like, however, with the “cold” light the skin tone is slightly green-yellow-like. In both cases, as I often do, I minimally correct my light sources with Calcolor and CT filters to get solid skin tones.

Appearance of the skin tone shows quite texture and depth through the delicate changes of the color hue, although for my liking we have to work over the illumination to minimize certain “electronic” feeling typical of Sony, opposite to the Alexa, which shows “watercolor” hues as we pointed out Art Adams.

Lighting with HMI light to 5600K. 4K DPX from RAW with S-Gamut/S-Log2

Lighting with Tungsten light to 3200. 4K DPX from RAW with S-Gamut/S-Log2

We have also analyzed how the skin tone changes in both overexposures and underexposures. In the overexposures, after correcting to adjust to the base, we can hardly see any deviation. In the underexposures occurs the same, however the noise of the chrominance is very high in the deeper underexposures, and it disrupts excessively as we have seen in the daisy of the still-life.

4KDPX 16 bit from RAW. Overexposed 5 stops regarding the base exposition and graded to the neutral gray.

As we would expect, this behavior of the skin tones is a bit different if we record with XAVC compression.

Next, we show a cutting from the face of the model in comparison with both formats.

In such high exposure (+5 stops) the compression of XAVC as well as the fewer number of bits opposite to the RAW show skin tones less natural.

Below, we show some images in which we can see the skin tone in natural ambiances very different.

All of the images come from frames of the tests recorded in Cartagena de Indias to the film festival. Shooting was made in 3840 x 2160, XAVC with S-Gamut3/S-Log3 and they were converted in 1920x1080 for the presentation. Colorization was made with Scratch. It can be watched on Vimeo: **https://vimeo.com/112596311**

Lighting from several sources, sodium vapor and fluorescence.

Daylight 5600k. S-Log3 curve -SGamut3. ISO 1250

Next, some portraits of our models under different conditions. We can see that the skin tone is natural, in both light and shadow.

Daylight 5600k. S-Log3 curve -SGamut3. ISO 1250

Daylight 5600k. S-Log3 curve -SGamut3. ISO 1250

Daylight 5600k. S-Log3 curve -SGamut3. ISO 1250

Finally, the image of the skin tone with the cold light at dawn.

Daylight 5600k. S-Log3 curve -SGamut3. ISO 1250

Final conclusions

The camera offers a lot of possibilities to configure the color, being the Raw format which offers the largest possibilities of color hues and handling in postproduction. The codec XAVC also provide an excellent image despite of the strong compression that handle, and in general, we can get skin tones more natural and colors with more nuances.
In short, we can say that the camera offers a range of possibilities of recording from the highest quality to the cinematographic projection for 4K Raw 16 bits, until the HD conventional environments with a great quality of image that combines efficiency of the compression with its appearance very natural. Without any doubt, in my opinion, the most significant of the camera is its color, excellent, plenty of nuances as well as the relation of this with the S-Log curves, above all with the S-Log3. It should be also pointed out the good behavior of the noise to high sensitivities as well as a black deep, dense and with texture. The range dynamic falls within the high-end of digital cameras, although it is still slightly below in the high lights regarding other cameras in the market.

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Video at https://vimeo.com/112596311