

EVALUATION OF THE ZOOM FUJINON CABRIO XK6x20

By Alfonso Parra AEC,ADFC and Adriana Bernal ADFC

In this occasion we are talking with de Director of Photography Alfonso Parra AEC, ADFC about the evaluation of the zoom Fuji XK6x20 that he did. In addition he used it to shoot the TVE series *Derecho a soñar* (*Right to dream*). The zoom forms part of the Cabrio lens series designed to work at 4K at T 3.5 for S35 sensors, PL mount and a weight of 3 kg whether we attach the servo drive unit that can be detach of the zoom in order to use as mode cine or ENG.

Adriana Bernal: Alfonso, why did you decide to use the zoom shooting *Derecho a soñar*?

Alfonso Parra: I already knew the zooms Cabrio features and as a DOP I have to look for a balance among the quality, effectiveness and economics solutions, so, the 20-120mm seemed the best option. *Derecho a soñar* is a daily series wherein we were working very fast, but wherein I, along with production and direction, also wanted to introduce a more cinematographic feeling. To that end, we chose to shoot with a camera of just one sensor of S35: the camera Sony FS7; it needed a zoom with a focal range from wide-angle to telephoto, neither too large nor too heavy, in addition it should also have the option to use in mode broadcast as well as it had to give me a good image quality at such format. The Fuji lens fulfilled all of requirements.

AB: From the photographic concept point of view, how does the zoom contribute to create such concept?

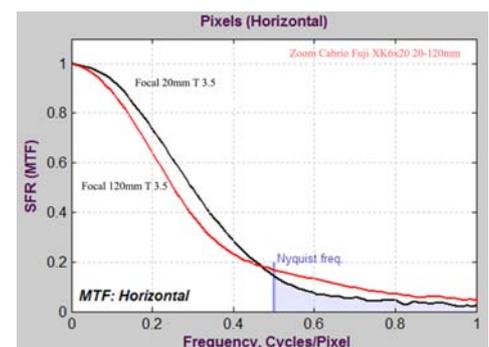
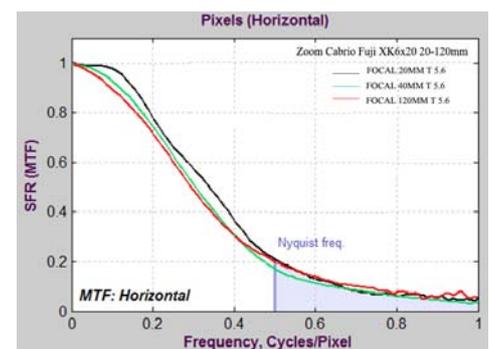
AP: Its contribution is essential. I wanted to recreate visually a fiction wherein the main character's dream were also the spectators' dream, wherein both the leading roles and spectators lived a totally plausible unreality, wherein they realized of the fictional scheme and at the same time they assumed it as real it still is not, for instance, I used very realistic light in the lawyer's office although the colorimetry was totally changed through a LUT that gave the ending fiction tone to the image. From this view, the zoom Fuji has made an important contribution because it creates a solid image, with detail and texture, but at the same time it is kind to the skin tones as well as creates a soft and still consistent black. At high lights it manages very well the limits of the contrast nevertheless the flare stains a lot the obscure and black middle tones. Moreover it gives a very nice Bokeh, above all at the largest T values.

AB: How did you get to know the lens performance?

AP: As usual in our profession, through tests, tests and more tests. Firstly, I begin discovering the technical features of the lens regarding the quality image, for example, resolution, aberrations, veil or color, and then I make a joint assessment of all elements putting in comparison with my subjective impressions.

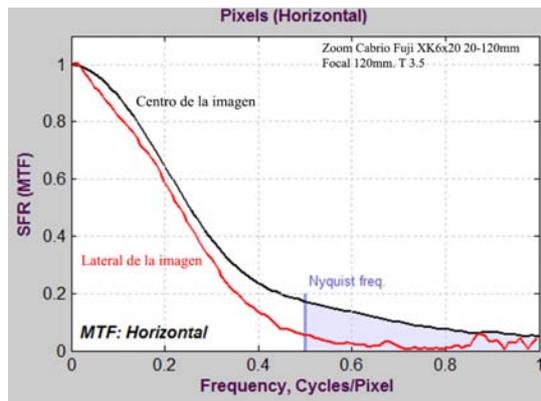
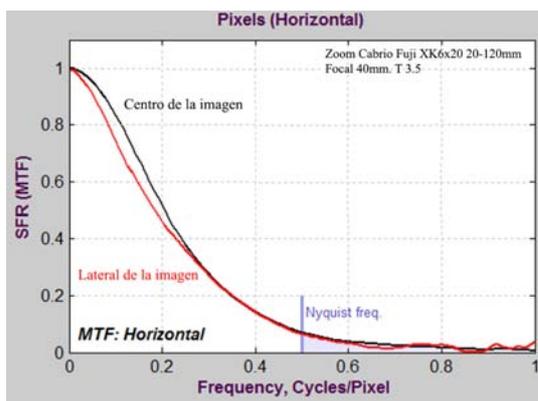
AB: If you don't mind we could talk about all of parameters that you have mentioned. What can you say to us about the lens resolution?

AP: I have to say that I evaluate the general resolution of the image, to which the lens contributes significantly. I check how is the performance of the lens, that's the reason why I am not showing on the graphs the values to 50% of the MTF curve since the camera determines the resolution limit, not the lens. However, we have got normal values for the 4K/UHD (3840x2160) format, they are around 1300 TV Lines to 50%. In order to evaluate the resolution we use charts of frequencies, and of course, the image observations, especially during the tests of the skin tones in the studio. The MTF curves give us a lot of information regarding the zoom performance. For this purpose, we have studied how is the



resolution with regard to different focal lengths and different T values, as well as the relation between the resolution on the center of the image and its sides. Resolution for zooms with long focal lengths tends to decrease to the widest T values because the image uses more the sides of the crystal to be made up, but also to very small T values occurs alike caused by the diffraction effect. If we put in comparison the different lengths to the same T 5.6, we can see that the resolution keeps similar through the zoom range as we can see on the graph, at T 3.5 the resolution is very similar, a bit larger with the 20 mm than with the most tele-photo 120 mm. Thus, we can say that the resolution keeps constant through the whole focal lengths.

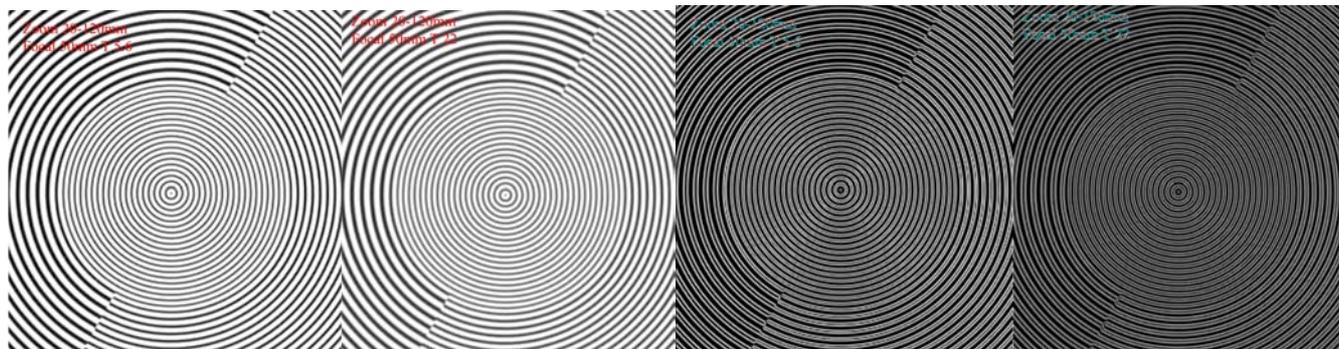
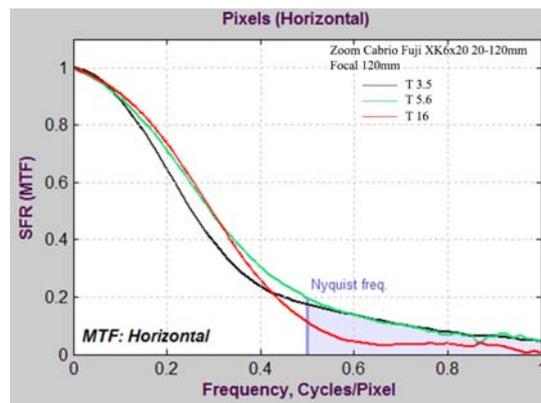
As the graphs show we can also see that the zoom to the widest T 3.5 value keeps a good sharpness relation between the center and the sides of the images. We are showing two MTF graphs, one with the 40 mm focal length and the other one with the 120 mm. We have verified that the performance is almost the same to other focal lengths as the 20 mm or the 75 mm.



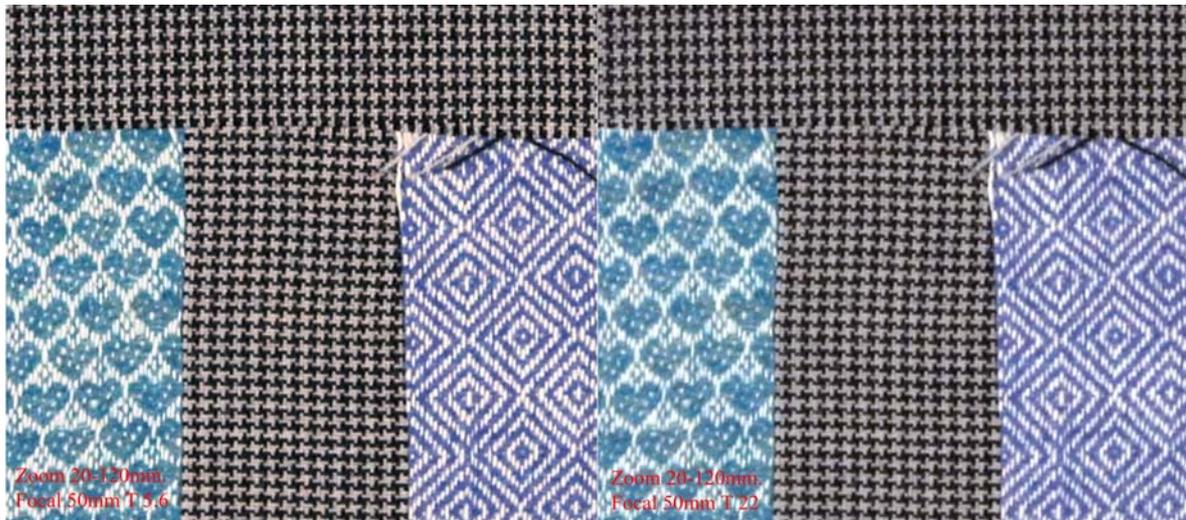
Finally, I will show you an example about how the resolution changes regarding the T value. Predictably, the resolution is a bit lower at the widest T, although I was surprised because the loss of resolution at wide T values is not significant, close to be invisible on a normal image, for example. Look at the Putora chart's cutting!

AB: But such loss at wide T values; does not depend on just the diaphragm diameter?

AP: Definitely, the loss of resolution due to the diffraction effect depends on the diaphragm value, but also on the pixel size of the sensor as well as the chosen CoC.



Precisely I have made a cutting of the Prêt-à-Porter chart in order to see such loss of texture. The image on the left has been shot at T 5.6, on the right at T 22.



AB: Actually we can see a bit of loss of sharpness at T 22. Would you say that the diaphragm is the limit of diffraction?

AP: No, I would say that it is at T 16 because at this value the loss of sharpness is absolutely irrelevant.

AB: How do all of these curves express in the images of the series?

AP: In the theoretical test we can see that the zoom is very homogeneous and consistent regarding all of the resolution aspects; it is able to work at 4K formats without problems, at all focal lengths and whatever T value, it shows the image slightly softer at the widest T and I use such fact to photograph the actors. I have constantly used the T 3.5 value because the skin tones remain with texture, detail but soft. I like the performance of the zoom; it delineates very well the lines but they haven't neither an excessive contrast nor a furious sharpness, as I've already told you. In addition, as we'll see later the Bokeh at such T value is very pictorial. Look at these tests of *Derecho a soñar*! Pay attention to the good texture of the skin, the details, the hair or even the costumes.

AB: Isn't the T 3.5 value a minimum aperture value too close which makes the lens little bright?

AP: Indeed, T is high however it wasn't any kind of problem at shooting because the camera was working at ISO 2000 which means that we need hardly around 86 lux in order to get a suitable exposure to the diaphragm. At such T value, the Bokeh and the depth of field look cinematographic-like.

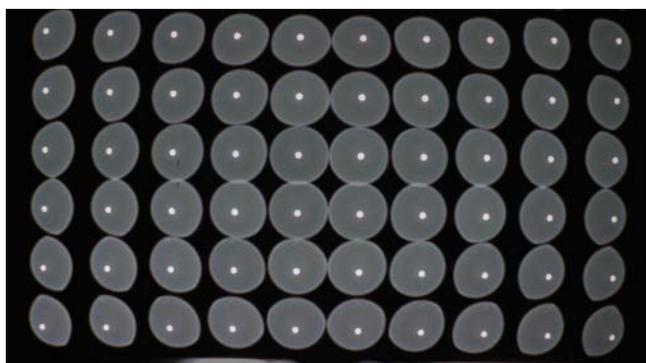


AB: You have mentioned that you liked the Bokeh; could you define it? What does the Bokeh depends on?

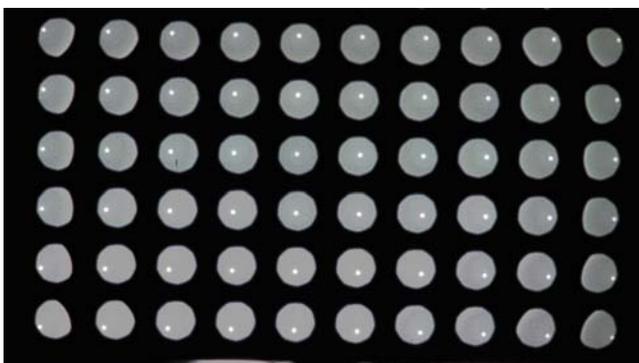
AP: The Bokeh is a subjective term; it is related to the perception that the unfocused objects make, whether they show soft or heavy, and either if the perception is more or less pictorial, with soft strokes as in the watercolors or with more plasticity as in the oil painting; it depends basically on the blades of the diaphragm as well as its position inside the optical design. We can see the diaphragm on the chart which I have called *Via Stellae* and I have also used it to check if the lens breathes.

AB: By the way, why don't you explain the reason through which the Directors of Photography give so importance if the lens breaths or no? How do you see on the chart?

AP: The lens breathing, that is, how the frame size changes when you move the focus ring, and that affects to the image in two ways, firstly, with regard to the spectator the camera shows itself and so the trick that we are using to tell the story, and secondly, it is more subtle and it is due to the perception generated by changing the frame while focusing: then the space change of dimension, it can be noted more the two-dimensional feature of the image, and the time built by the frame itself with the motion changes. With regard to the chart, we can see overlapped the focused chart on the unfocused one. If the focused point is inside the unfocused one we can state that the breathing lens is not significant, on the contrary if the unfocused point does not contain the focused one and it is out of it, then we are seeing the lens breathing.



Focal length 120mm T 3.5



Focal length 120mm T 5.6

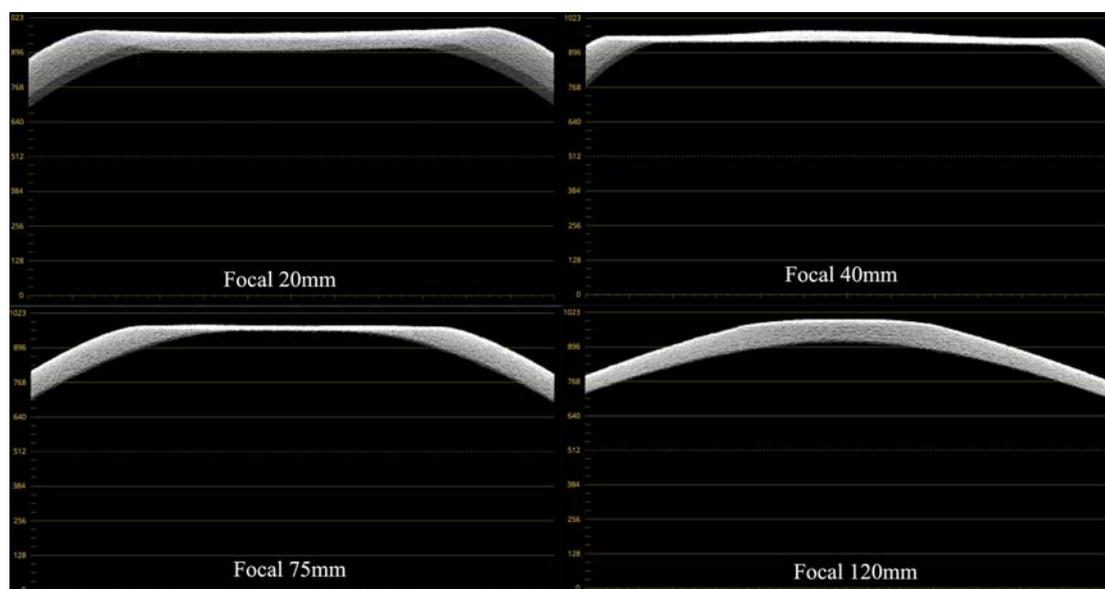
We can see on the two images how the larger point, the unfocused, contains the white point, the focused. It indicates that the lens breathing is low; however we can see more things, for example, at the T 5.6 we can see that the center of the circles are not exactly so but nonagons, that is, a nine-sided polygon; the number nine is precisely the number of blades that makes the diaphragm. On the other hand, we can also see how the circles are transforming into “lenticils” as we are moving away from the center of the image.

AB: What is the cause of the “lenticils” effect? How does the effect influence on the image?

AP: The effect is the vignetting which is caused by the most sided and oblique light beams incident through the lens on the sensor, the light beams collide with the internal crystal mounts of the zoom, and it is a physical barrier to the entering light which entails the loss of brightness on image sides. It is common for all the zooms, above all if the focal range is large, as in the case of the 20-120 mm

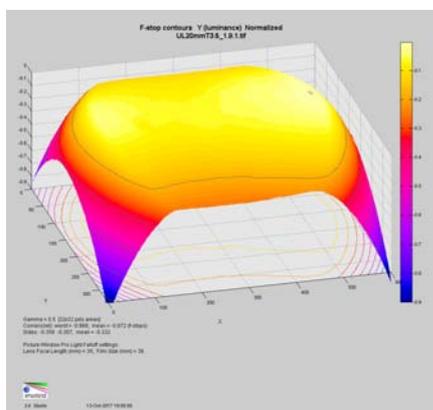
AB: Have you been able to see such loss of brightness on the images you shot?

AP: In practice, I haven't seen it, however I could measure the loss of brightness. I have shot a homogeneously lighted white surface at different T values, then I checked the loss through the Imatest analysis and the values with the microwave monitor. I show the different focal lengths at T 3.5 in the images

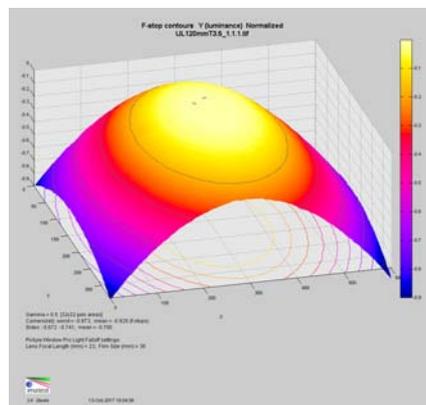


The lost of brightness is not significant up to the 75 mm focal length, from there we lose brightness on the sides. The loss is caused not only by the physical effect above mentioned, but also we have to take into account the

natural vignetting, which is responsible for the loss of brightness of the lens from the its center to its side; the loss is accorded to the cosine fourth power law. In order to minimize the natural vignetting it has to make larger lenses, which implies greater cost as well as greater weight. Manufacturers are always looking for a balance to their lenses, among the weight, the cost, the size and the handling of the different aberrations through the optical design. In this occasion, it seems that Fuji has made a nice work accepting certain loss of brightness on sides to the longest focal lengths, in addition it has adjusted the size as well as the weight; as I told you, with normal images we can hardly see the change of brightness. Anyway, I show you some graphs where the loss is quantified though Imatest.



Focal length 20mm T 3.5



Focal length 120mm T 3.5

The loss of brightness is larger at wider T values with the 20 mm focal length, the average of the loss of brightness is 0.3 stops and on the corners is 0.8. With the 120 mm, the average for sides is 0.7 and on the corners is 0.9. The loss of brightness is practically no significant from T 4.7.

AB: Are not they a high values, especially with the tele-photo of the zoom?

AP: Yes, they are high values, but under normal circumstances of shooting we can hardly see the difference, we should have plane surfaces regularly illuminated to appreciate it. Notice that the loss of brightness affects the resolution of the image sides, and although we have already seen that it occurs, the loss is not significant. Perhaps, this fact is the weakest point of the zoom, but as I told earlier, the manufacturer chooses a balance which includes the cost; at the end the main goal is the image which we are able to get.

AB: Then, to the series, haven't you taken into account this aspect of light or putting in a frame?

AP: No, I haven't, absolutely no. We have shot with three cameras for each unit, we have done at the same time a medium shot and a close-up. For instance, we could use the 40 mm for the first shots and the 120 mm for the second ones without any problem of brightness. During the colorization process had not any difference either

AP: The zooms build the space in a different way that a Prime. Pasolini pointed out: "with their long focal, the zoom is attached to the things, expanding them as a piece of bread too much inflated." The zoom changes the relation time-space, thus it is needed to know how represents the world, the reality. I use a cylinder to check how the perspective distortion is. I shoot it perpendicularly to the sensor; the distance between the two bases of the cylinder, the one close to the lens and the other far to it, determines how the distortion is.

The distance between the two circles with the 20 mm focal length is longer than with the 120 mm. The way the relative distances are and the size of the objects to such distances are the key to use the zoom in a narrative way.



AB: How is the test translated into the normal images?

AP: Look at the next image! Our readers can see on it how changes the size of the color chart, and so the relative distance regarding the used focal length.



As all of the zooms, the image change in some abstract way, and it is precisely what I was interested in for the series, wherein we tried to do a play where the main character's dream were also the spaces' dream, a bit unreal but at the same time plausible. I think that in such aspect the zoom helps a lot.

AB: In this respect, you had already used the zoom, hadn't you?

AP: Yes, I had. I had used it in the *A casa da luz* feature film. We shot the whole movie with a zoom to reach the same goal that I have already pointed out, creating a meta-reality, abstract, plenty of plausibility.

AB: How is the contribution regarding the lens handling of the light to create for the series the perception which you are mentioned?

AP: The lens allows crossing the light, but when the light is inside and it is reflected among the different crystals, contributes to the appearance of the blacks is or the high lights to create certain effect as flare or veil. The veil is the ratio between the light that is incident on the sensor of the black regarding the white that surround it. I usually measure the veil with Imatest. We can see the results that we have got in the table. We can say that is a relatively high value which entails that the blacks are going to be a bit soft.

AB: Does such softness at the blacks contribute to the image that you wave wanted to create too?

AP: Without a doubt I believe that the dream state feeling matches the soft blacks. Moreover I had other objective in mind, I wanted to portray the actors as attractive as possible; that's why besides the lens I use enough a Classic Soft filter. For instance, look at the flare in the test with a flashlight!



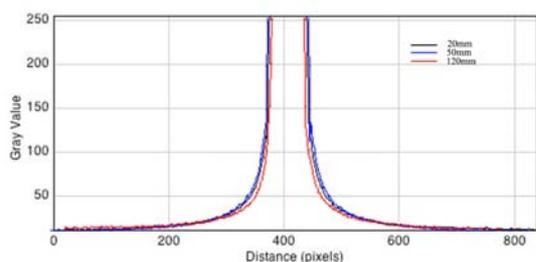
The halo surrounding the flashlight spreads softly until being lost in the darkness, the flares are soft with color patterns, without excessively staining the black. It seems to me really nice.



Focal length 50mm T 3.5



Focal length 120mm T 3.5



Another question is how we see the veil through the whole focal range. On the next graph I have overlapped the value of the pixel going from the black to the black through the white from a candle. As you can see outcomes with the three focal lengths are alike. On the images of the candles you can appreciate how the flare is subtle, controlled.



We can say that the veil and the flare are very balanced through the whole focal length, we have got the blacks with body but soft and with a very good response at high lights. On the next image there was a huge quantity of light crossing a large window, as you can see the actor's outline looks very nice.



Derecho a Soñar. Zoom Fujinon20-120mm Focal length 35mm T 5.6. 25fps 180°

Here it is another image at low key.



Derecho a Soñar. Zoom Fujinon20-120mm Focal length 50mm T 3.5. 25fps 180°

AB: Apart from the features which you have already talked about, what other features of the lens have you evaluated?

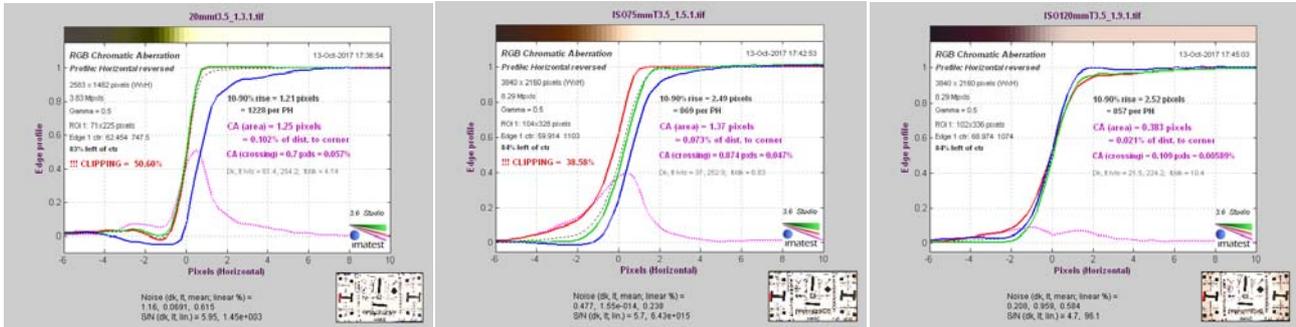
AP: The aberrations inserted by lenses in the image, as the chromatic or the geometric aberrations.

AB: How did you evaluate the chromatic aberrations?

AP: I usually use charts of resolution wherein I measure the RGB deviation on sides. As you know there are axial and transverse chromatic aberrations. The most common is the transverse ones and this is the most difficult to reduce. We can see on the enlarged image from the Via Stellae chart how the transverse chromatic aberration look with the three different focal lengths. You can see how the color of the aberration changes with regard to the focal length, to the widest or to the tele-photo.



From the Imatest analysis we can see that the aberration is larger with the widest focal length and lower with the tele-photo.



Focal length 20mm T 3.5

Focal length 75mm t 3.5

Focal length 120mm T 3.5

The graphs show a RGB shift, which is indicated by the CA area of the magenta dotted line as well as the number of pixels. The greater is the CA value, the more visible the aberration is. The aberration is also indicated as a percentage of the distance to the center of the image according to the next table provided by Imatest. We have to take into account that the gradation is related to still-photography rather than motion picture photography, which suffers huge enlargements, above all on screen movie theaters.

We can see in the next table the figures as well as its average. The value of the transverse chromatic aberration is moderate/low, that is, if we enlarge enough the image we can see the AC. As I have already told you, we can see in the enlargement the AC with the widest position of the zoom, meanwhile it is difficult to see with the telephoto. I have brought an example with an image of the judge office. I cut the area of the judge's cravat, and then I enlarged the cutting. We can clearly see the typical AC, a magenta edge and another one green-yellow-like. It is enlarged at 1200 %.

AB: Is it possible to detect the aberration on a TV-screen or a monitor?

AP: Not really, it is very difficult to see because the size of both the TV-screen and the monitor and the distance between the viewer and the devices. We could see on a movie theater screen, but the effect would go unnoticed for the majority of the spectators. Making the most of the frame, you can see the excellent texture provided by the zoom, the sharpness without harshness and the closest unfocused objects.

Transverse chromatic aberration in percentage of the distance to the center of the image	Grade
0-0.04	Insignificant
0.04-0.08	Low. Difficult to see unless it is looked in detail.
0.08-0.15	Moderate. Visible when the image is significantly enlarged.
Over 0.15	High. Clearly visible on enlarged images

Zoom Cabrio XK6x20. 20-120mm T3.5 Focal length	% of the distance to the corner
20mm	0.102
75mm	0.073
120mm	0.021
Promedio	0.0653



AB: How is the zoom performance regarding the geometric aberrations?

AP: The geometric distortion is caused by a different magnification of the image in the field covered by the lens. They can be classified in barrel or pincushion distortions, in order to evaluate them I use a grid chart which I analyze through Imatest. The program gives a SMIA TV value at percentage.

Zoom Cabrio XK6x20. 20-120mm T3.5 Focal length	Distortion SMIA TV %
20mm	- 2.45 Barrel
50mm	2.07 Pincushion
120mm	0.998 Pincushion

The values are normal for a zoom with a focal range as the evaluated.

You can feel the distortion of the -2.45 value with the 20 mm focal length in the images that we have already seen about the young man with the Macbeth chart behind, then we were discussing about the perspective distortion.



AB: Another feature to consider is the color, there are warmer lenses than others, or lenses that color slightly. How is the zoom performance regarding this fact?

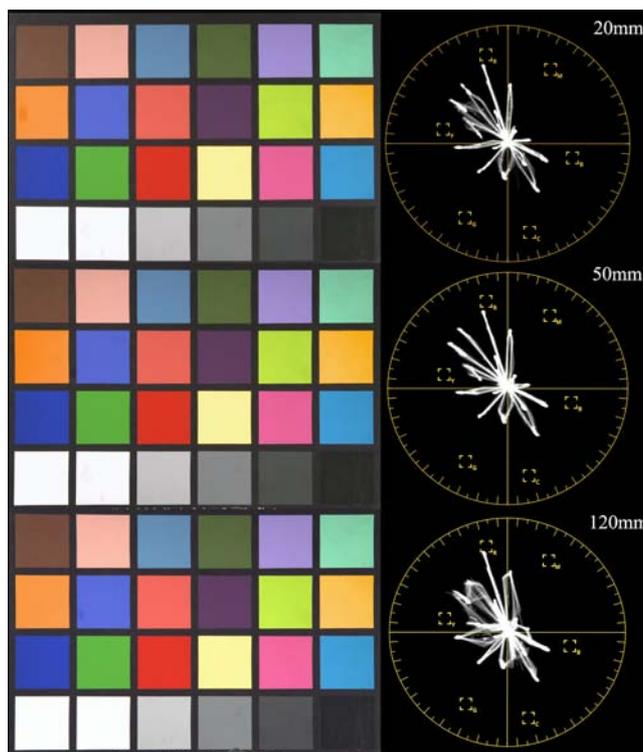
AP: The zoom has a color balance neutral enough, although for the skin tones it can be noted certain tone slightly yellow/green-like, we could state that it is placed among the lenses subtly warm. We have also checked that the color doesn't change through the focal range as we show with a Macbeth chart and a vectorscope beside.

AB: With regard to the zoom handling in the set, how did you feel?

AP: The zoom is a bit heavy although easy to handle with the detachable servo drive unit, which allows both carrying the focus and moving the zoom, the zoom ring rotates 200° which entails a pointer very accurate, in addition it has a back focus, so it is very easy to attach to the camera. We didn't have any problem in the course of shooting.

AB: To sum up, what is your general evaluation of the zoom? How would you define its personality?

AP: The personality of a lens doesn't depend on only their technical features but also on who made it and in what culture is designed. That's why I like to look for artistic references that define it. In this case, I believe that the Ôgata Kôrin's works, who was a Japanese painter and lacquer-worker in the 17th century, could inspire the personality of the Cabrios. The works of the painter are based on forms, idealized strokes, tending to abstraction without leaving the line inside a dim space. I think that his works Wind God and Thunder God are good examples.



With regard to a general evaluation I propose the next table which resume what we were talking about.

- Resolution ★★★★★☆
- Chromatic aberrations ★★★★★☆
- Geometric distortion ★★★★★☆
- Perspective distortion and lens breathing ★★★★★☆
- Bokeh ★★★★★☆
- Vignetting and illuminance uniformity ★★★★★☆
- Veiling glare ★★★★★☆
- Flare ★★★★★☆
- Color ★★★★★☆
- Ergonomic and handling ★★★★★★
- Price-performance ratio ★★★★★★
- Overall evaluation ★★★★★☆

Closing credits

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