Technical facts/differences between 33 MPxDalsa & 39 MPx Kodak Sensors

1. Some technical facts as background

a. The active area of both competing sensors is in the range of the professional 36 mm x 48 mm format.

b. The size of one single pixel is 7.2 microns (µm) with Dalsa's 33 MPx sensor and 6.8 microns (µm) with Kodak's 39 MPx sensor.

c. The surface area of one single pixel is 51.84 µm2 (Dalsa) and 46.24 µm2 (Kodak).

d. The above-mentioned dimensions result in 33 MPx (Dalsa) and 39 MPx (Kodak), respectively.

e. The silicon design of the pixels of the Dalsa sensor requires less physical depth (is thinner) than the Kodak design.

f. Nominal clock rate (how fast can the Sensor be operated): Dalsa = 27 MHz versus Kodak = 24 MHz.

g. Outputs: The Dalsa sensor can be operated with alternatively one or two outputs. With the Kodak sensor there is no other way than to operate it using two outputs.

h. Power consumption: although working at higher speed, the Dalsa sensor uses considerably less power thank to its design.

i. The Dalsa sensor's "pulse-flush" design allows an instantaneous reset of the whole CCD. Kodak needs to be run actively in the so-called "keep clean" mode.

j. The color filter technology used by Dalsa is different from the one used by Kodak. Both, however, use the Bayer-pattern.

k. Neither the Dalsa 33 MPx sensor nor the Kodak 39 MPx sensor use micro-lenses (Kodak's smaller 31 MPx sensor, however, is manufactured with micro lenses).

2. What does all the above really mean?

a. Both sensors are well suited for medium format and view camera applications. This is supported by the fact that none of the two sensors use micro-lenses and therefore allow shifts, swings, and tilts.

b. The size of a pixel defines the resolution to be achieved. According to the Nyquest rule, a pixel of 6.8 µm requires a lens with a resolving power of 74 line pairs per millimeter (lp/mm) over the entire image circle. A value that hardly will be achieved by any lens (and which was one of the reasons to invest in the HR- series of the Sinaron Digital lenses). Therefore, nowadays more pixels do not necessarily also mean more resolution. It is not only the sensor that counts but also the overall camera system. This is true for other components of the overall system as well: any movement – be it focusing or view camera movements – need to be more precise if the pixels are getting smaller.
To put it in a nutshell: theoretical resolution easily gets converted in – expensive – pseudo-resolution.

c. The surface area of a 33 MPx Dalsa pixel is 12% larger than the pixel of a Kodak 39 MPx sensor. Considering the fact that both pixels have also some non-active area (wiring, overflow drain, etc), which has a certain minimum size, the relation between the active and non-active areas is even more in favor of the Dalsa pixel (better "fill factor"). Technology improvements of the last years have allowed shrinking pixels without loosing performance. Comparing pixels of the same generation, the

old rules are still valid, however: the bigger the pixel the better is light sensitivity and contrast/dynamic range.

d. Consumers often think that more pixels automatically also means better quality. Correct? Part of the answer has been given above. Some additional factors have to be considered: Data from a 39 MPx sensor means file sizes of about 74 MB (RAW) or 223 MB (16 bit, interpolated). This means that more time is required for image handling – that is interpolation, filtering, exporting and post processing – be it in the back, in the back-software, later in Photoshop or another program, be it for transmission and/or writing the data in a memory or a disk. This means more costs – time is money – and the same is true when it comes to investments for more memory.

e. Dalsa pixels have not only a larger surface; they are also thinner, i.e. they are less tall. As a consequence, they are better suited for wide-angle applications and photography with view cameras (movements). Incident light hitting a pixel in a flat angle will therefore produce less shadow if the pixels are less tall.

f. The 33 MPx sensor can be clocked faster than the 39 MPx. And this results in a faster capturing rate. In case of the Sinarback eMotion, full advantage is also taken by the fact that the system itself supports fast capturing thanks to the integrated fast solid-state memory that represents a unique feature by itself. With this, fast capturing ends not before some 80/160 images – other backs begin to slow down already after only a few images taken.

g. When mentioning above that the sensor with fewer pixels and a higher clock rate results in a higher capturing rate, it was not yet taken into consideration that so far only one of the two possible CCD sensor-outputs was used. There is still the possibility for even faster capturing. However, our priority lies on quality without compromise. Having had the freedom of choice, with the 33 MPx sensor we were not forced using two outputs. With the 39 MPx sensor there is no other possibility than to read out the data on two outputs. Reading out on two outputs finally ends in two individual images, which have to be stitched together.
Having already been there (Macroscan), we know how burdensome stitching partial images (tiles) can be depending on the subject. Its also obvious, that part of the time gained by using two outputs is later lost for stitching and filtering in order to hide the transition area.

h. Thanks to its design, the 33 MPx sensor uses much less power than the 39 MPx. As a consequence, one video battery in a Sinarback eMotion lasts for about three hours, whereas other backs are running out of power after less than 1 hour. This is perhaps the most important difference when working mobile. In addition: less power consumption = less heat generation = less noise.

i. The pulse-flush/reset technology of the Dalsa sensor allows using a state of the art digital back with almost all existing cameras including older medium format cameras that can only be operated in the Master-mode. Pulse-flush allows leaving the sensor in the idle mode – low power consumption – and to fully remove all accumulated electrons before going active. This means to be ready all the time for taking the image without loosing energy; – that is actually one of the "secrets" behind the long operating time of a battery in the case of a Sinarback eMotion.

The above cannot be done when lacking this pulse-flush technology. In that case, the only option is to continuously operate such sensors in the so-called keep-clean mode – i.e. keeping the sensor active higher power consumption/lower battery more heat more noise). However, the keep-clean mode cannot be stopped in time when operation the camera in Master-mode. Once the flash synch signal (x-synch) arrives at the digital back, it is too late and part of a "smear" produced by the "keep-clean" will possibly be visible in the image (especially when using continuous light and focal plane shutters).
Is there a better Live Image when using the reset-technology? For obvious reasons in the case of the Sinarback eMotion we are not talking about Live Image – yet.

j. Since both sensors use the Bayer-pattern, in this matter, there is no difference between the 33 MPx

and the 39 MPx sensor. However, there is still a huge difference between a 1-shot and a multi-shot back. It is simply a question of the right (or wrong) subject to prove this: even though 1-shot interpolation is quite good nowadays, it is still an interpolation. Limits may have been shifted so that newspaper characters get black and white and color moiré in some tissues is avoided. Increasing the distance to the subject, however, will bring you back to start: moiré appears again and small characters in newspapers are getting very colorful again.
An other thing are the properties of the individual color filters (RGB) that are applied on the single pixels.
We see more even results comparing the three channels and that also lead to better conditions when using the original image data. Other technologies may, for example, have a weaker red channel thus lacking fine structures in the final image.

k. When using view cameras, the use of micro-lenses is a "don't do". Both, the Dalsa 33 MPx and the Kodak 39 MPx sensors are o.k. in this respect. Please note that the 31 MPx sensor of Kodak uses micro-lenses and therefore is not suited to be used on both, medium format cameras with wide-angle lenses and view cameras with displacements.