

Re: Basic newbie question on cmos sensor and optics

Source: <http://sci.tech-archive.net/Archive/sci.optics/2005-05/msg00040.html>

- *From:* "KLFrosty" <Keith.L.Frost@xxxxxxxxx>
 - *Date:* 4 May 2005 17:09:34 -0700
-

Antonio Pasini wrote:

- > Sensor A (MT9V111):
 - >
 - > Resolution: 640x480
 - > Pixel size: 5.6um x 5.6um
 - > Sensitivity: 1.9 Volts / lux*sec at 550 nm
 - >
- > Sensor B (MT9M001):
 - >
 - > Resolution: 1280x1024, region of interest really used: 1024x768
 - > Pixel size: 5.2um x 5.2um
 - > Sensitivity: 1.8 Volts / lux*sec at 550 nm
 - >
- > Obviously using two different custom designed optics.
 - >
 - > But now I'm asking myself... if the light I drop on the target is the same,
 - > the light that comes back must be spread on a much wider area on sensor B,
 - > so the single pixels will receive a much smaller light flux... Used,
 - > "illuminated" area of B would be $21.25 / 9.63 = 2.2$ times bigger
 - >
 - > What signal I'll get from B ?
 - >
 - > Just $1.8 / 1.9 = 0.947$ times the signal of A as stated from sensitivity ?
 - > This would be okay...
 - >
 - > Or will B output $0.947 \text{ times} * (1 / 2.2) = 0.430$ times the signal of A ?
 - >
 - > In other words... if the two different optics are made to fit each one
 - > active area, and target size, distance, light will be the same, do I

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need to

> factor in also the bigger area of B ?

>

> It's counter-intuitive to me why a much bigger, more costly sensor, with

> similar pixel size, given the same target image and illumination, would give

> me back a more noisy image...

>

It depends on the two different custom designed optics you mention.

The bigger, more costly sensor, with more pixels of a similar size, needs MORE LIGHT to illuminate those pixels, so your optics must be designed with a larger field of view, in order to provide that light.

If you take the same optics, and just increase the magnification, so that the real field of view is the same, but your resolution just went up — your effective sensitivity will go down in proportion as the sensor area goes up, just as you are worried about. So, if you really need that sensitivity, either use the higher resolution sensor to image a larger (real) field of view, or use a bigger lens to collect more light at the higher magnification, so that you can view the same real field of view, with the same sensitivity, at higher resolution, with (incidentally) reduced depth of field (inversely proportional to your lens diameter).

Have you ever noticed how those little cheap point-and-shoot digital cameras with lots and lots of megapixels, take really crappy pictures in dim light situations? It's because what they really need is a bigger diameter lens to collect enough light to fill all of those pixels.

• *Follow-Ups:*

- ◆ **[Re: Basic newbie question on cmos sensor and optics](#)**

◇ *From:* surfer

- ◆ **[Re: Basic newbie question on cmos sensor and optics](#)**

◇ *From:* Antonio Pasini

• *References:*

- ◆ **[Basic newbie question on cmos sensor and optics](#)**

◇ *From:* Antonio Pasini

- Prev by Date: **[Young's experiment question](#)**
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◆ *Thread*