

Computer Science E-7

Exposing Digital Photography

Lecture 10: Digital Cameras (cont.)
November 2, 2010

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Home

Final Project

Lectures

Problem Sets

Resources

Syllabus

Welcome to Computer Science E-7: Exposing Digital Photography! This is a course offered in Spring, 2008 at **Harvard University's Extension School**.

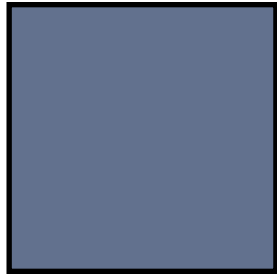
The course strives to offer students a more thorough understanding of digital photography through an exploration of technical, rather than strictly artistic, details. With a better understanding of the limitations and compromises behind digital photography, students will be better prepared for unexpected and dynamic photographic situations.

Find the **syllabus** and much more on the menu at the left!

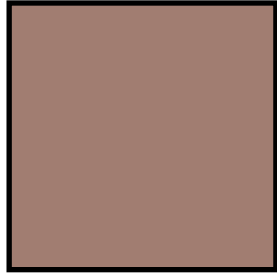
(cc)2008 Dan Armendariz, some rights reserved: Creative Commons BY-NC-SA.

Assignment 4

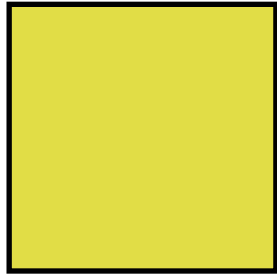
Website Theme



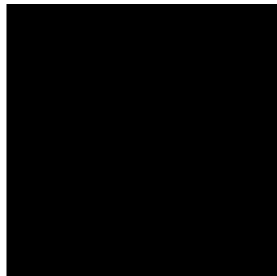
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highlight: FFDD46



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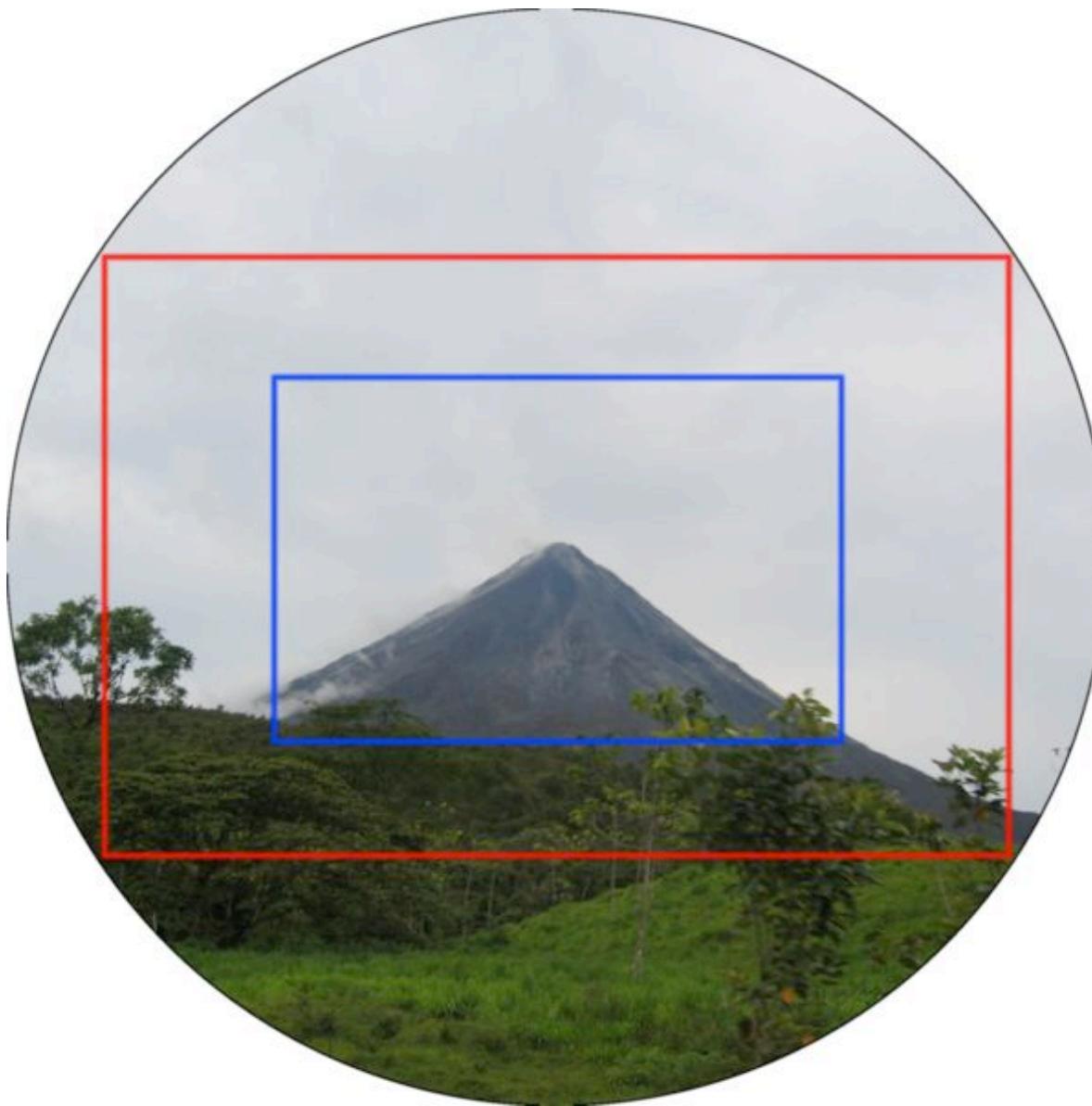
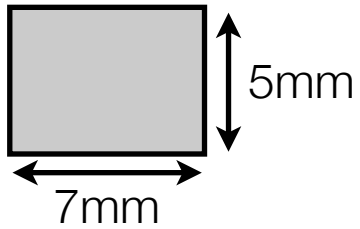


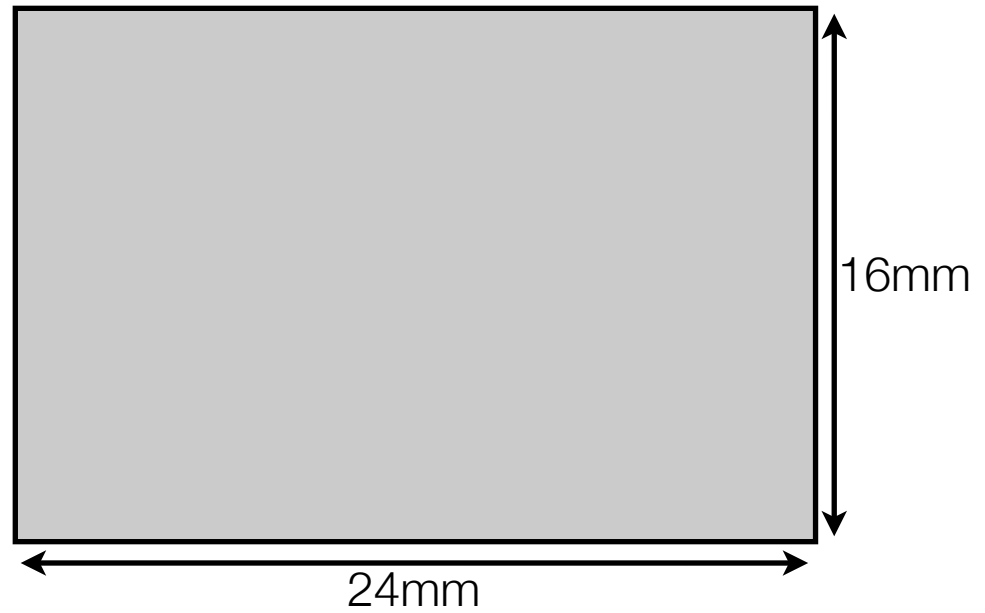
Image from http://en.wikipedia.org/wiki/Crop_factor

Review

Focal Length and Perspective



1/2.5"
6 MP



APS-C (SLR-sized)
6 MP

Review

Sensor & Pixel Sizes



Canon 1D Mark II, 28mm f/13 1/8 sec, ISO 640



Canon S70, 8mm f/3.5 1/8 sec, ISO 50



Canon 1D Mark II, 28 mm f/3.5 1/100 sec, ISO 640

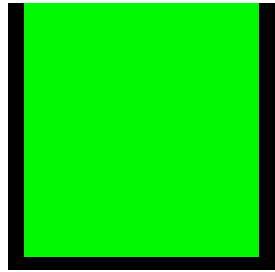
© Roger N. Clark

www.clarkvision.com

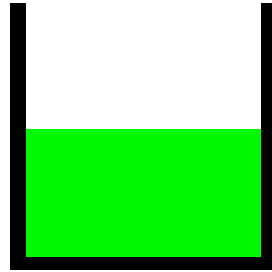
Image from http://www.clarkvision.com/photoinfo/dof_myth/

Review

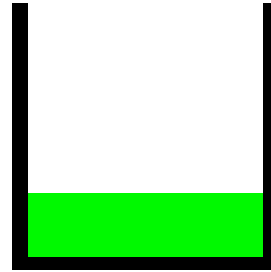
Depth of Field



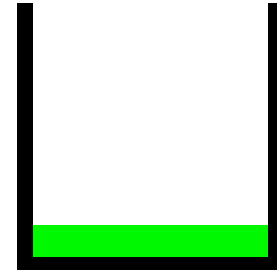
100



200



400



800

Review

Full capacity of pixels at ISOs

Passive Pixel Sensors

CCD

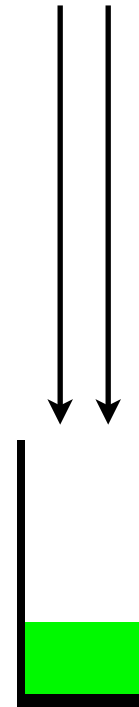
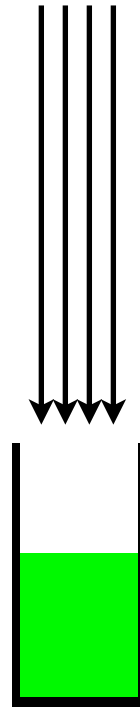
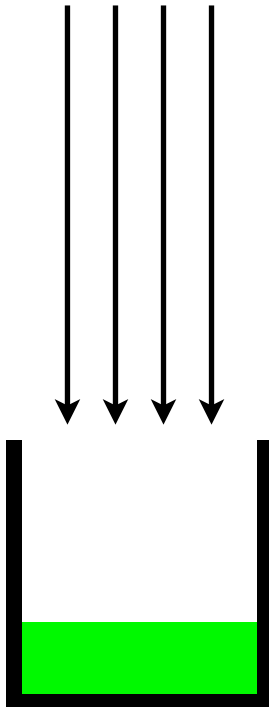
Active Pixel Sensors

CMOS

JFET LBCAST

Digital Cameras

Sensors



Sensors

Pixel Size

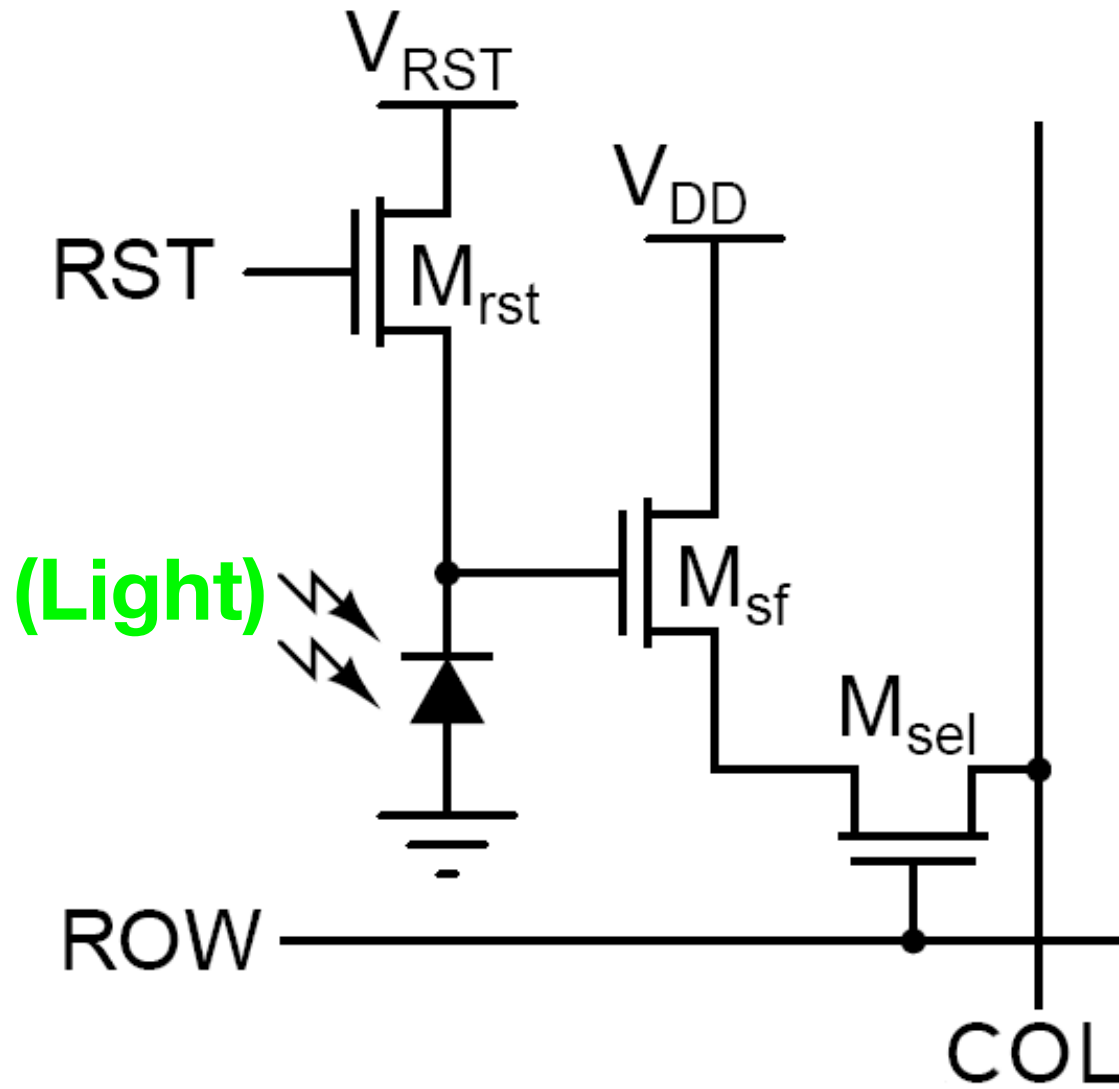


Image from http://en.wikipedia.org/wiki/Active_pixel_sensor

Sensors

Pixels

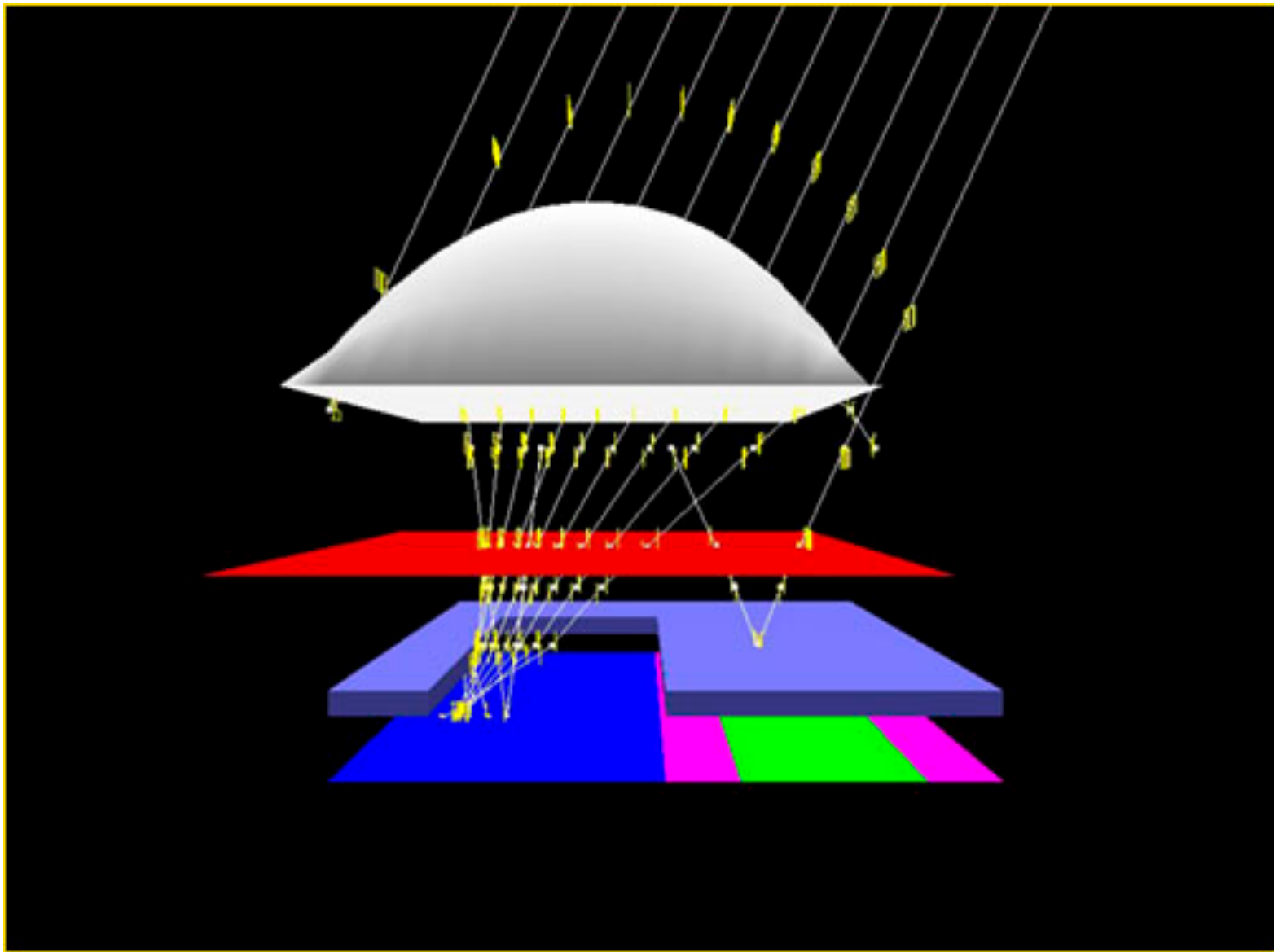


Image from Eastman Kodak, from <http://www.luminous-landscape.com/essays/kodak-iss.shtml>

Sensors

Microlens

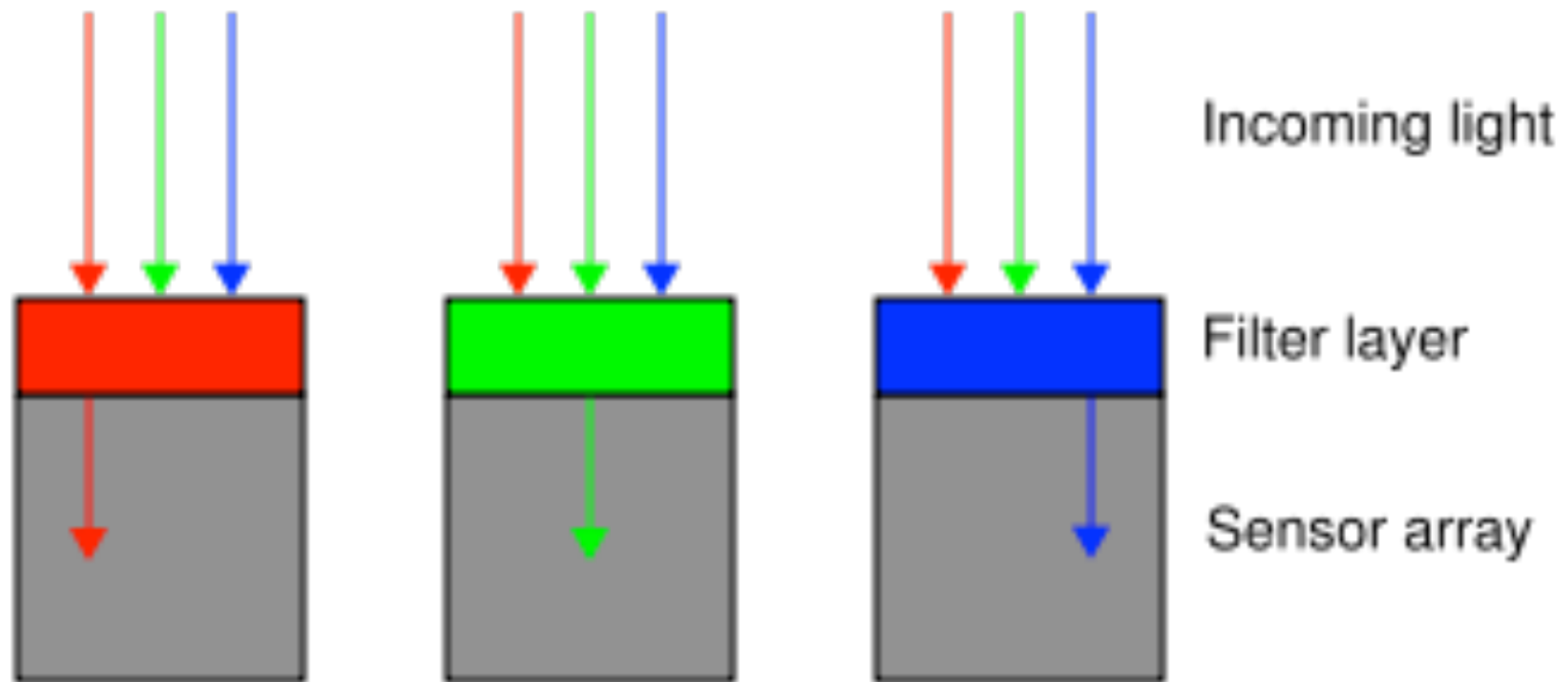


Image from http://en.wikipedia.org/wiki/Bayer_filter

Sensors

Color Filter Arrays

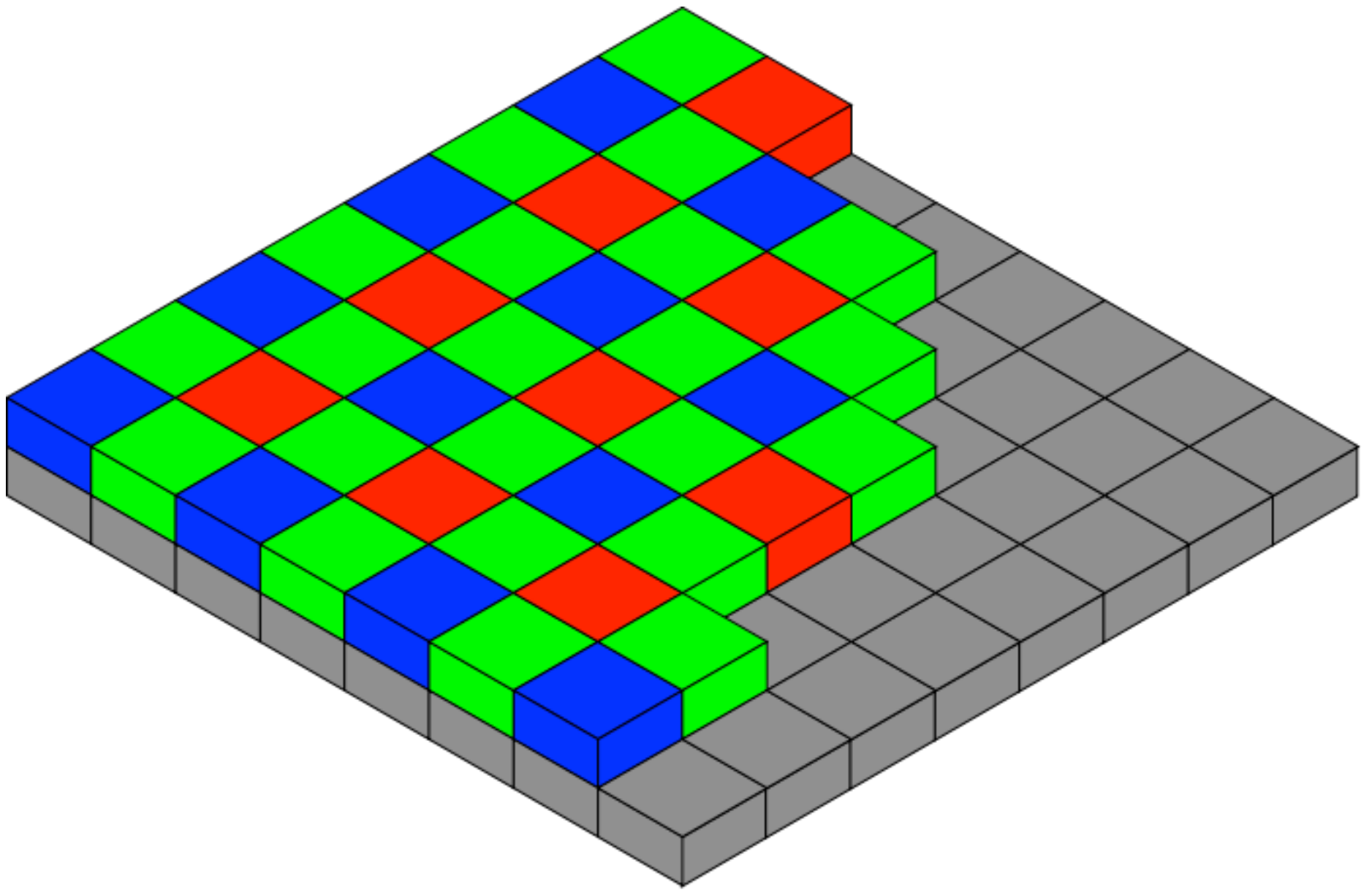
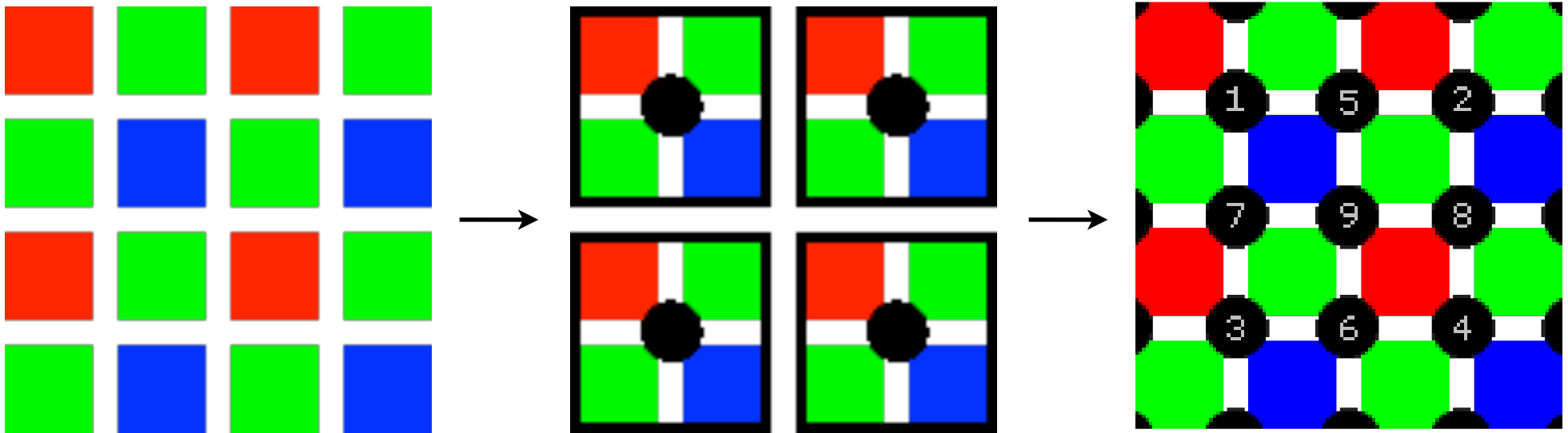


Image from http://en.wikipedia.org/wiki/Bayer_filter

Color Filter Arrays

Bayer Filter



Images from <http://www.cambridgeincolour.com/tutorials/sensors.htm>

Color Filter Arrays

Demosaicing

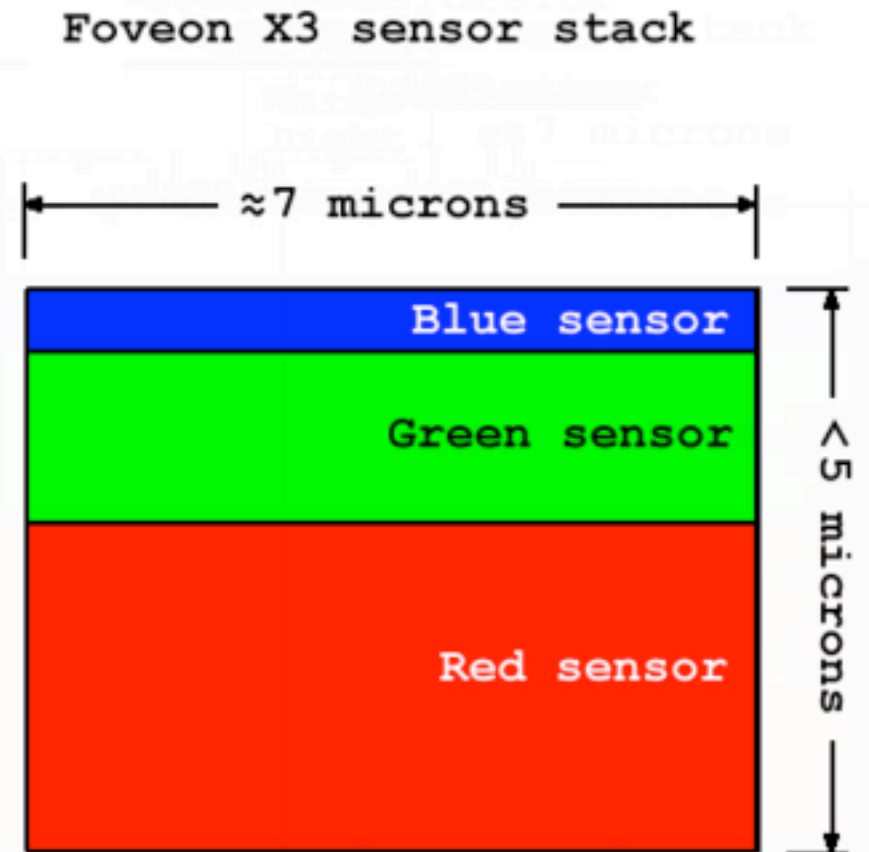
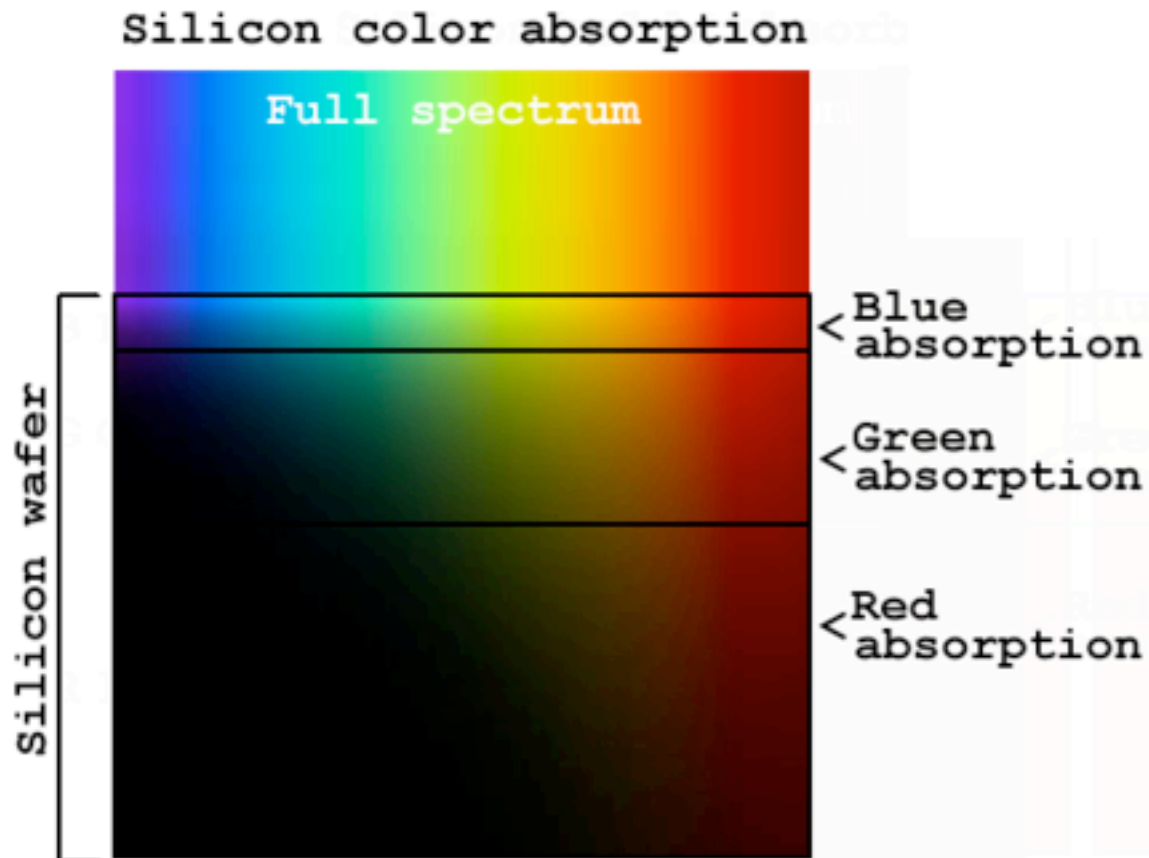
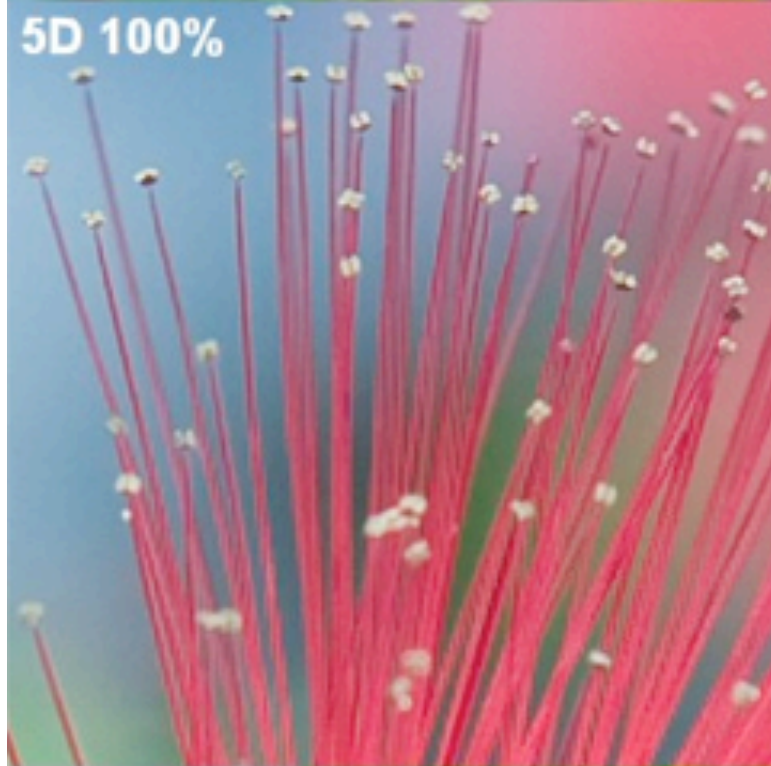


Image from http://en.wikipedia.org/wiki/Foveon_X3_sensor

Sensors

Foveon X3



Images from <http://www.ddisoftware.com/sd14-5d/>

Sensors

Foveon X3



Foveon



Bayer

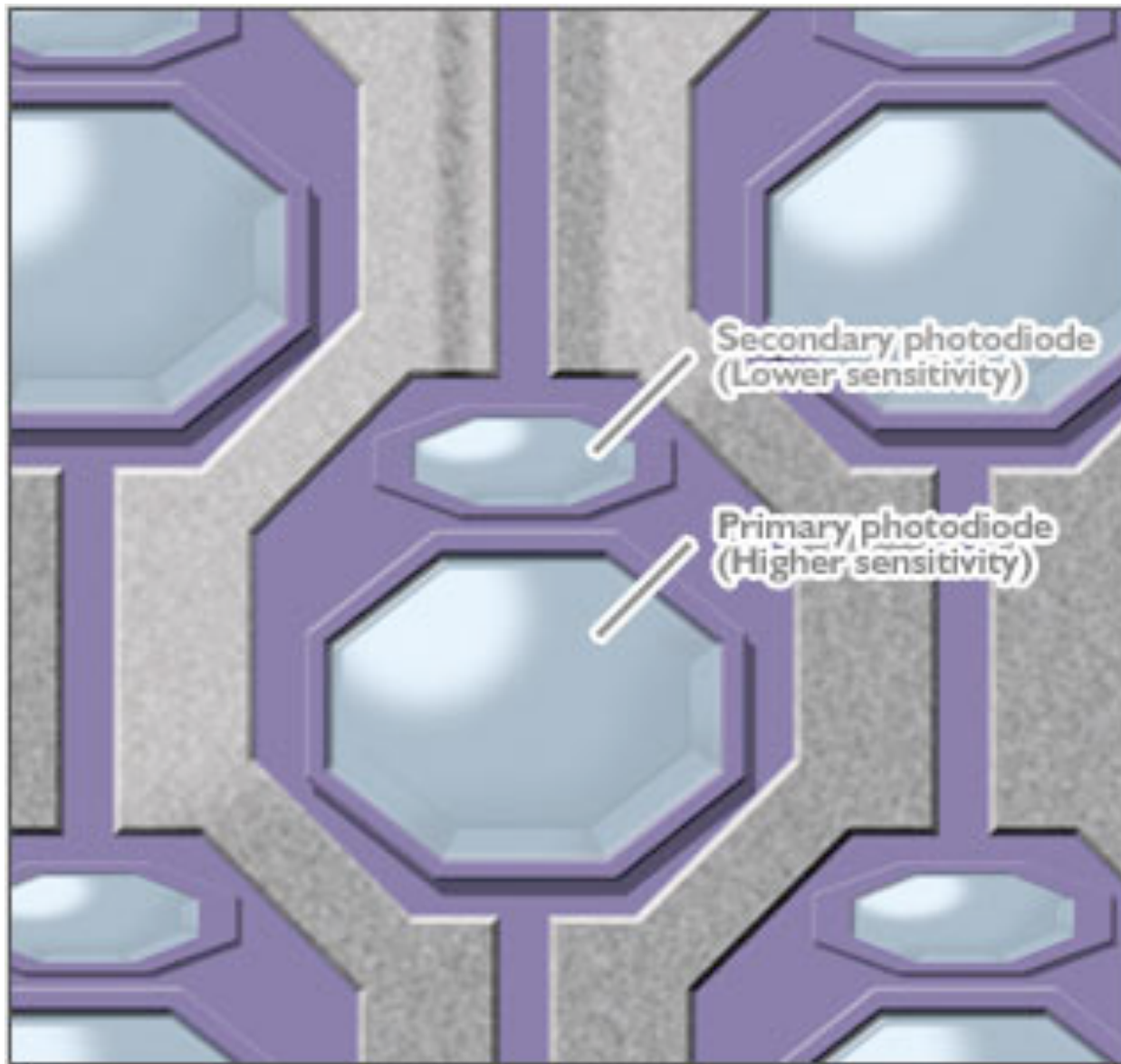


Bayer+LP (AA)

Images from <http://www.ddisoftware.com/reviews/sd9-v-bayer/>

Sensors

Low-Pass (Anti-Aliasing) Filter



Images from <http://www.dpreview.com/news/0301/03012202fujisuperccdsr.asp>

Sensors

Fujifilm SuperCCD SR



309s, ISO 100

Photo by Dan Armendariz, 2009

Digital Cameras

Histograms



Images from http://www.dpreview.com/learn/?/Glossary/Digital_Imaging/dynamic_range_01.htm

Digital Cameras

Dynamic Range



Images from http://www.dpreview.com/learn/?/Glossary/Digital_Imaging/dynamic_range_01.htm

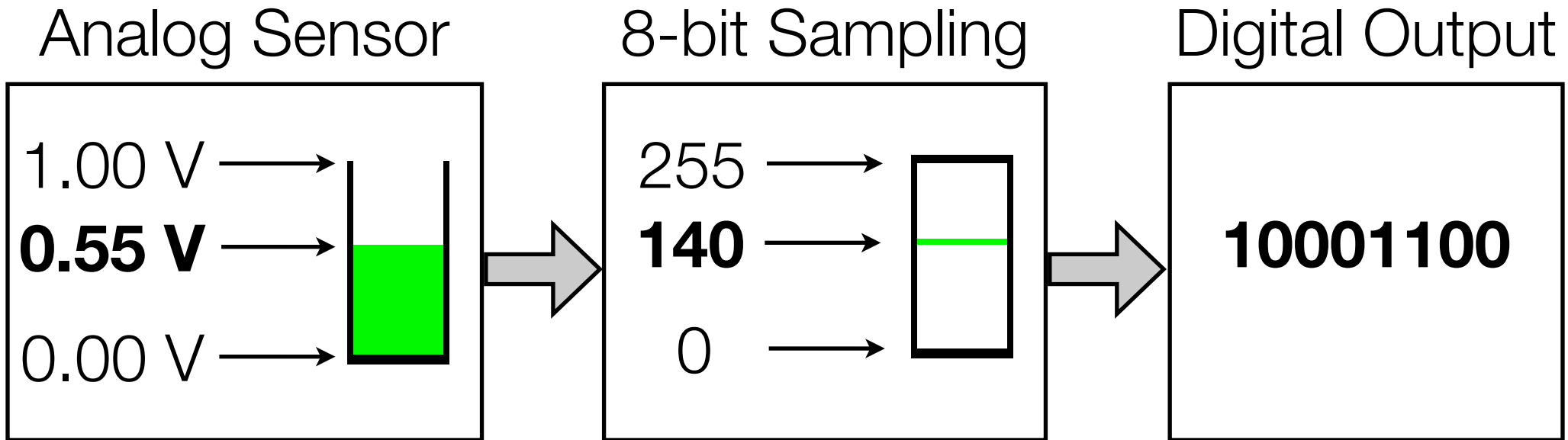
Digital Cameras

Dynamic Range

Bit	0 or 1
Byte	8 bits

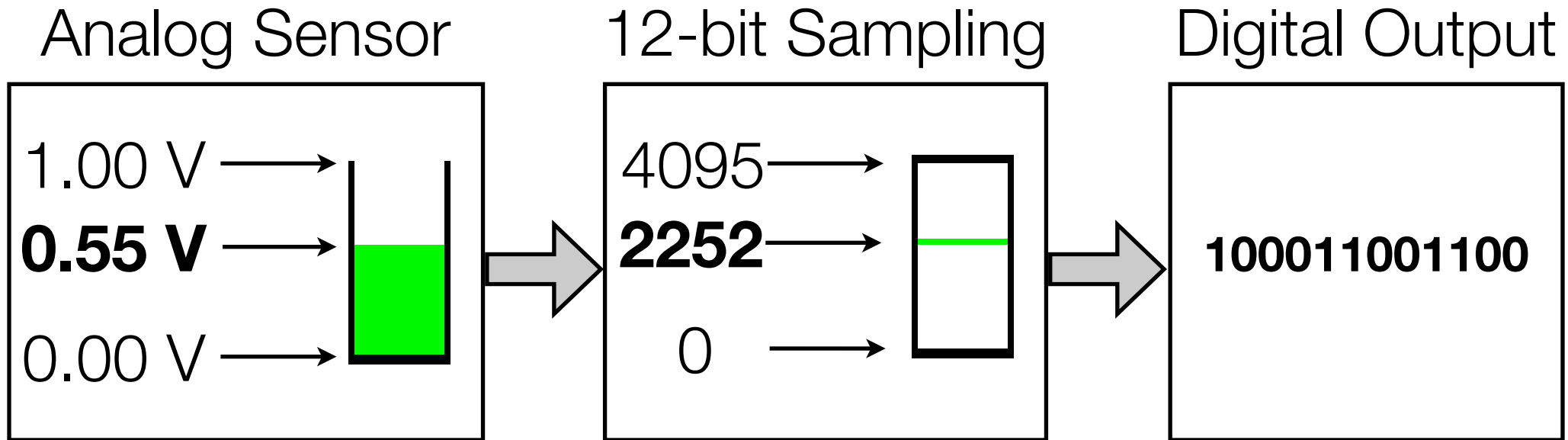
Bits and Bytes

Refresher



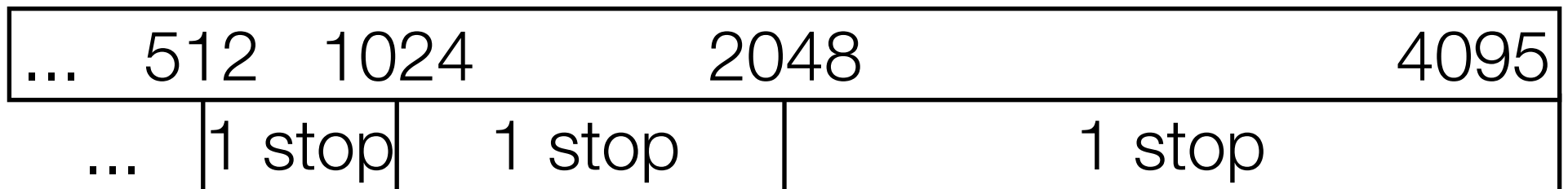
Digital Cameras

Analog to Digital Converter (ADC)



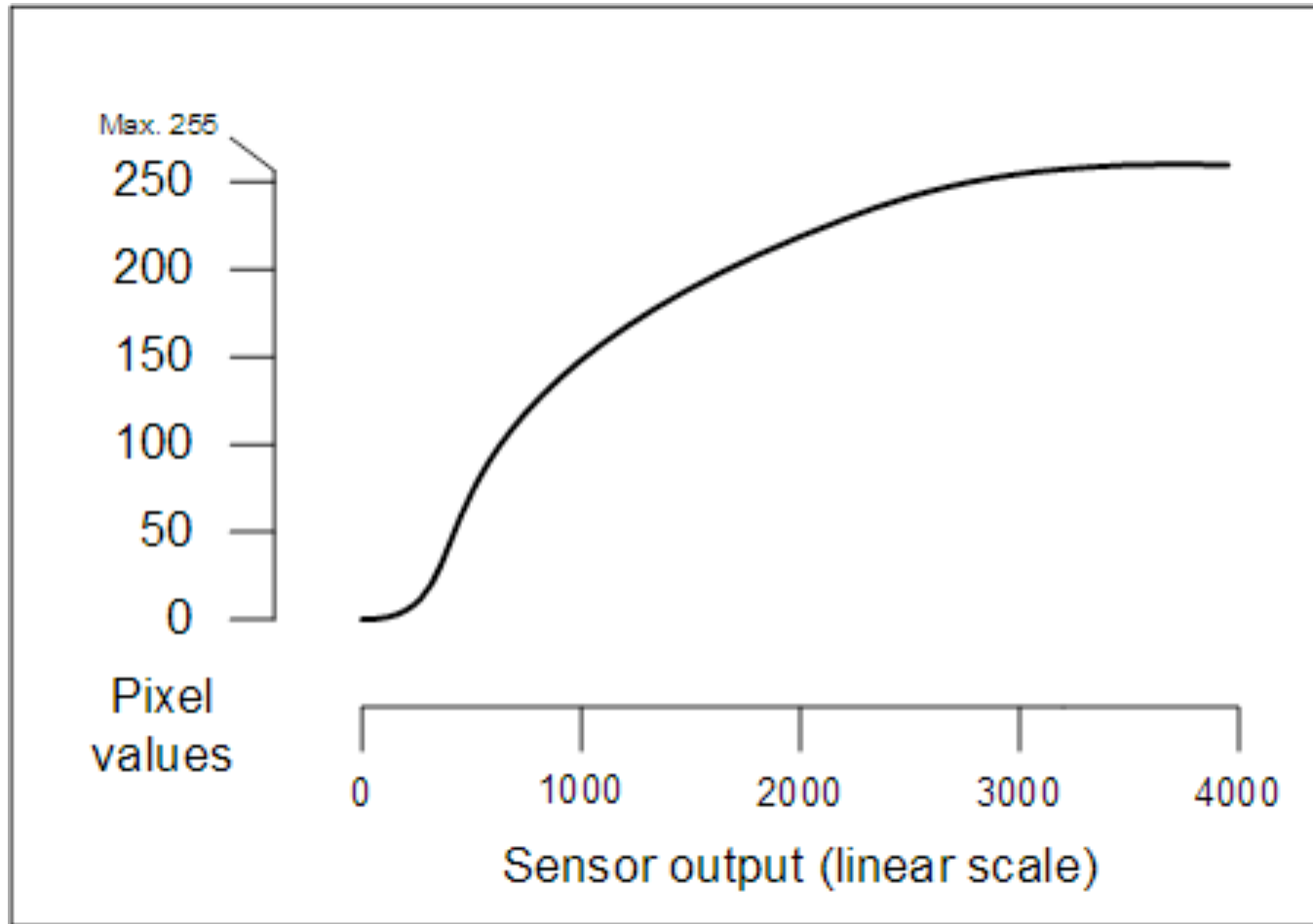
Digital Cameras

Analog to Digital Converter (ADC)



Digital Cameras

Sensor Linearity



Images from <http://www.covingtoninnovations.com/dslr/Curves.html>

Digital Cameras

Tonal Curve

	RAW	JPEG
Bit depth	10-, 12-, 14-bit	8-bit
Tonal Curve	Not applied	Applied
White Balance	Not set	Set
Compression	Lossless	Lossy
Portability	Nonstandard	Standard
Post-Processing	Required	Optional

Digital Cameras

RAW vs JPEG!

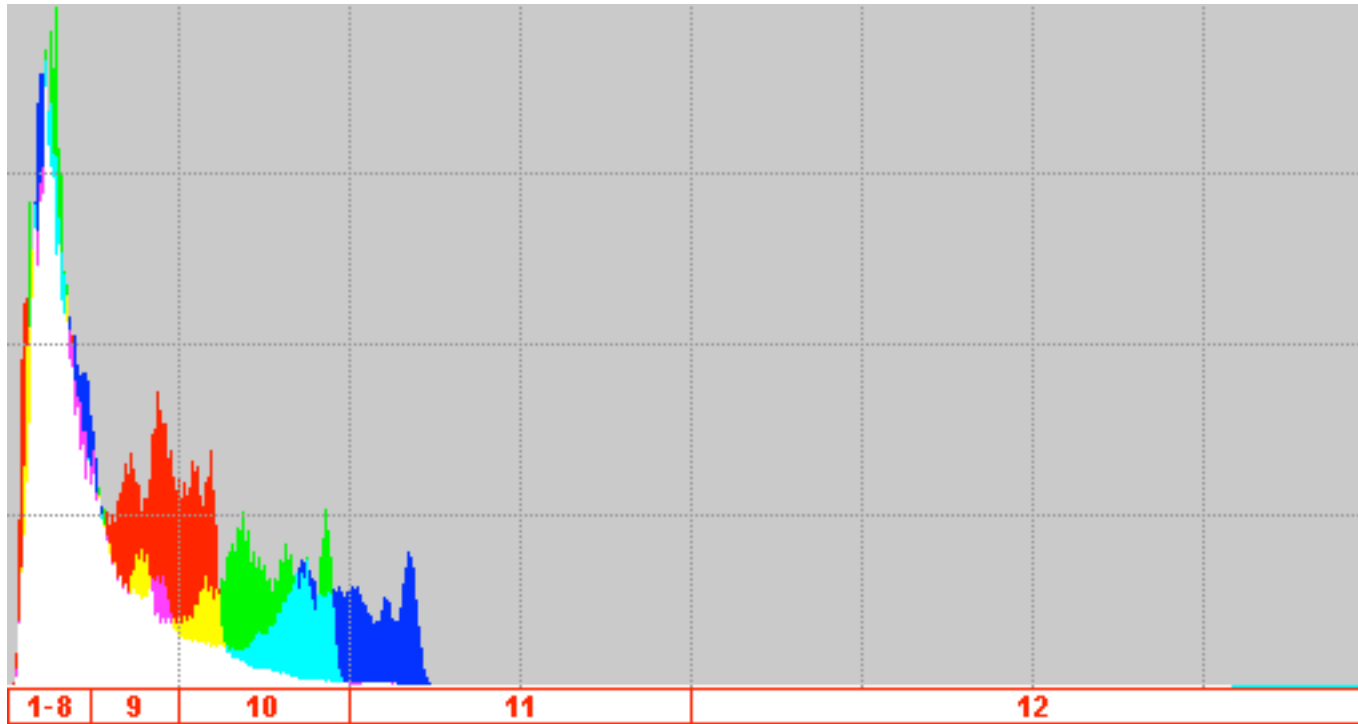


Image from http://www.guillermoluijk.com/tutorial/dcraw/index_en.htm

Digital Cameras

“Expose to the Right”

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