



HI-TECH
VISIONX
COMPONENTS

Kamery pro průmyslové aplikace
objektivy • světla • komunikace • software
školení • návrhy • studie

www.visionx.cz

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ATEsystem s.r.o. a VisionX

Firma ATEsystem s.r.o. byla v roce 2013 založena odborníky na automatizaci a strojové vidění s dlouholetou praxí

ATEsystem – služby a projekty

VisionX – prodej a podpora



Hi-tech kamery a příslušenství



KAMERY



OBJEKTIVY



FILTRY



KOMUNIKACE



SVĚTLA



SOFTWARE



SYSTÉMY



LINE-SCAN



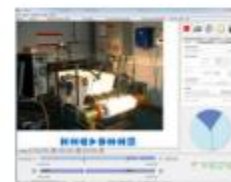
**INTELEKTUÁLNÍ
KAMERY**



KABELÁŽ



MECHANIKA



**VYSOKORYCHLOSTNÍ
ZÁZNAM**

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Partneři ATEsystem s.r.o.



See the possibilities



OPTO ENGINEERING
THE TELECENTRIC COMPANY



Basler ace pro USB3 Vision

350 MB/s

Snadné připojení Plug & Play

Napájení z rozhraní (900 mA)

Velmi nízká latence

Velmi nízká zátěž CPU (<1%)

Přenos dat do paměti DMA

Délka kabelu cca 5 m

Mnohem vyšší stabilita než USB2.0 – nelze srovnávat

Nástupce USB2.0 a FireWire



BASLER

USB[®]
VISION

Basler ace pro USB3 Vision

29 x 29 x 29 mm (bez c-mount)

VGA až 5 megapixelů

Color, mono, NIR

Sony, Aptina, e2v, CMOSIS

SDK zdarma

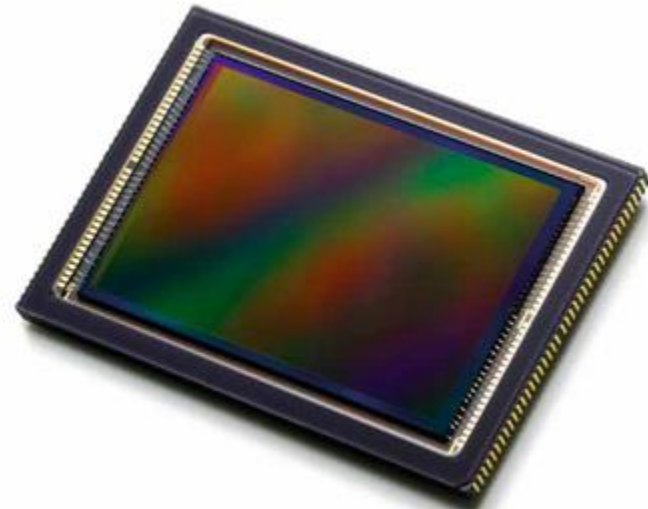
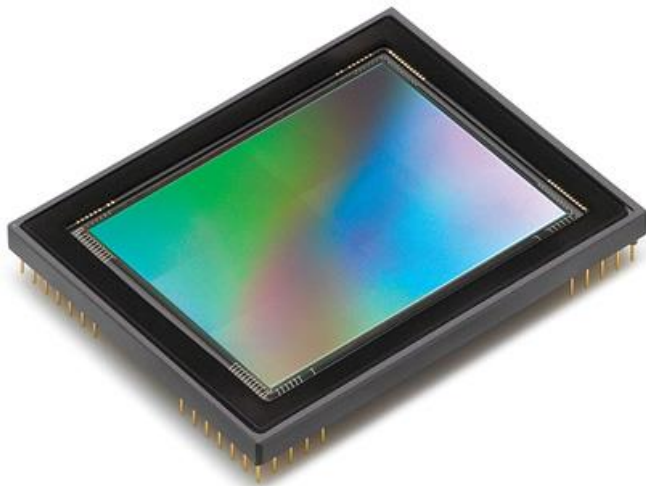
Záruka 3 roky !!!



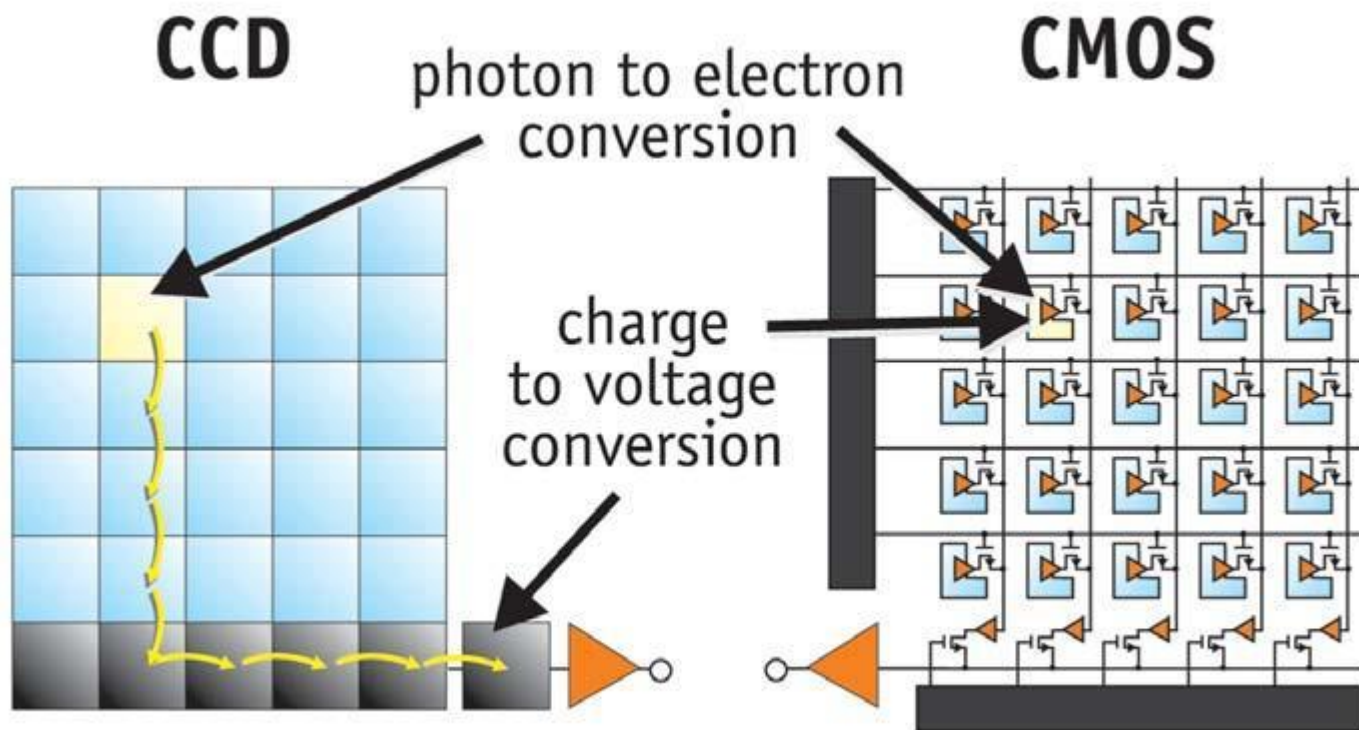
BASLER

Demo sestavy a zápůjčky zdarma !!!

CCD nebo CMOS?



CCD nebo CMOS?



CCD (Charge-Coupled Device)



Větší plocha pixelu => vyšší citlivost
Věrnější podání barev
Nižší šum než CMOS



Drahá výroba => dražší kamera
Omezená frekvence snímkování (řeší se pomocí multi-tap)
Větší spotřeba

CMOS (Complementary Metal Oxide Semiconductor)



Nízká cena

Vysoká rychlost snímání

Nízká spotřeba



Šum (fixed pattern noise)

Nižší kvalita obrazu

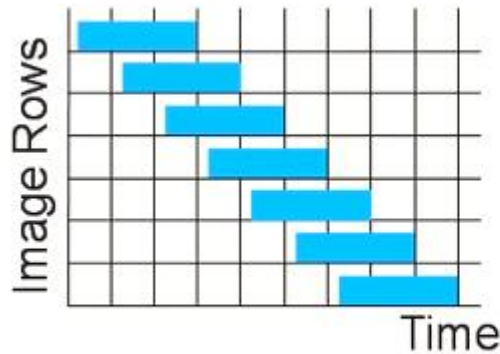
Nižší citlivost (řeší se mikročočkami a BSI)

Budoucnost

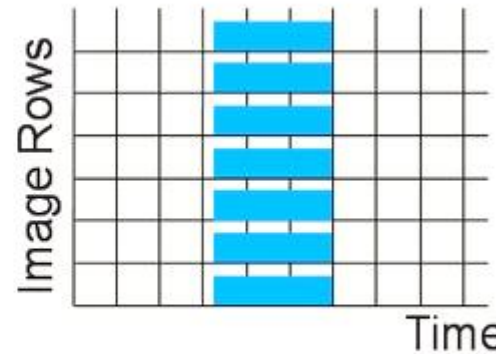
=> zvyšování kvality CMOS

=> častější nasazování

Global / Rolling Shutter (CMOS)



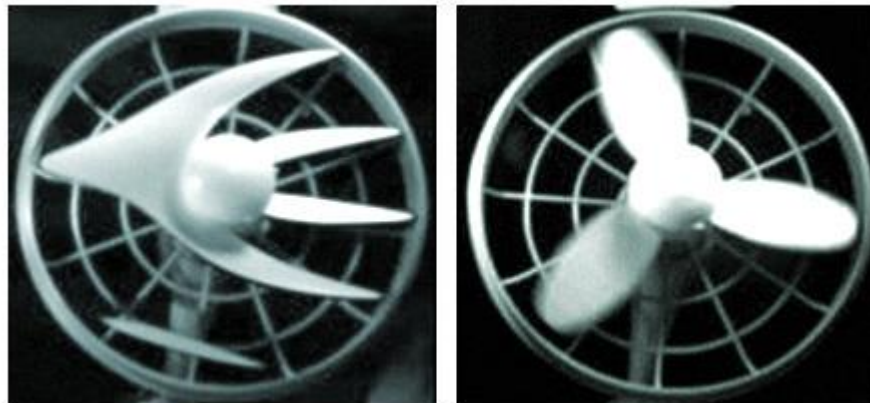
Rolling Shutter (CMOS)



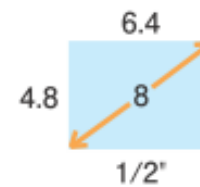
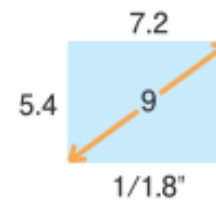
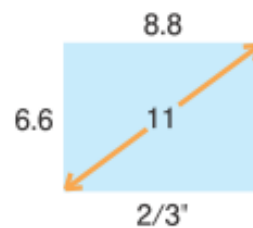
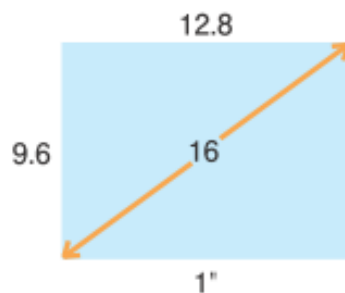
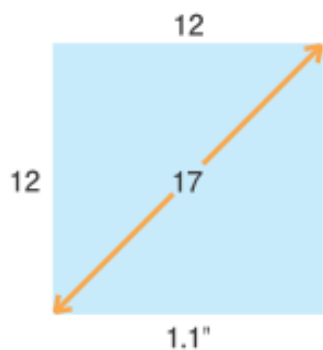
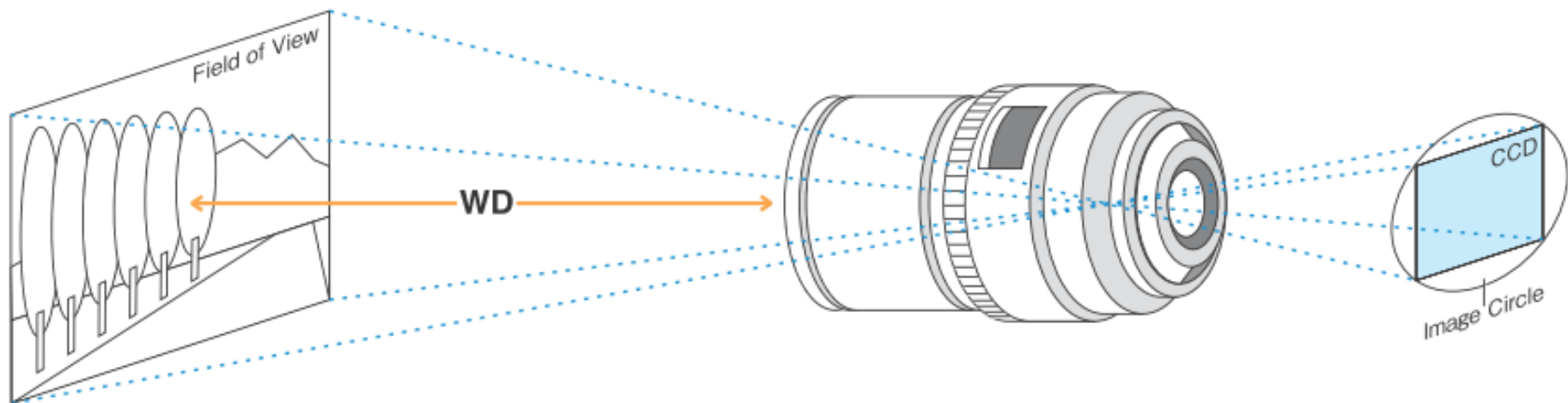
Global Shutter (CCD)



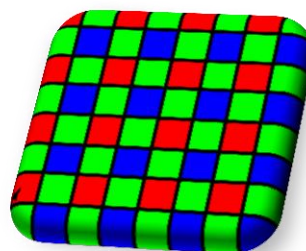
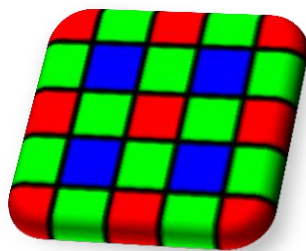
Levnější
Kamery



Velikost senzoru

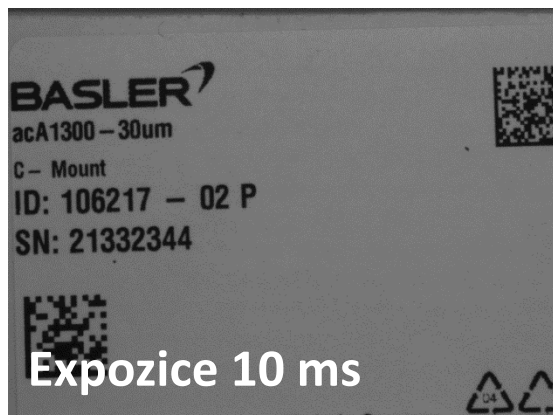


Rozteč pixelů (velikost pixelu)



Citlivost	+	-
Dynamika	+	-
Šum	+	-
Kontrast	+	-
Velikost	-	+
Cena kamery	-	+
Cena optiky	+	-

Srovnání kamer - citlivost



acA640-120gm
Sony ICX618
CCD 1/4"
659 x 494 pixels
Sensor size 3.69 x 2.77 mm
Pixel size 5.6 μm

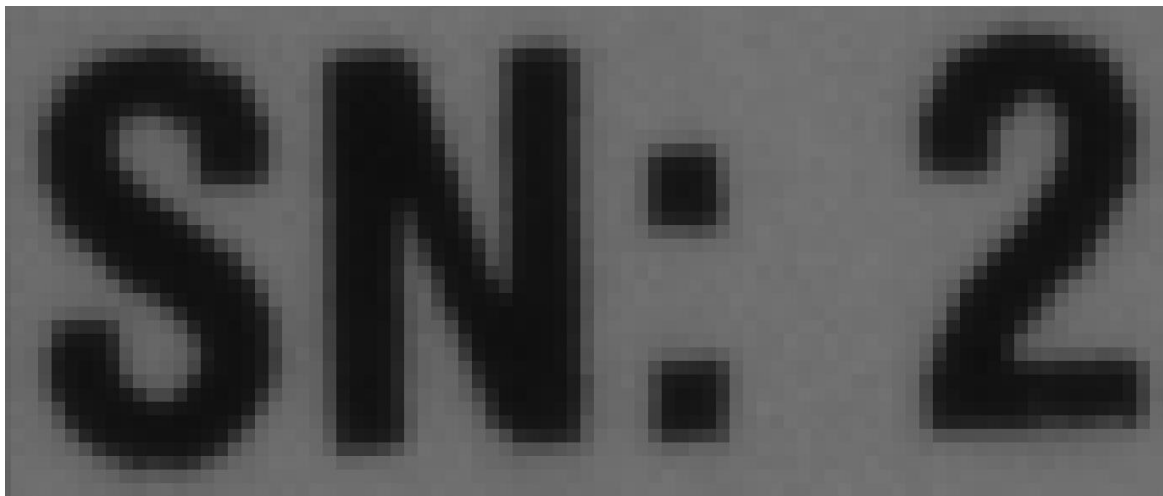


acA2500-14gm
Aptina MT9P031
CMOS 1/2.5"
2592 x 1944 pixels
Sensor size 5.70 x 4.28 mm
Pixel size 2.2 μm



Objektiv KOWA LM25JC10M, F8
Pracovní vzdálenost 400 mm
Nulové zesílení (gain)
visionx.cz

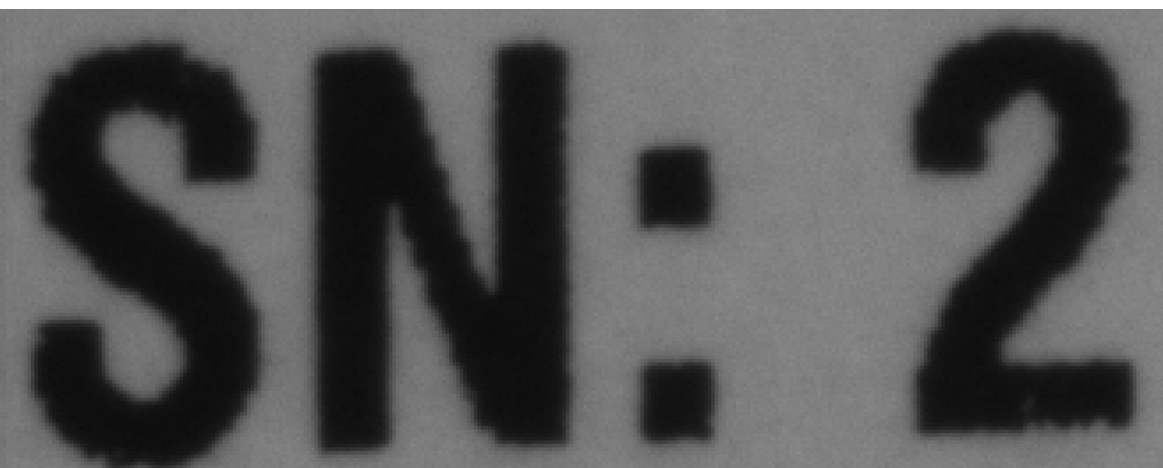
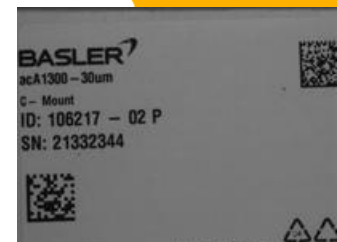
Srovnání kamer – stejné zorné pole



acA640-120gm
Sony ICX618
CCD 1/4"
659 x 494 pixels
Sensor size 3.69 x 2.77 mm

Pixel size 5.6 μm

Vzdálenost 400 mm



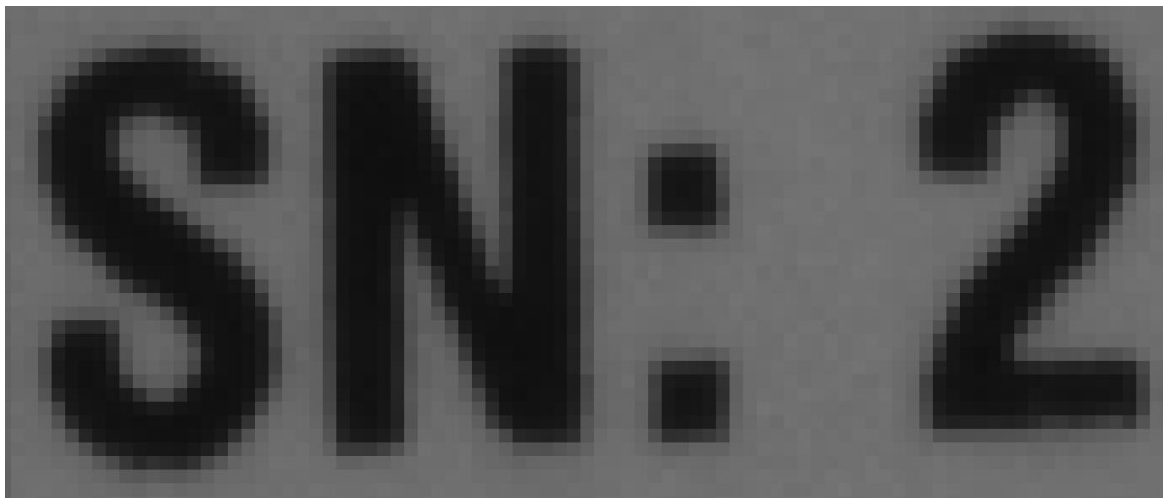
acA2500-14gm
Aptina MT9P031
CMOS 1/2.5"
2592 x 1944 pixels
Sensor size 5.70 x 4.28 mm

Pixel size 2.2 μm

Vzdálenost 240 mm



Srovnání kamer – stejné rozlišení



acA640-120gm

Sony ICX618

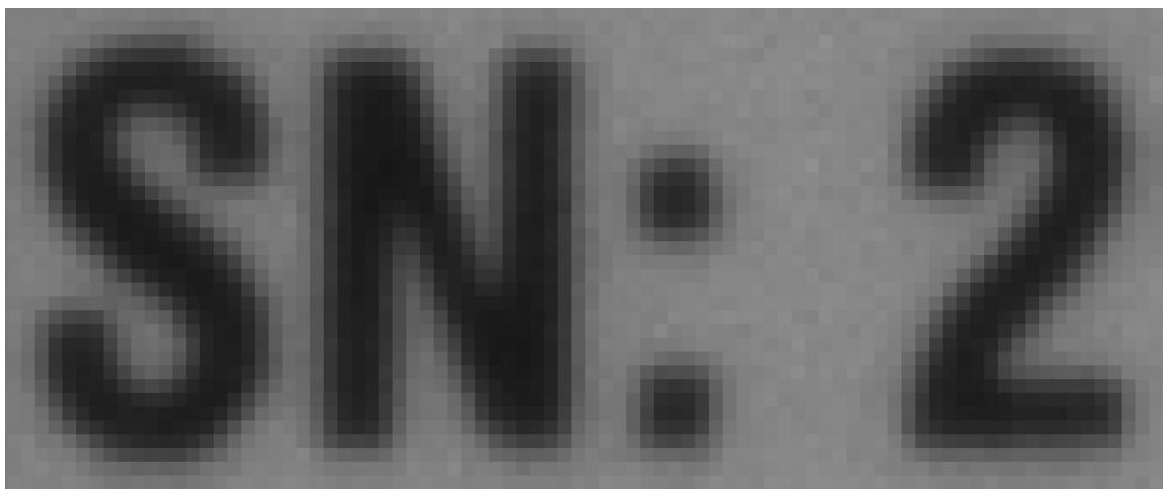
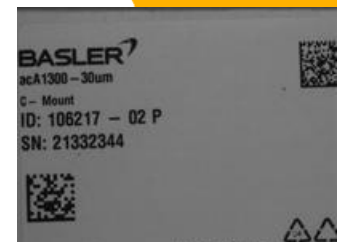
CCD 1/4"

659 x 494 pixels

Sensor size 3.69 x 2.77 mm

Pixel size 5.6 μm

Vzdálenost 400 mm



acA2500-14gm

Aptina MT9P031

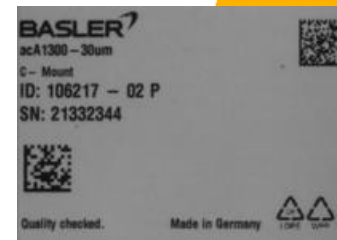
CMOS 1/2.5"

AOI: 659 x 494 pixels

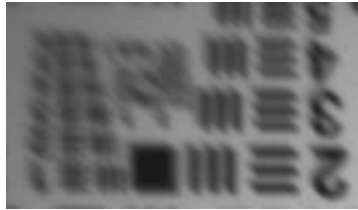
Sensor size 5.70 x 4.28 mm

Pixel size 2.2 μm

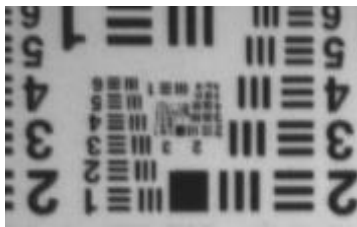
Vzdálenost 1150 mm



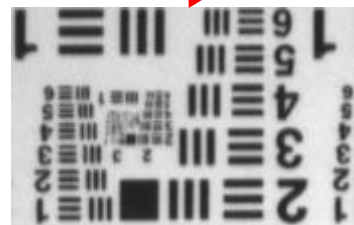
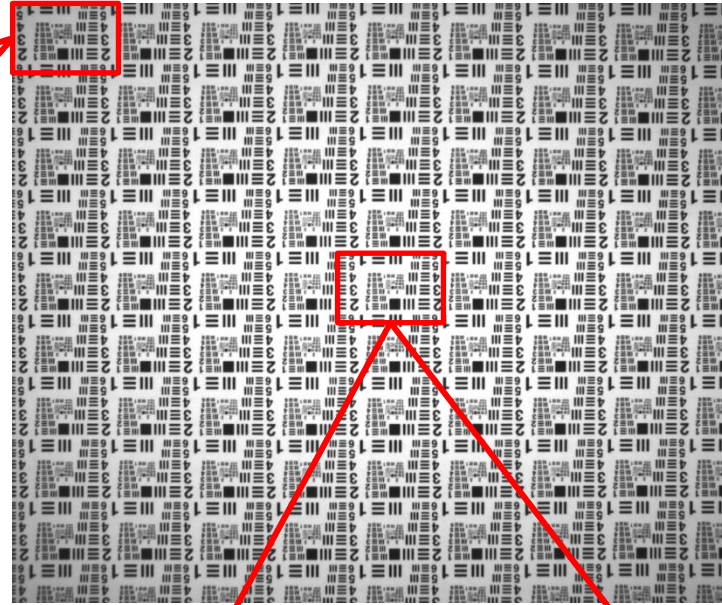
Rozlišení objektivu



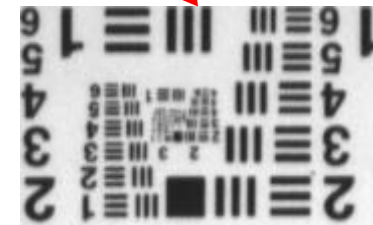
Standardní



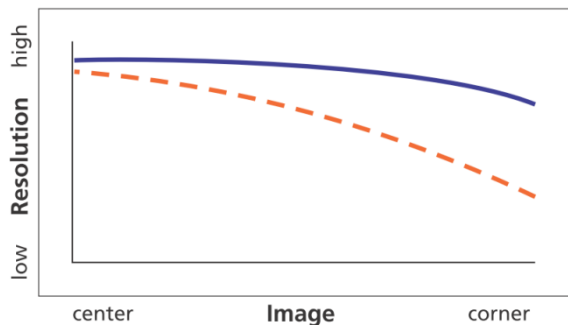
Megapixel



Standardní




Megapixel



Megapixel lens ————
Non-megapixel lens - - - - -

Rozlišení objektivu

Products

LM12JC10M 



up to 10 Megapixel
9 Elements in 7 Groups
Locking screws for iris and focus
Metal mount
Metal housing

10 Megapixel

Categories

► 2/3"JC10M-Series ► 2/3" ► 10 Megapixel ► Manual Iris
► Fixed Focal Length ► C-Mount ► VIS ► Broad band coating

Features

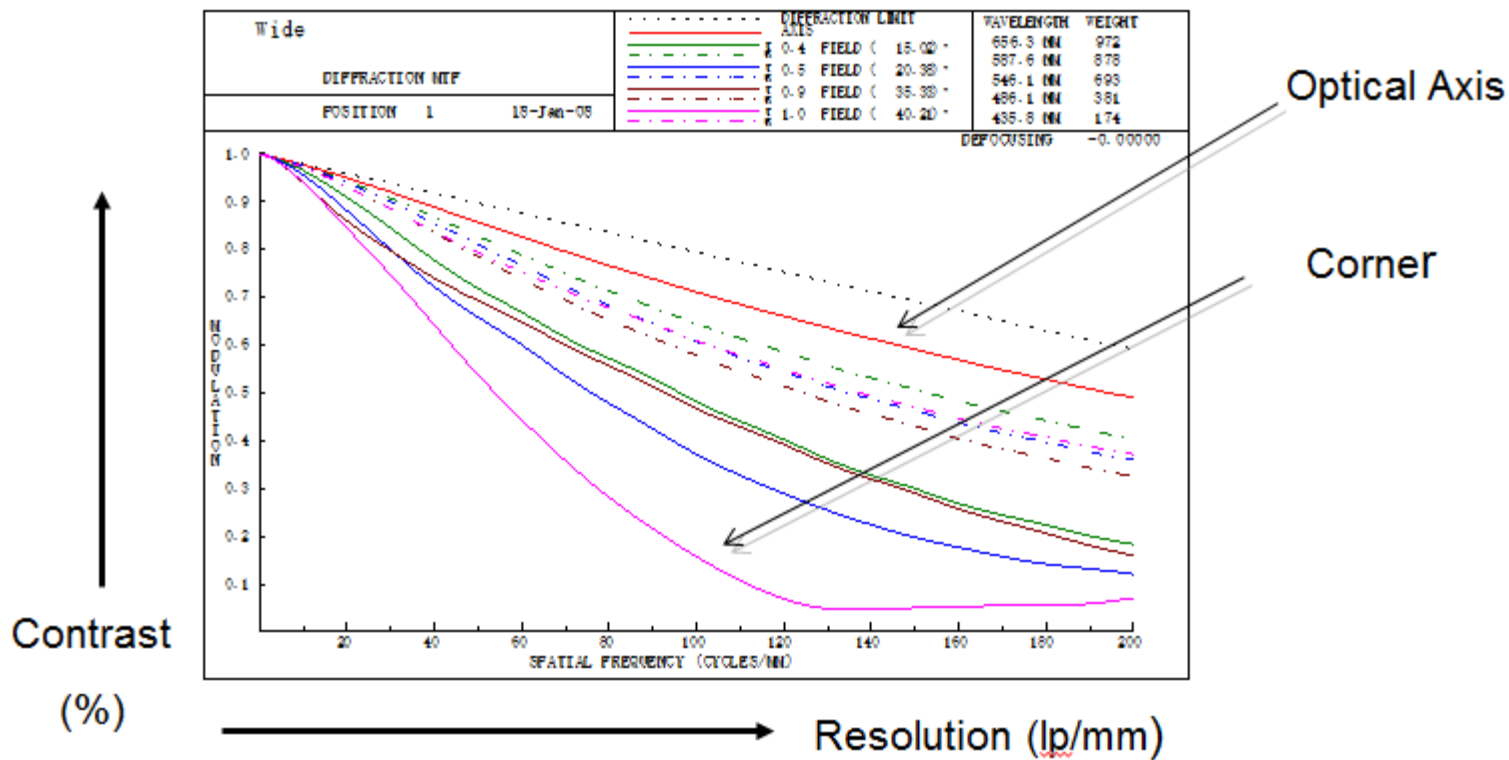
Main Sensor size	2/3"
Focal length (mm)	12.0
Iris range (F-stop)	1.8 - 11
Focusing range (m)	0.10 - ∞
Iris Control	Manual
Focus Control	Manual
Shooting range at MOD (m)	h: 00.70 / v: 60.20
Resolution	200.00 lp/mm (center) 160.00 lp/mm (corner) 2.50 μm (pixel-size)
Distortion (TV)	-0.12%
Back focus in air (mm)	13.90
Filter size (mm)	M25.5 × P0.5
Size	∅27 × 53.5 mm
Mount	C-mount
Weight	105 g
Temperature range (°C)	-10°C - +45°C

200.00 lp/mm (center)
160.00 lp/mm (corner)
2.50 μm (pixel-size)

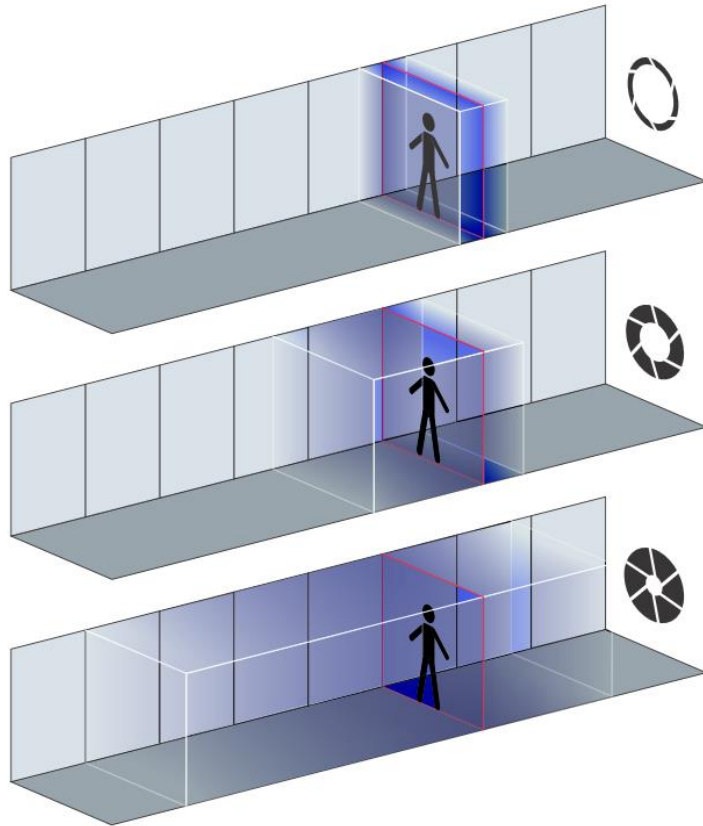
Angle of view

Sensor size	horizontal	vertical
1/3 inch	21.90°	16.50°
1/2 inch	28.90°	21.90°
2/3 inch	39.10°	29.80°

Zkreslení objektivu

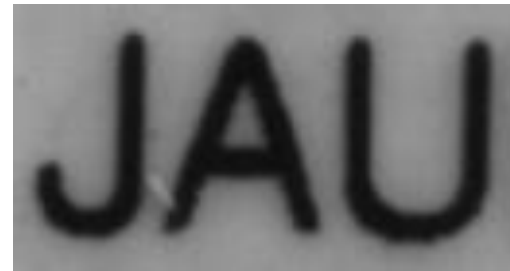


Hloubka ostrosti

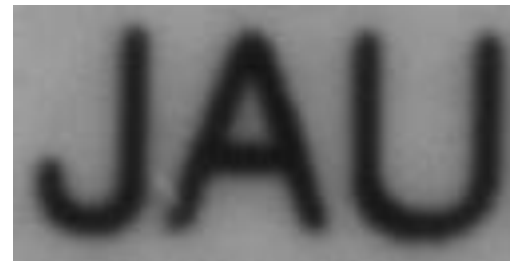


Clona ovlivňuje hloubku ostrosti

Clona zvyšuje difrakci



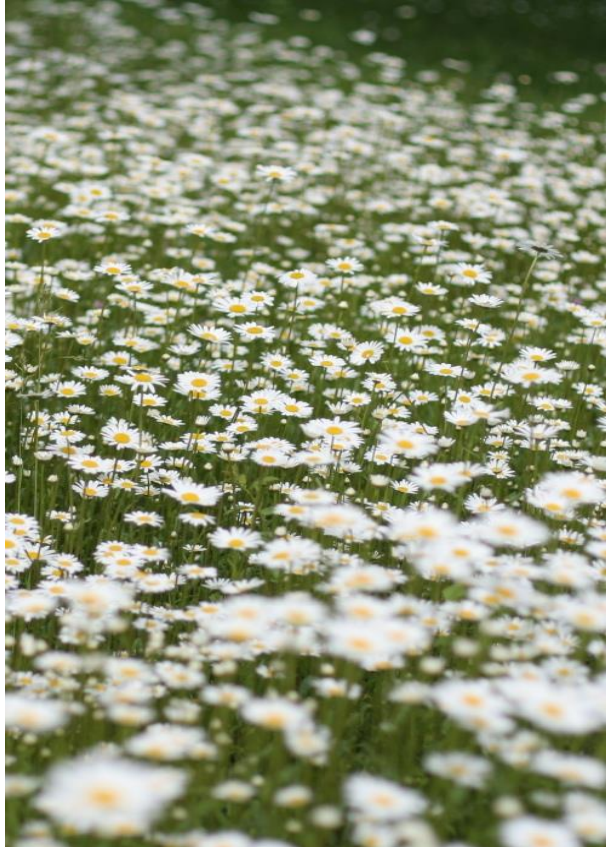
F8



F32

M0814-MP2, acA1300-30gm

Hloubka ostrosti



F 2



F 16

Ztmavení okrajů (shading)

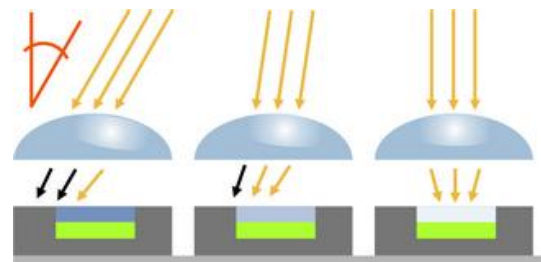


Nestejnorné osvětlení senzoru

Mikročocky

Nekvalitní objektiv

Příliš otevřená clona



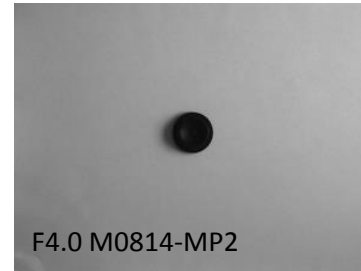
Ztmavení okrajů (shading)

Co pomůže:

Přivření clony

Anti-shading objektiv

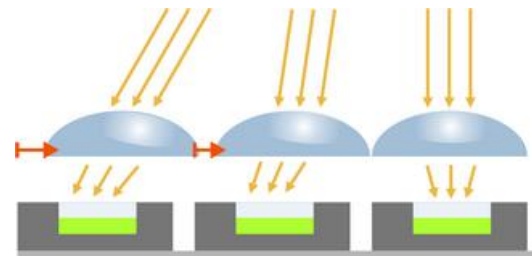
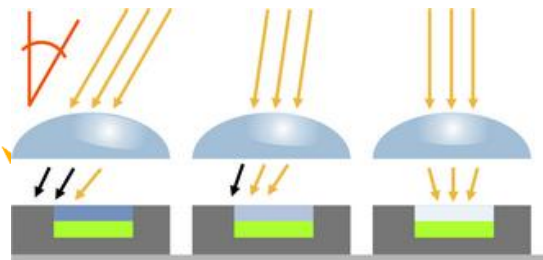
Korekce v kameře



APO-XENOPLAN 2.0/35 mm

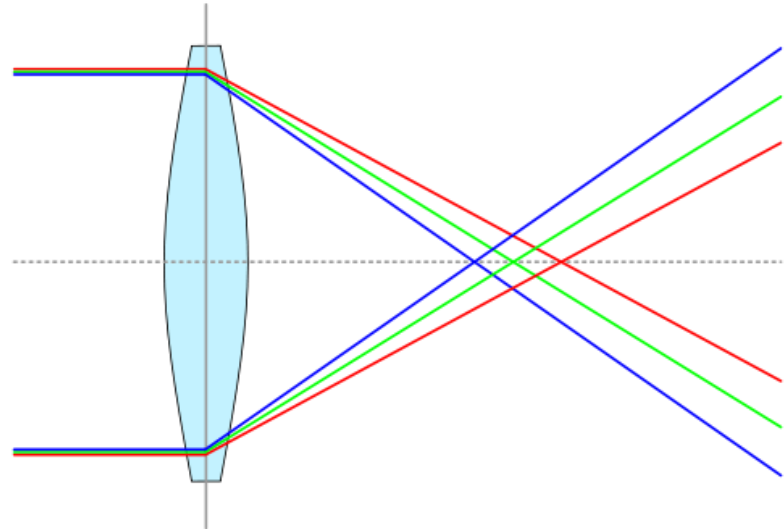
Senzor s korekcí úhlu dopadajícího světla

(pozor na telecentrické objektivy !!!)



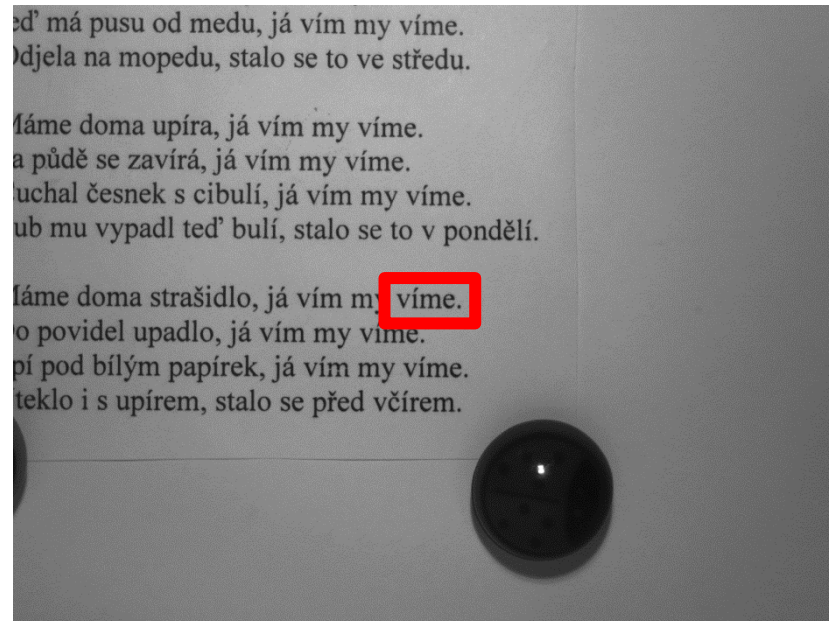
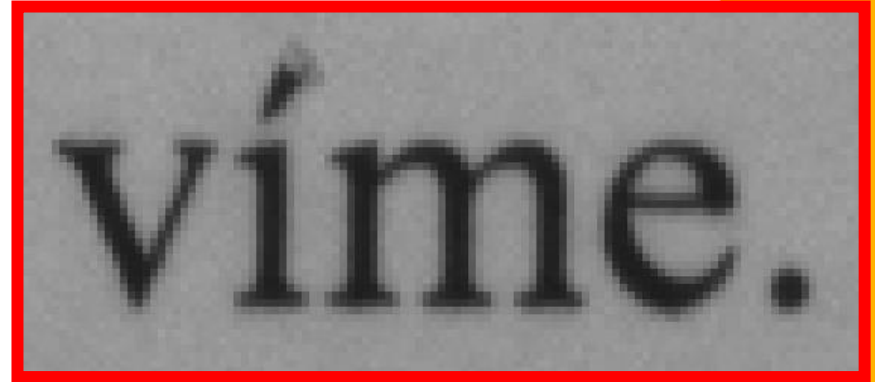
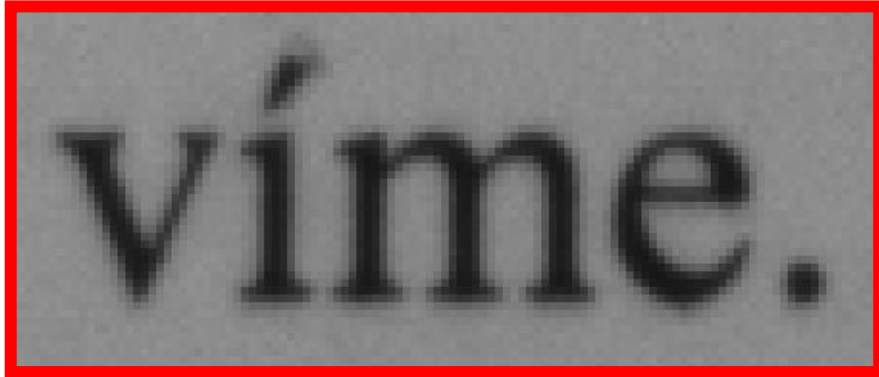
Například Basler acA2500-14gm

Světlo bílé nebo monochromatické?

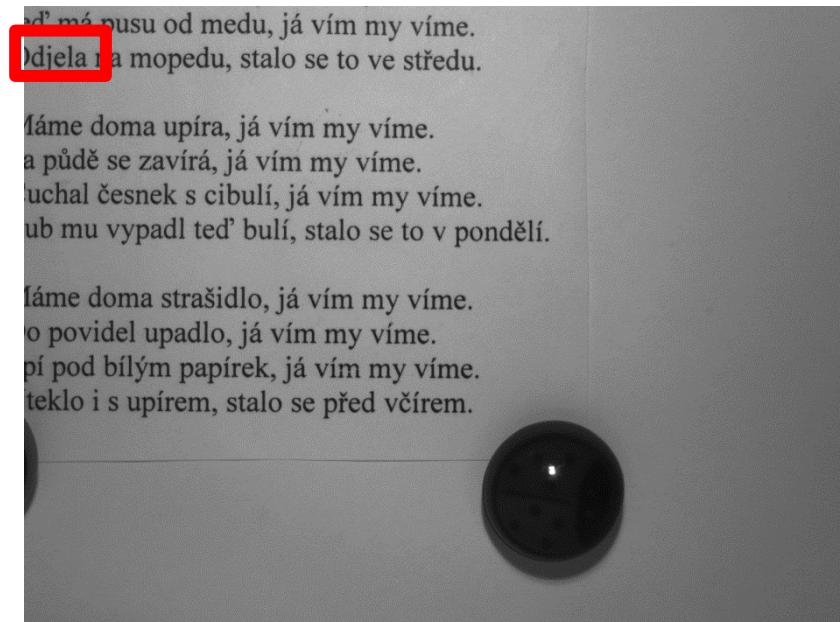
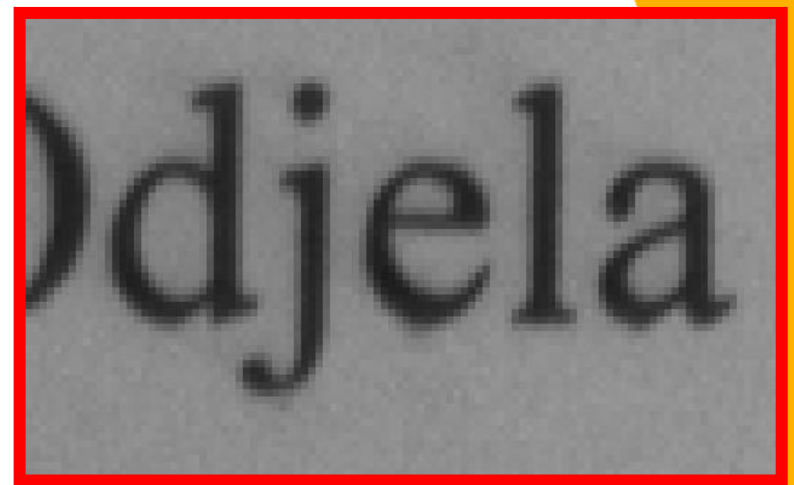
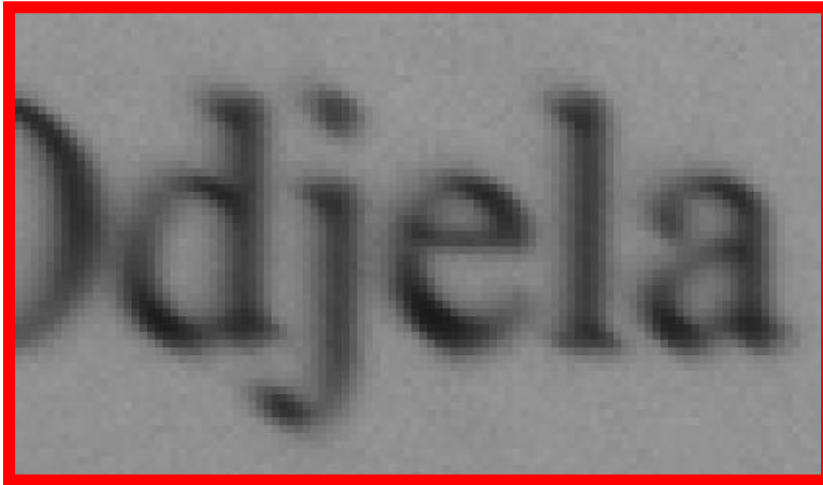


Barevná vada objektivu

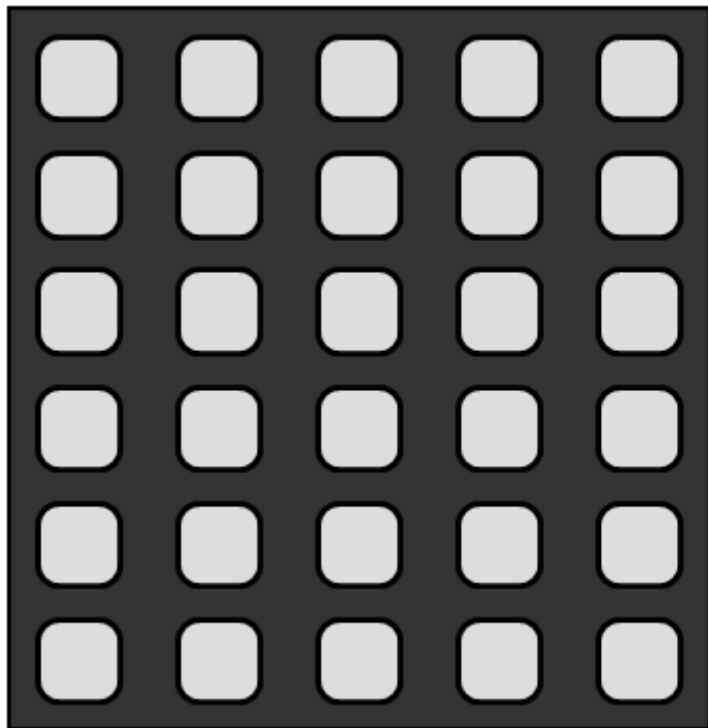
Světlo bílé nebo monochromatické?



Světlo bílé nebo monochromatické?



Barevný nebo černobílý CCD?

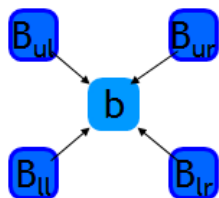
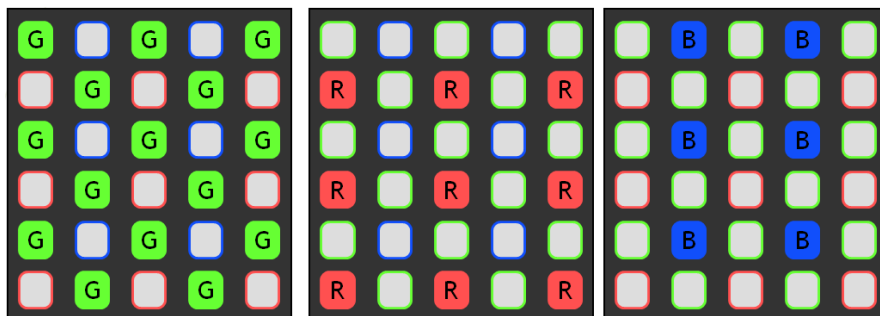


Monochrome

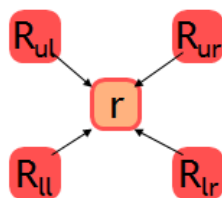


Bayer color

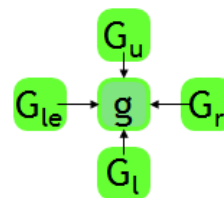
Barevný nebo černobílý?



$$b = 1/4(B_{ur} + B_{ul} + B_{ll} + B_{lr})$$



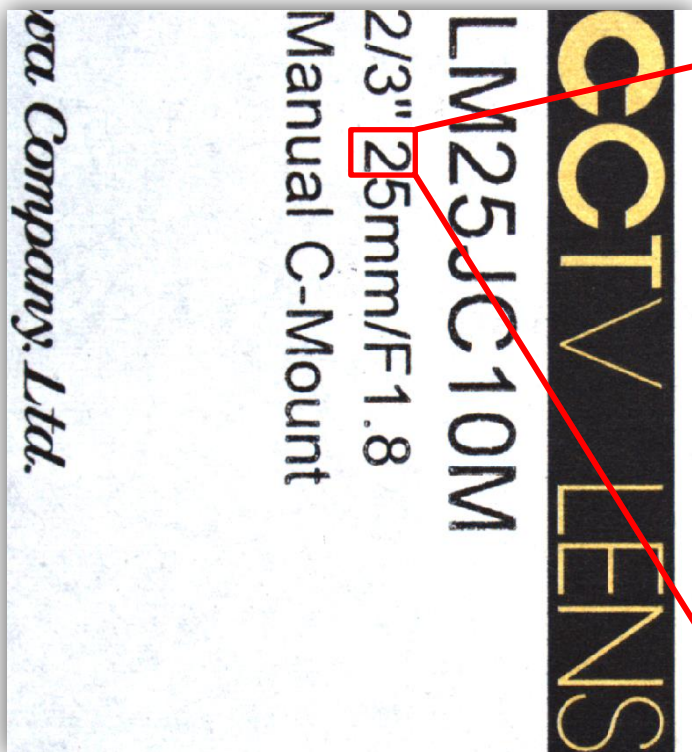
$$r = 1/4(R_{ur} + R_{ul} + R_{ll} + R_{lr})$$



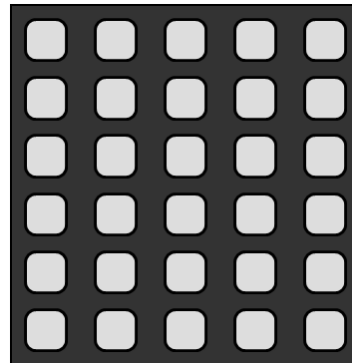
$$g = 1/4(G_u + G_r + G_l + G_{le})$$

Interpolace z Bayerovy masky na barevný obraz
Provádí se zpravidla v PC (cca 10% CPU)

Barevný nebo černobílý?



Barevný nebo černobílý?



Citlivost



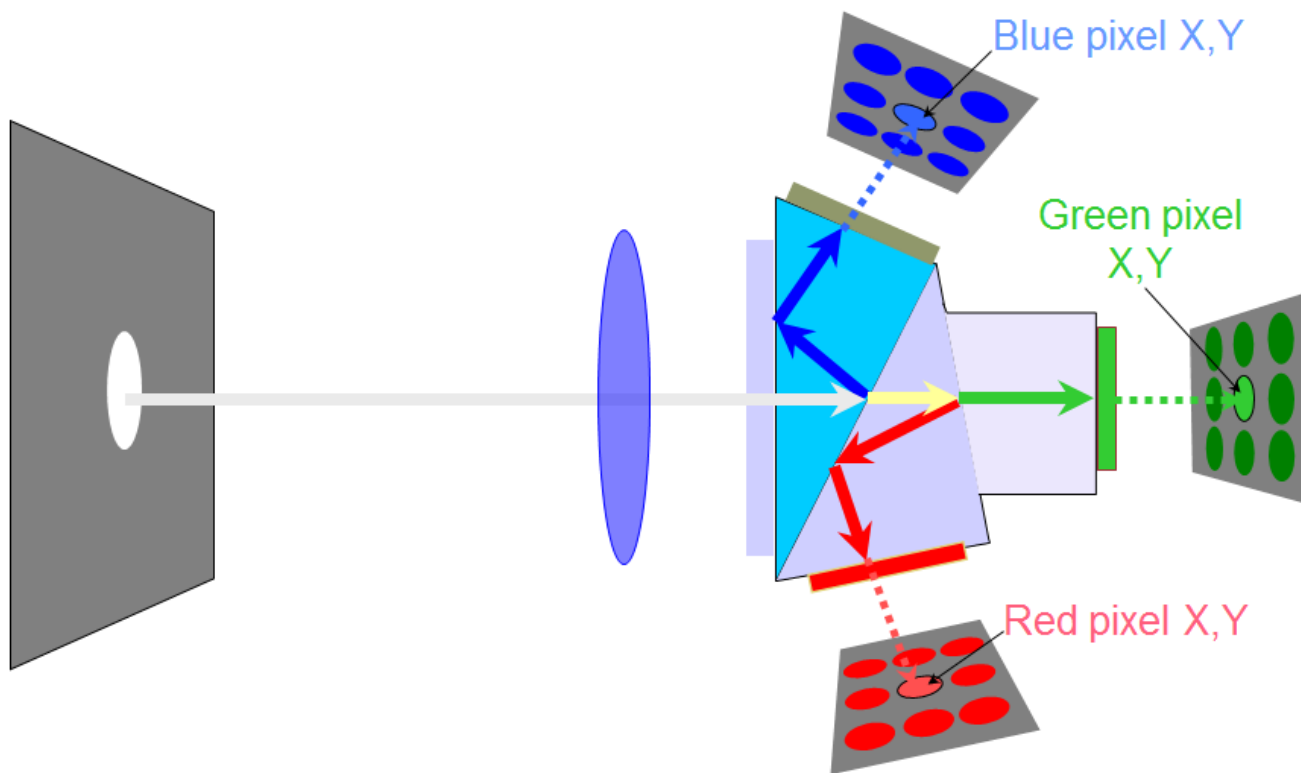
Přesnost zobrazení



Rozlišení

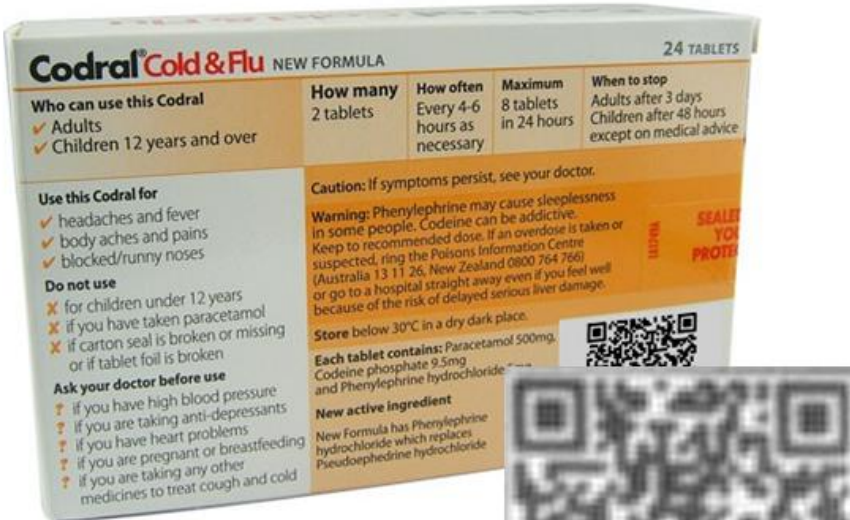


3CCD kamera

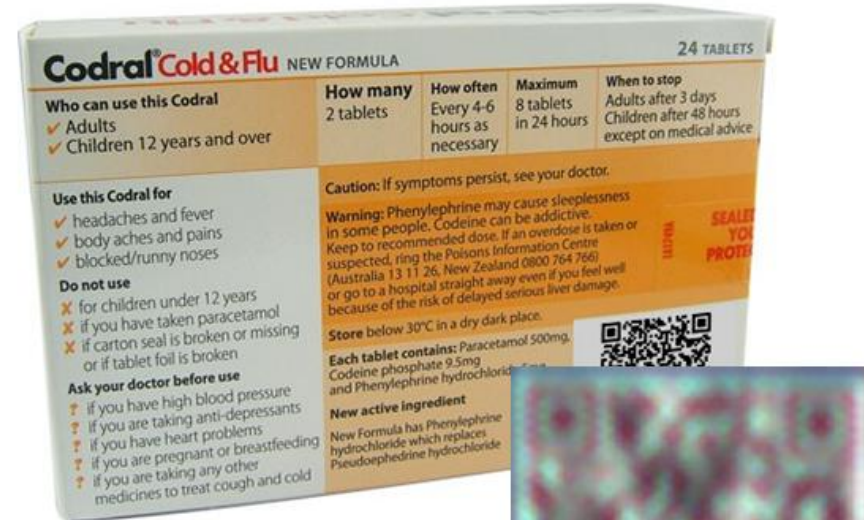


Princip 3CCD kamery

Bayer versus 3CCD



3CCD
2 MP



Bayer
2 MP

Bayer versus 3CCD



JAI AT-200GE (3CCD) 2 MP



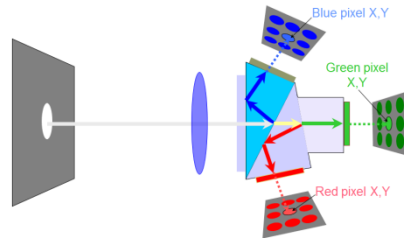
JAI BB-500GE (1CCD) 5 MP

Kvalitnější barvy

Přesnost zobrazení

Není třeba vysoké rozlišení

Barevný nebo černobílý?



Věrnost barev	<input checked="" type="radio"/>	<input type="radio"/>
Přesnost zobrazení	<input checked="" type="radio"/>	<input type="radio"/>
Rozlišení	<input checked="" type="radio"/>	<input type="radio"/>
Velikost kamery	<input type="radio"/>	<input checked="" type="radio"/>
Cena	<input type="radio"/>	<input checked="" type="radio"/>



HI-TECH
VISIONX
COMPONENTS

Děkuji za pozornost!

system
ATE

Ing. Tomáš Gřeš
kamery@visionx.cz
www.visionx.cz