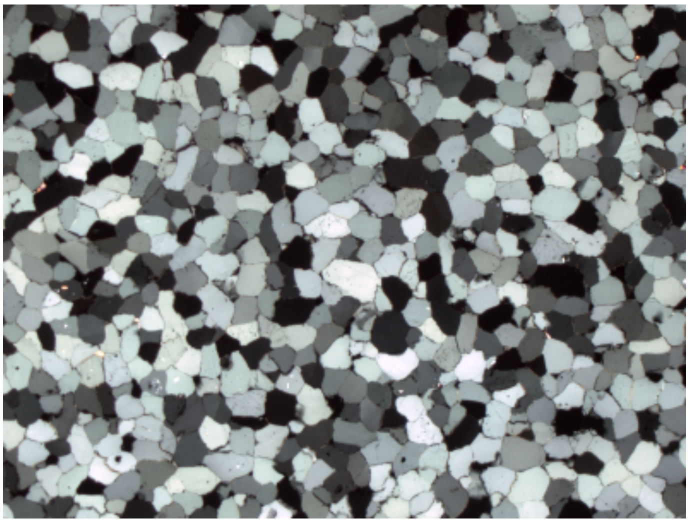
EX OCCIDENTE LUX

... probably ...

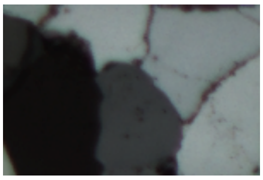
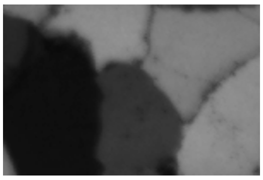
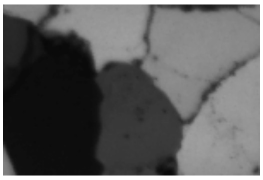
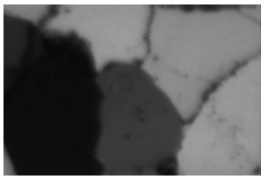
Doing CIP with a digital colour camera (such as the optronics microfire) has a few distinct disadvantages. Most importantly, the resolution is cut in two because the 1600·1200 pixel matrix records 800·600 color 'pixels' - one colour 'pixel' being a 2·2 Bayer array of G-B-R-G (2 green - one blue - one red).

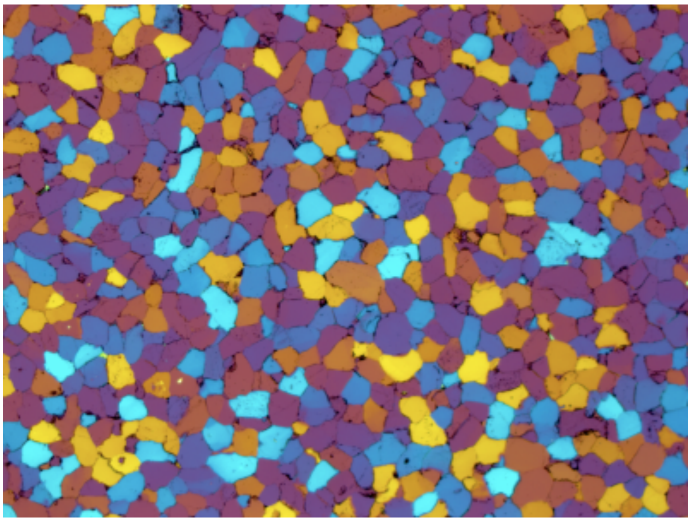
If the image is recorded (and stored) as colour image with the Picture Frame PF3 program (and good luck with that one), the red, green and blue channels are re-calculated and interpolated (by de-mosaicking). The results is NOT very satisfying, there is a bug in the program. If the program is recored and stored as monochrome, the result is the interpolated (numerically enlarged) 1600·1200 version of the recorded 800·600 version.

RECORDING IN COLOUR

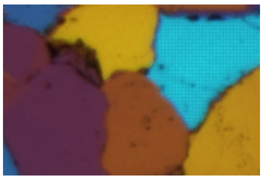
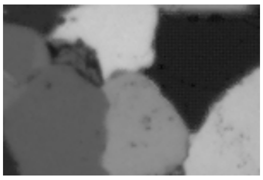
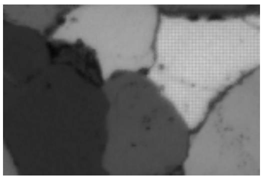


colour image of circular polarization (PF3) in white light
Image recorded on 2011-02-17- see folder 'camera wrestling subsite / 4a color bhq 12bit /':
Untitled-4.png cirpol 49.9 ms AUTOWB Red 2.22 1.31 (on wombat) 49.9 ms

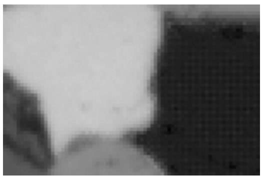
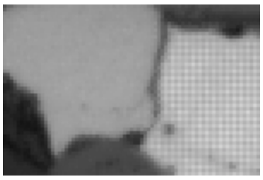
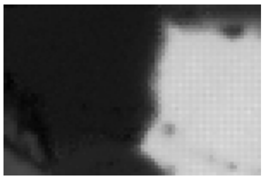
			
color ROI(150,0,150,100)	red channel	green channel	blue channel



colour image of crosspolarized & lambda plate (PF3)
Image recorded on 2011-02-17- see folder 'camera wrestling subsite / 4a color bhq 12bit /':
Untitled-11.png crosspol L Red 0.85 Blue 0.66 32.4 ms

color ROI(150,0,150,100) | red channel | green channel | blue channel

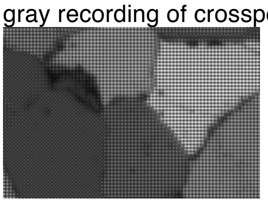
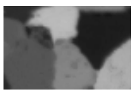
   

color (detail) | red channel | green channel | blue channel

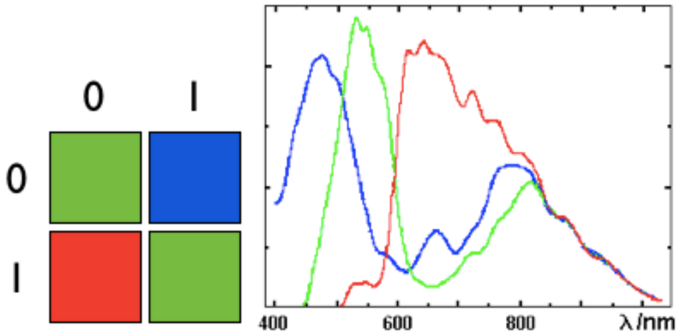
Note: kitchen towel artefact in blue and green channel

If the image is recorded with the grabber supplied with Image SXM, the individual pixels are recorded as grey values, two for green, one for blue one for red, thus producing four 'interleaved' images that can be separated by selecting an area of 1599·1199 with top left corners at (0,0), (1,0), (0,1) and (1,1). Collecting them in a stack and scaling (bilinear) to 0.5 yields 4 800·600 colour channels: two (almost identical ones) for Green, one for Blue and one for Red. Scaling these channels up to 1600·1200 again and superposing R-G-B (shifting R and B by 1 pixel up or left to achieve perfect overlap) yields a nice colour image.

gray recording of crosspolarized & lambda plate (SXM grab) ROI(150,0,150,100)

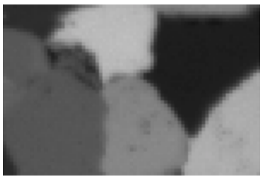
  G1  B  R  G2

Bayer grab ROI(150,0,150,100) | subimages (half size) - note: G1 ≠ G2 !!

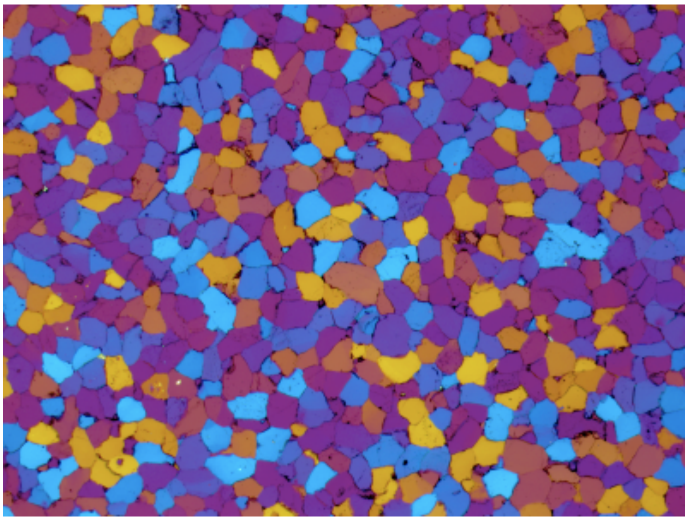



G1 subimage

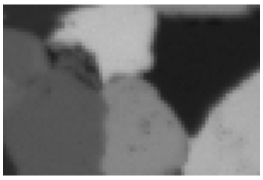

B subimage


R subimage


G1 subimage


3 channels = R - G1 - B subimages
Image recorded on 2011-02-17- see folder 'camera wrestling subsite / 4c color bhq SXM grab/':
GrabFile.013 U 512 V 128 gain 512 shutter 80 FULL


RGB NN 2x

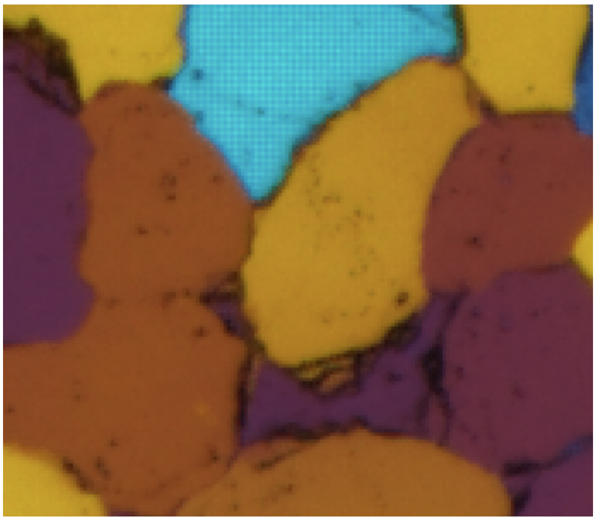

red channel


green channel

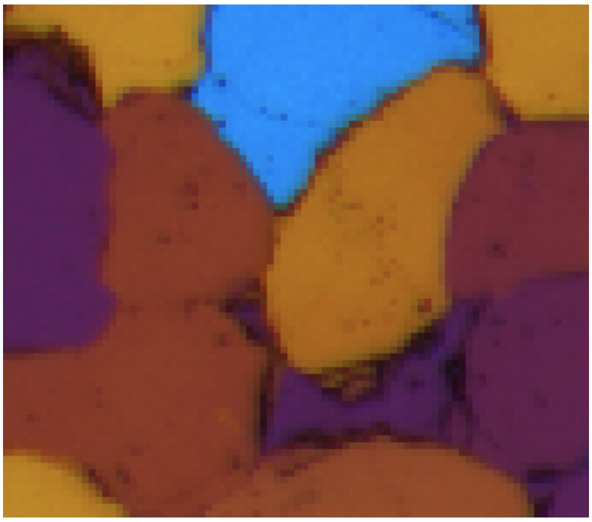

blue channel


RGB bicubic 2 x

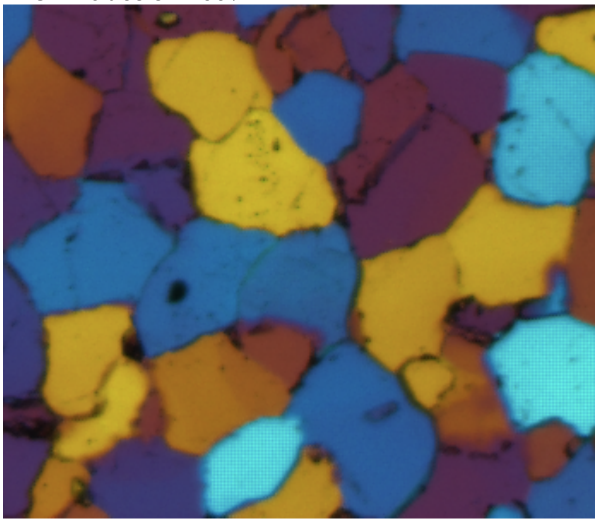
compare



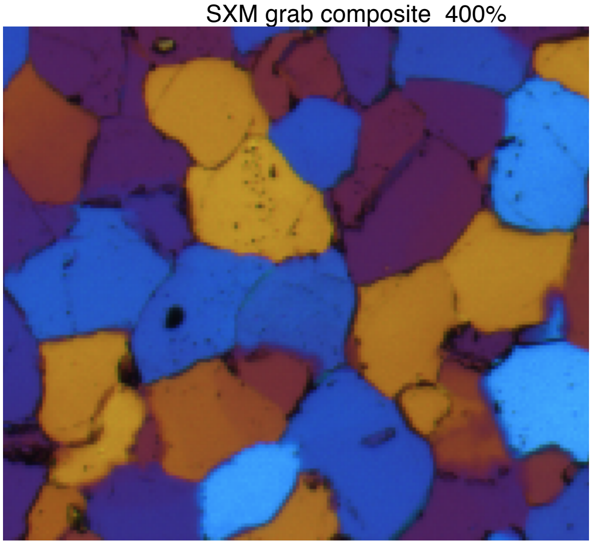
PF3 12 bit color 200%



SXM grab composite 400%



PF3 12 bit color 100%



SXM grab composite 200%

RECORDING MONO AT 660 nm

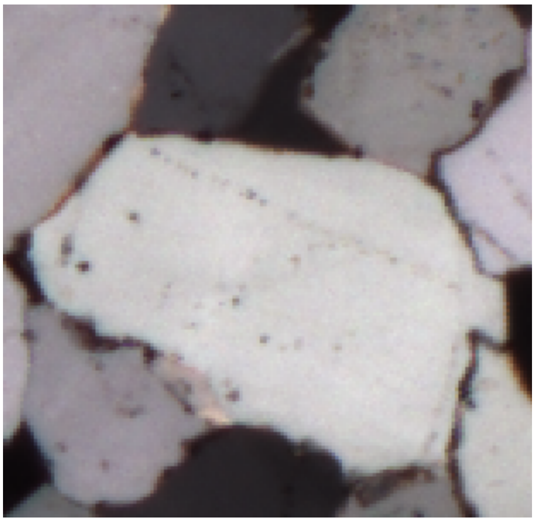
On account of the spectral transmission of the Bayer filter, only the red pixel can record at the 660 nm wavelength of the interference filter.

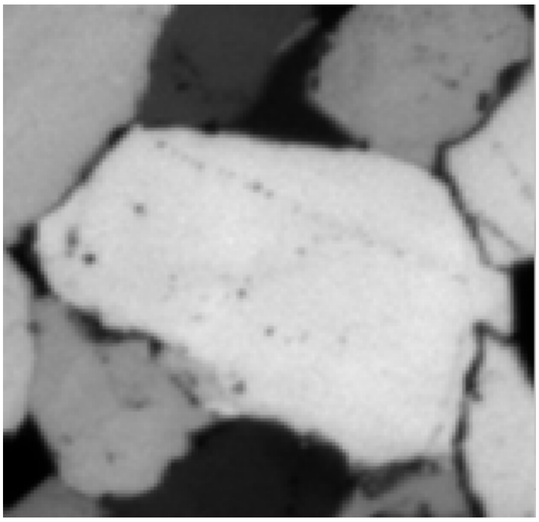
Transmission of RGB of Bayer filter of Kodak CCD used in optronics microfire camera. In other words, only 800·600 pixels (the R pixels of the Bayer pattern) receive any light. Whether this image is recorded as colour or mono in PF3 or as FULL FRAME size in Image SXM or as HALF FRAME in Image SXM returns exactly the same result: an interpolated 1600·1200 mono image or a true size 800·600 image.

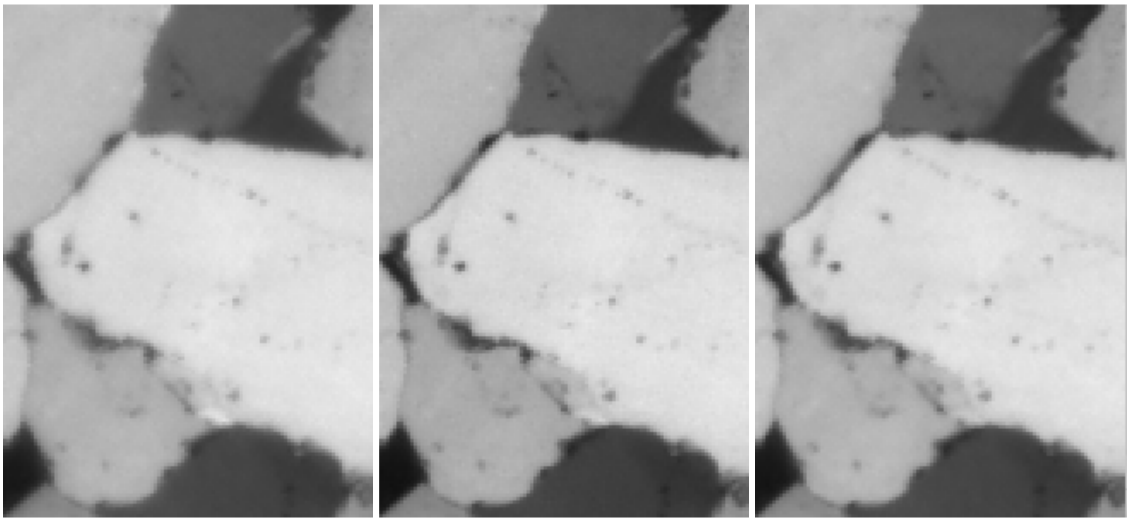
A very minimal chance was to test if the green pixels have at least some residual sensitivity at 660nm. If so, the intensity could be recorded at least at three pixels (out of four) and an almost complete gray scale image could be retrieved. However, recordings with maximum possible gains for the green component (setting U = 4095 and V = 128 in image SXM or Red = 0.02 and Blue = 8 in PF3) demonstrates that the green channels too noisy - and recalculating gray values from them would not add any significant information to the image recorded by the R pixels.

:-(

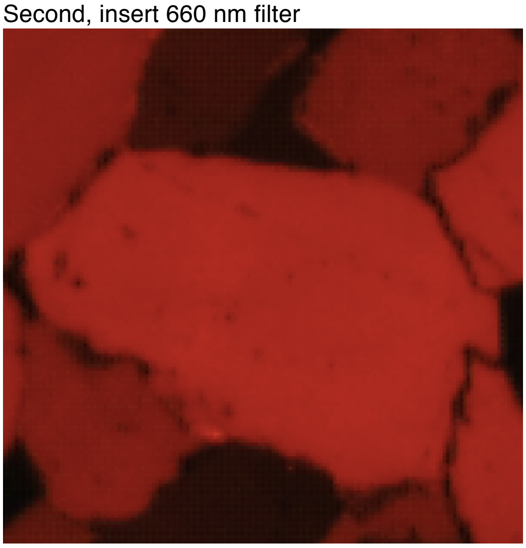
First, compare PF3 12 bit MONO and COLOR recording of cirpol image *which is essentially grey:

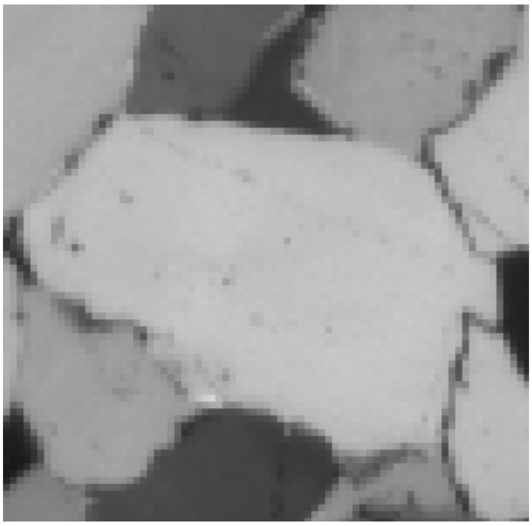

color r 1.13 b 1.40 8.838 ms

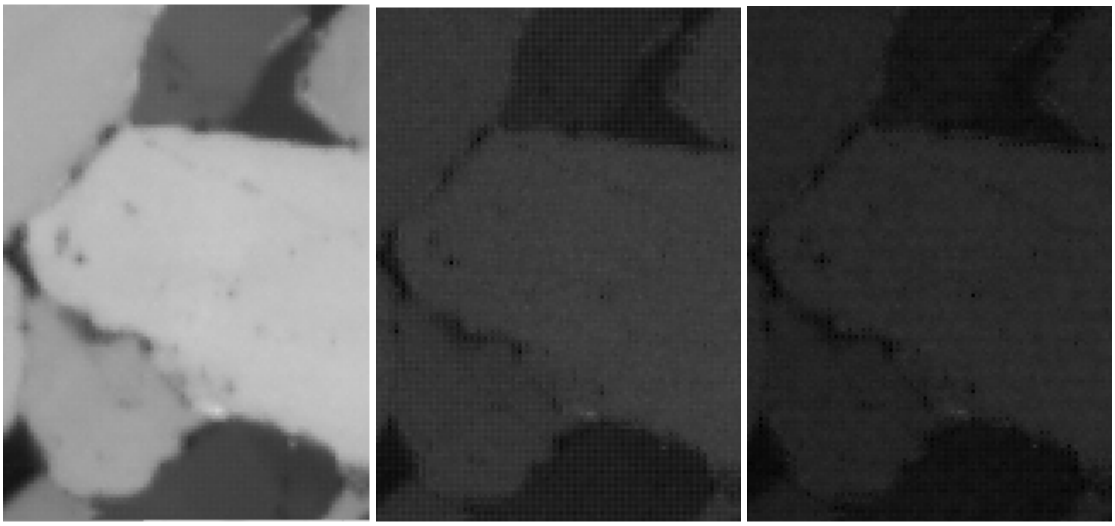

mono r 1.00 b 1.00 10.511 ms
Note: resolution is same as color ...


R - G - B of color

Second, insert 660 nm filter

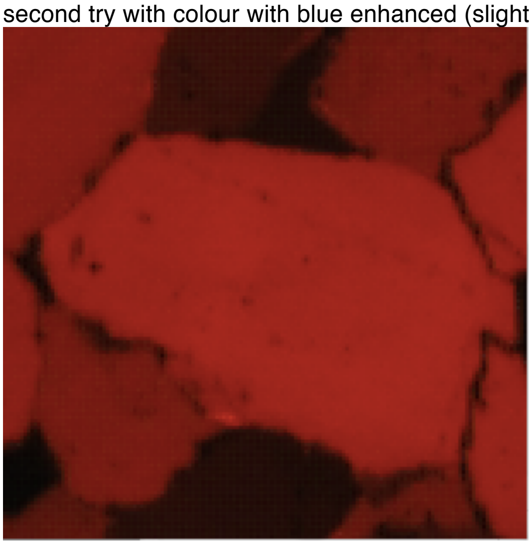

color r 0.02 b 2.04 70.708 ms


mono r 1.00 b 1.00 64.8 ms
Note: superpixels (2·2)

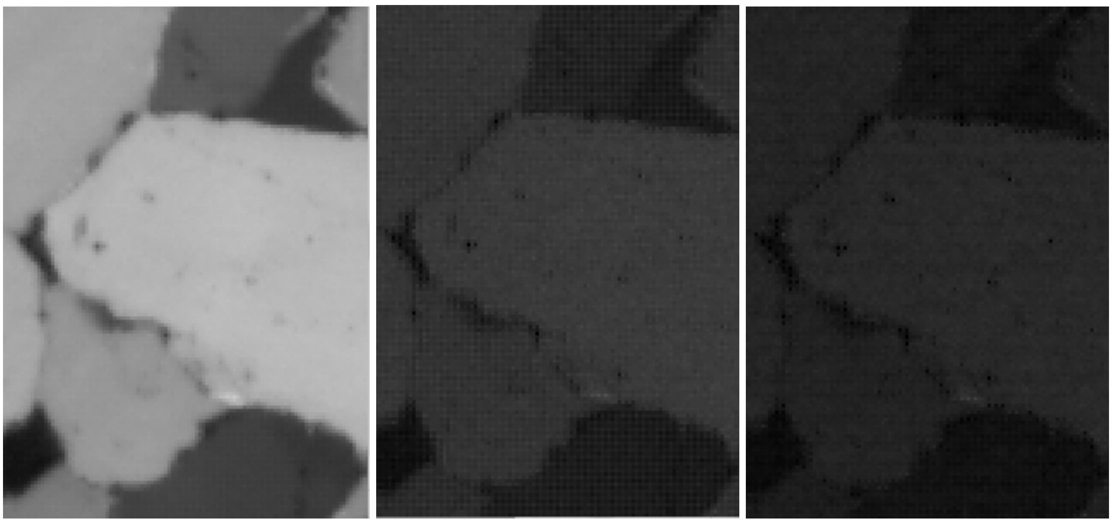


R - G - B of color

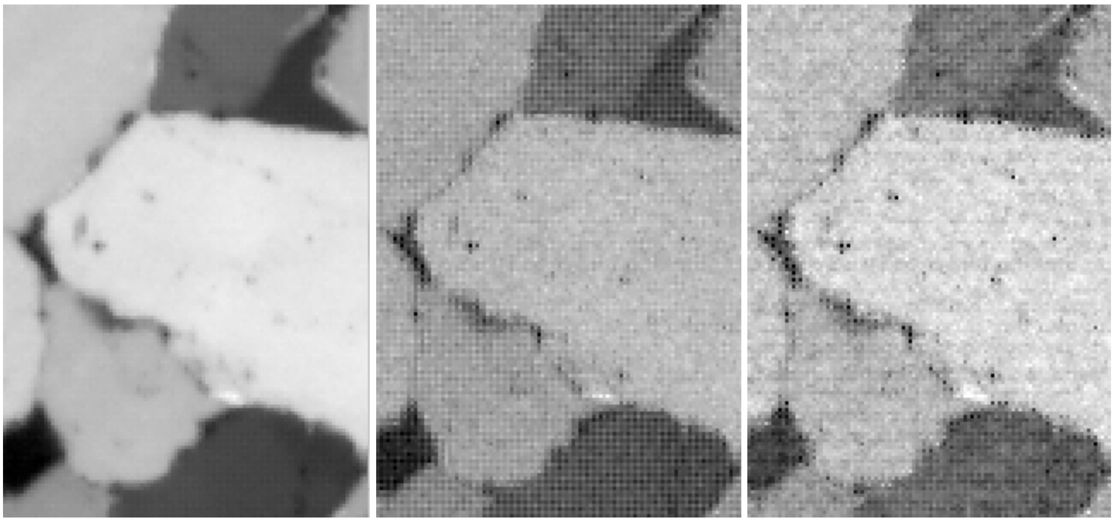
second try with colour with blue enhanced (slight improvement)



r 0.02 (only possible with AUTOWB - manually MIN= 0.60) b 8.00 manually   64.839 ms

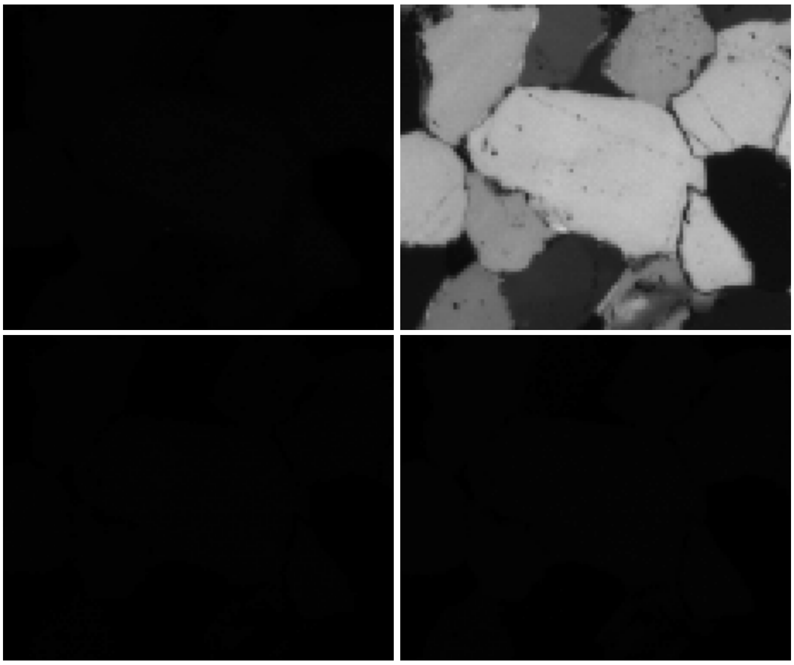


R - G - B channels   note: brighter G and B channels



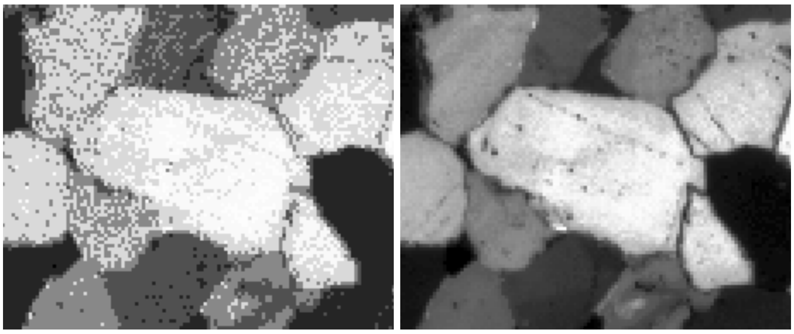
R - G - B channels (Auto-Level) note: very noisy

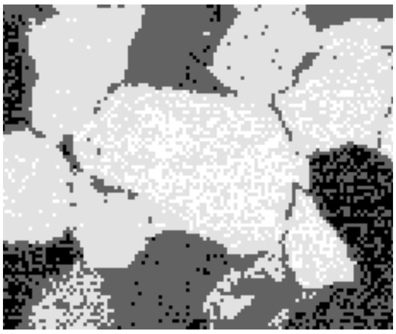
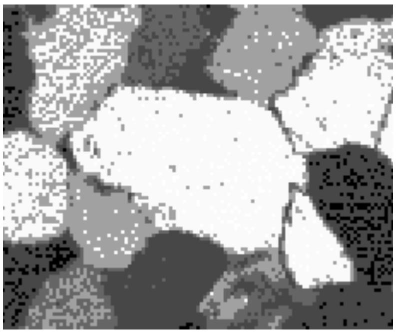
And this is what you get with Image SXM at FULL resolution



(0,0) (1,0)

(0,1) (1,1)



  all equalized

can use only R

SUMMARY

In other words, the options are:

(a) color 16 bit on Picture Frame - linear setting

use R channel - is 1600·1200 interpolated image (true resolution 800 · 600)

This is useful if you want to derive the primary INCP file (0 - 90°) in Photoshop. To do this is a good idea because the higher density resolution of 16-bit images. 16 bit intensity images produce a better angular resolution (especially at the critical upper and lower end) and Photoshop can handle 16-bit while Image SXM cannot (...yet). After converting the 16-bit.cirpol file to 16-bit.INCP, this file is converted to 8 bit.INCP (which still has a better populated histogram than the 8-bit.INCP created by CIP1A). The file is then saved in the CIP1A result folder replacing the 8-bit.INCP and used for further CIP calculations, CIP1B, CIP2, CIP4.

(b) color 8 bit on Picture Frame -

use R channel - a 1600·1200 interpolated image (true resolution 800 · 600)

This input is for standard CIP calculations, i.e., preparation in Image SXM (Lazy prepstack 2011) and calculation by CIP1A, CIP1B, CIP2, CIP4.

After matching and cropping the stack (Lazy prepstack 2011), the input should be reduced to 1/2 size (it makes no sense whatsoever to perform CIP calculations on numerically en-larged input). After CIP calculations, the images can be enlarged again.

The Lazy prepstack performs quite a number of calculations that could also be done within CIP: camera calibration, image flattening. The macro is something like a gradual transition between the combination of (Lazy stack / CIP) and PrinCIPia.

(c) mono 8 bit HALF frame on Image SXM

1 channel - true 800 · 600 image

This input may be scaled up (bilin) 2 times to duplicate exactly the R channel of PF3. It is for standard CIP calculations, i.e., preparation in Image SXm and calculation by CIP1A, CIP1B, CIP2, CIP4.

As with the 8-bit PF3 input, the should be reduced after matching and cropping and processed as 800·600.

Option(c) (using the Image SXM image grabber) may become very interesting as soon as the grabbing routine of Image SXM work smoothly.

And even more interesting, once Image SXM handles 16 bit.