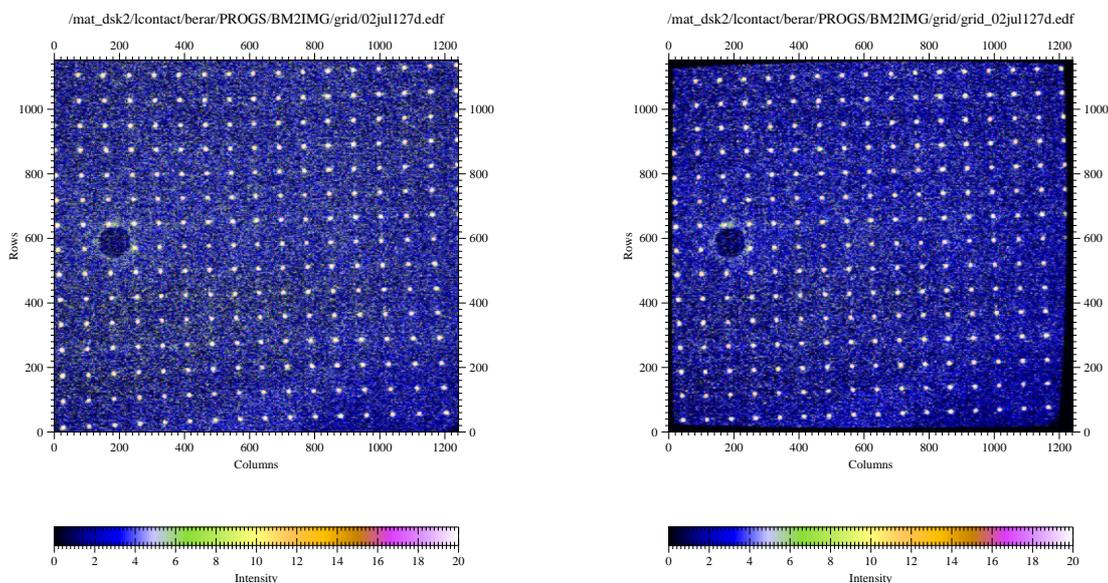


# Grid distortions on D2am CCD camera.

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SAXS users have noticed that distortions on D2am CCD camera were significant and lead to some troubles when data have been collected both at high and at low Q with separate settings. Using a copper grid etched by electronic board technics by Cyrile Rochas (LSP, Grenoble), these distortions have been characterised and a correction procedure deduced.

## Uncorrected grid image and corrected one.



### The distortions

As distortions seem very weak near the center, they have been expressed by a polynomial function using the center as origin :  $X = f(X - X_o) = f(x)$  The adjustment lead to a grid size of 74.9 pixels corresponding to  $40.1 \mu\text{m}/\text{pixel}$  in the horizontal direction.

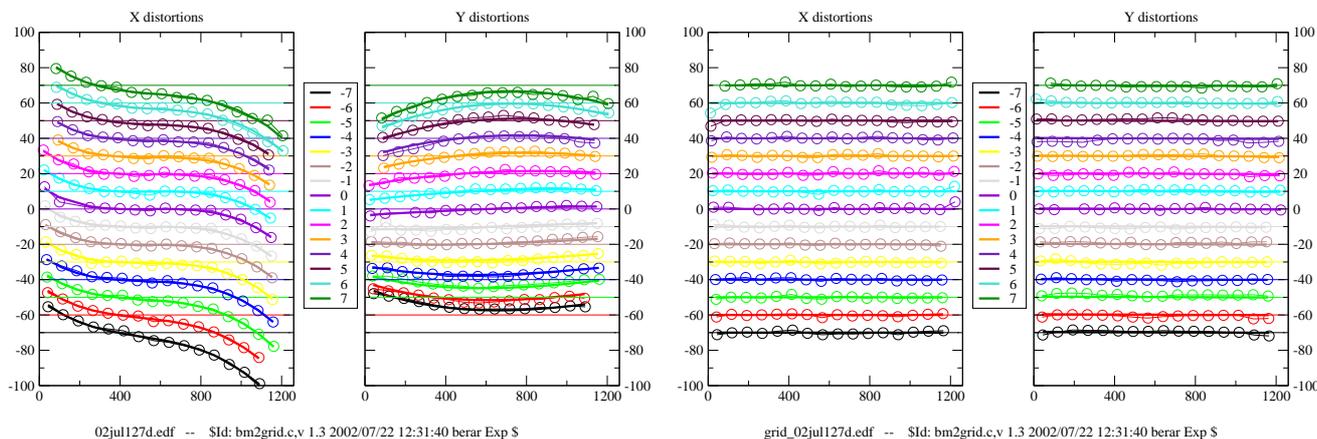
Following table contain the coefficients of X and Y expansions :

$$X = X_o + A_x x + A_y y + A_{x^2} x^2 + A_{xy} xy + A_{y^2} y^2 + \dots$$

axis	table scale factor on $A_{x^i y^j}$	$x^i y^j$						maximum shift in pixels
		$x^0 y^0$	$x^1 y^0$	$x^2 y^0$	$x^3 y^0$	$x^4 y^0$	$x^0 y^1$	
X	1	621						
	$10^3$	1000	0.00					0.0
	$10^5$	-1.84	0.44	-1.55				13.8
	$10^8$	-7.34	1.96	-5.40	-0.29			33.6
	$10^{11}$	1.33	0.07	-0.34	2.55	-0.546		5.31
Y	1	576						
	$10^3$	4.24	1003					4.4
	$10^5$	-0.24	0.31	2.63				10.8
	$10^8$	0.00	-5.05	0.02	-6.56			12.7
	$10^{11}$	-0.08	1.49	-1.43	1.57	-3.70		9.9

The  $A_{y^2}$  value, 1.003 shows that the lattice is nearly a perfect square. The last column indicate the maximum deviation from a square lattice associated with the coefficients of the row. As these rows are not independants, the maximum deviation is observed in X (bottom right) is near 30 pixels, in Y (botom left) near 24 pixels.

The 234 nodes found on the grid are then adjusted with a standard error of 1.1 pixels to be compared with an error of 8.9 pixels before correction. Following pictures show the distortions on each nodes and the remaining values after correction of the image.



## bm2grid procedure

The grid coefficients have been calculated using *bm2grid* associated with *bm2grid.ini* file which contains the following lines:

**GRID\_LEVEL=20** : minimum count on pixel used in grid nodes

**GRID\_COUNT=10** : minimum pixels number in grid nodes

**GRID\_ERROR=0.2** : tolerance around translation for nodes extraction

**GRID\_SIZE=3.00** : used only to convert pixel size in mm

**@GRID\_IMAGE=02jul127d.edf** : analyse the image *02jul127d.edf*, and run *xmgrace bm2grid.agr* on resulting data.

**@GRID\_PRINT=bm2grid.res** : print coefficients to *bm2grid.res* file

**@GRID\_INPUT=bm2grid.res** : read coefficients from *bm2grid.res* file

**@GRID\_CHECK=02jul127d.edf** : correct image *02jul127d.edf*, print corrected image in *grid\_bm2grid.res* and analyse it, and run *xmgrace bm2grid.agr* on resulting data.

## Use with bm2img

The lines from *bm2grid.res* can be added to *bm2img.ini*. The image is corrected after dark and flat if the tag *GRID=AUTO* exists. Without tag or in case *GRID=NONE* the user can request the grid correction using the *%G* command. These correction add a *g* in the output file name.