

2013-01-29 CSPad XPP alignment

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Optical measurement

Update

- 2013-06-11 Modify script `convertOpticalToStandard.py` for indexing of rotated CSPAD
- directly generated `center_global/0-end.data` constants
- deployed to `sxr65713`



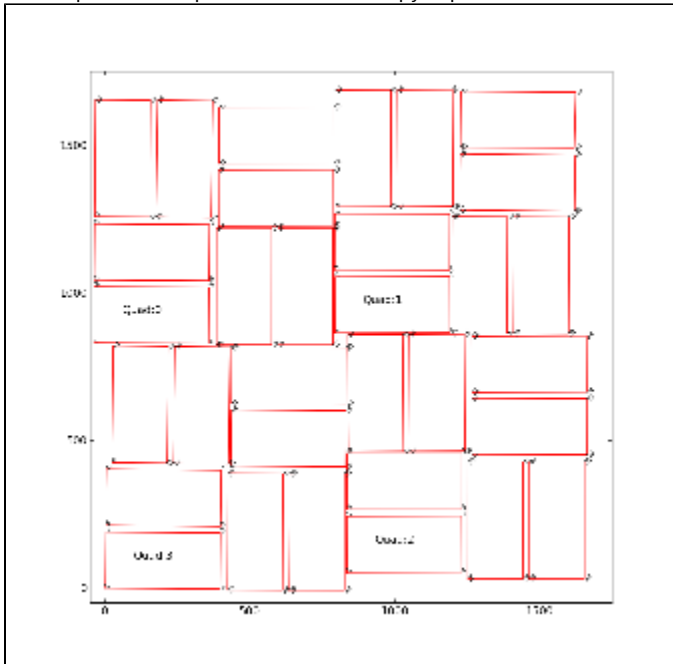
Note from Chris:

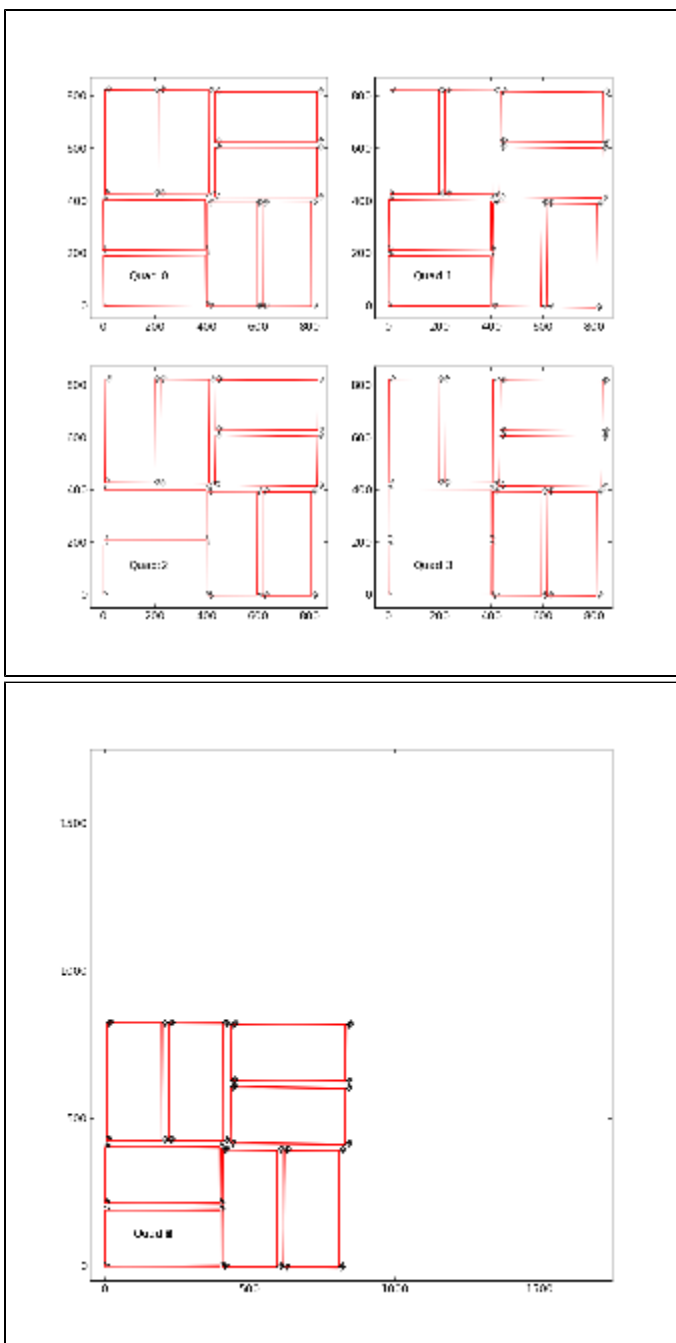
The new metrology file is attached. It has some unique characteristics.

- 1) all the positions are the same for 3 of the 4 quadrants
- 2) only the values for Quad 0 have changed.
- 3) this was done by aligning the entire detector to about 30 microRadians by hand.
- 4) This was checked by recording the positions of a few points on the other three quads
- 5) The slight rotation between last weeks and this weeks metrology can be taken out using these extra data points

Procedure

- [2013-01-29-CSPAD-Metrology-XPP.xlsx](#)- file from Chris Kenney
- [2013-01-29-CSPAD-XPP-Metrology.txt](#) - text version of the file. Only Quad 0 in this file is changed comparing to [2013-01-29-CSPAD-XPP-Metrology.txt](#)
- Use script `convertOpticalToStandard.py` to produce [2013-01-29-CSPAD-XPP-Metrology-standard.txt](#)





- Numeration of quads is still wrong by 180 degree... So, change the numeration in [2013-01-24-CSPAD-XPP-Metrology-standard.txt](#)
- Apply the same corrections of a couple of corners:

```

Q1, p3:
12  21331  47024      47 -> x+200, y-200
12  21531  46824      47

Q3, p5:
24  90849  68979     218 -> x+300, y-200
24  91149  68779     218

```

Or the same correction in [2013-01-29-CSPAD-XPP-Metrology.txt](#) (2013-01-29-CSPAD-XPP-Metrology-corr.txt):

```

Quad 1
< 24      177872      164109  218 -> x+300, y-200
> 24      178172      163909  218

Quad 3
< 31      90737 42743  37-> x+200, y-200
> 31      90937 42543  37

```

QC procedure and results

We calculate

S1 - 1st short side length of 2x1

S2 - 2nd short side length of 2x1

L1 - 1st long side length of 2x1

L2 - 2nd long side length of 2x1

D1 - 1st diagonal of 2x1 between corners 1 and 3

D2 - 2nd diagonal of 2x1 between corners 2 and 4

dS and dL are the deviations of the 1st and 2nd corner along the short and long sides, respectively. The sign of all dS are chosen in order to provide correct sign for the tilt angle (the same direction for all 2x1 sensors).

<dS/L> - the tilt angle of 2x1 averaged over two sides in radians.

angle(deg) - the same angle in degrees.

dD = D1 - D2

d(dS) = dS1 - dS2

d(dL) = dL1 - dL2

Quality check parameters for the perfect measurement:

- S1=S2, L1=L2 - the 2x1 sides should have equal length and width,
- D1=D2 - the 2x1 diagonals should be equal,
- dS1 = dS2 = 2*dL1 = 2*dL2 - tilt angle should provide consistent deviation for all corners,
- dD=0, d(dS)=0, and d(dL)=0 - within precision of measurement.

Everything, excluding <dS/L> and angle(deg), are in micrometers.

pair:	S1	S2	dS1	dS2	L1	L2	dL1	dL2	<dS/L>	angle(deg)	D1
D2	dD	d(dS)	d(dL)								
Quad 0											
pair: 0	20891	20913	200	222	43539	43541	-102	-100	0.00485	0.27766	48298
48297	1	-22	-2								
pair: 1	20910	20894	293	277	43540	43535	-127	-132	0.00655	0.37506	48302
48289	13	16	5								
pair: 2	20890	20906	99	83	43536	43536	42	42	0.00209	0.11976	48290
48293	-3	16	0								
pair: 3	20897	20895	131	133	43545	43543	65	63	0.00303	0.17369	48299
48297	2	-2	2								
pair: 4	20911	20896	-30	-45	43549	43547	17	15	-0.00086	-0.04934	48303
48306	-3	15	2								
pair: 5	20901	20898	10	7	43540	43544	-8	-4	0.00020	0.01119	48296
48299	-3	3	-4								
pair: 6	20904	20903	104	105	43536	43540	55	59	0.00240	0.13752	48302
48290	12	-1	-4								
pair: 7	20901	20901	-7	-7	43545	43543	-3	-5	-0.00016	-0.00921	48299
48301	-2	0	2								
Quad 1											
pair: 0	20913	20914	-343	-342	43540	43550	165	175	-0.00787	-0.45066	48313
48303	10	-1	-10								
pair: 1	20898	20901	-145	-142	43548	43551	62	65	-0.00330	-0.18880	48300
48309	-9	-3	-3								
pair: 2	20895	20903	-151	-159	43535	43532	-74	-77	-0.00356	-0.20400	48289
48291	-2	8	3								
pair: 3	20872	20909	-235	-272	43341	43354	-37	-24	-0.00585	-0.33507	48201
48036	165	37	-13								
pair: 4	20940	20904	-455	-491	43527	43554	214	241	-0.01086	-0.62242	48309
48309	0	36	-27								
pair: 5	20910	20903	-302	-309	43546	43546	145	145	-0.00702	-0.40196	48304
48307	-3	7	0								

pair: 6	20901	20919	-421	-439	43529	43539	-213	-203	-0.00988	-0.56593	48296
48298	-2	18	-10								
pair: 7	20907	20907	-452	-452	43548	43539	-201	-210	-0.01038	-0.59475	48315
48294	21	0	9								
Quad 2											
pair: 0	20914	20914	-25	-25	43536	43540	10	14	-0.00057	-0.03290	48300
48300	0	0	-4								
pair: 1	20901	20897	7	3	43546	43536	-1	-11	0.00011	0.00658	48293
48300	-7	4	10								
pair: 2	20899	20903	-256	-260	43533	43539	-127	-121	-0.00593	-0.33954	48293
48294	-1	4	-6								
pair: 3	20912	20904	-210	-202	43540	43547	-106	-99	-0.00473	-0.27106	48300
48306	-6	-8	-7								
pair: 4	20910	20903	-543	-550	43535	43536	261	262	-0.01255	-0.71923	48298
48299	-1	7	-1								
pair: 5	20904	20905	-241	-240	43538	43544	111	117	-0.00552	-0.31647	48298
48301	-3	-1	-6								
pair: 6	20903	20902	21	22	43539	43543	8	12	0.00049	0.02829	48298
48298	0	-1	-4								
pair: 7	20902	20903	82	81	43546	43547	35	36	0.00187	0.10723	48300
48306	-6	1	-1								
Quad 3											
pair: 0	20902	20898	-82	-86	43536	43543	30	37	-0.00193	-0.11054	48289
48302	-13	4	-7								
pair: 1	20900	20904	79	83	43548	43541	-35	-42	0.00186	0.10658	48301
48301	0	-4	7								
pair: 2	20912	20894	181	199	43536	43535	97	96	0.00436	0.25005	48298
48289	9	-18	1								
pair: 3	20912	20905	119	126	43539	43538	57	56	0.00281	0.16121	48296
48301	-5	-7	1								
pair: 4	20894	20912	-454	-436	43534	43545	212	223	-0.01022	-0.58560	48303
48296	7	-18	-11								
pair: 5	20906	20919	-336	-323	43527	43535	155	163	-0.00757	-0.43369	48295
48294	1	-13	-8								
pair: 6	20902	20905	-203	-206	43537	43525	-89	-101	-0.00470	-0.26916	48293
48287	6	3	12								
pair: 7	20900	20897	-140	-137	43539	43544	-68	-63	-0.00318	-0.18225	48298
48296	2	-3	-5								

- All measurements are consistent within measurement precision about 10um
- Angles of 2x1 are in the range from -0.59 to +0.25 degree.

Configuration parameters

✓ center_global/0-end.data (pixel)

477.78	690.20	159.77	160.06	277.17	64.77	591.30	591.01
990.78	989.30	1105.38	891.19	1421.65	1423.66	1502.28	1289.93
1143.85	932.00	1461.86	1463.74	1349.75	1562.62	1032.39	1033.60
633.06	632.80	518.88	731.75	200.62	198.75	118.50	331.23
1018.54	1019.42	1134.27	921.94	1451.06	1451.01	1532.55	1319.23
1173.24	960.71	1490.18	1491.45	1374.97	1587.78	1058.56	1061.14
658.23	658.54	542.73	755.26	225.91	224.22	146.39	358.27
507.44	720.59	189.73	190.28	306.25	93.65	620.68	619.85
1.00	1.04	0.64	1.14	0.05	-0.03	-0.18	0.45
0.92	1.37	0.26	-0.02	0.62	0.13	1.35	1.25
-2.10	-1.76	-3.00	-2.29	-3.85	-4.20	-3.63	-2.94
1.83	1.57	2.23	2.31	1.91	2.07	1.41	0.54

✓ center/0-end.data (pixel)

196.58	197.46	312.31	99.99	629.11	629.05	710.60	497.27
199.85	198.38	314.45	100.27	630.72	632.74	711.36	499.00
198.36	198.05	313.86	101.34	630.68	632.38	710.21	498.32
197.65	197.91	311.84	98.96	630.09	631.96	712.21	499.47
308.83	96.41	626.85	626.55	509.45	721.85	195.31	195.60
306.93	94.41	623.89	625.15	508.67	721.48	192.26	194.83
306.96	95.10	624.97	626.84	512.86	725.73	195.49	196.70
308.59	95.44	626.29	625.74	509.78	722.37	195.35	196.18
1.00	1.04	0.64	1.14	0.05	-0.03	-0.18	0.45
0.92	1.38	0.26	-0.01	0.62	0.13	1.35	1.25
-2.09	-1.76	-3.00	-2.29	-3.84	-4.20	-3.63	-2.94
1.83	1.58	2.23	2.32	1.92	2.07	1.42	0.54

✔ tilt/0-end.data (degree)

0.27766	0.37506	0.11976	0.17369	-0.04934	0.01119	0.13752	-0.00921
-0.45066	-0.18880	-0.20400	-0.33507	-0.62242	-0.40196	-0.56593	-0.59475
-0.03290	0.00658	-0.33954	-0.27106	-0.71923	-0.31647	0.02829	0.10723
-0.11054	0.10658	0.25005	0.16121	-0.58560	-0.43369	-0.26916	-0.18225

✔ offset/0-end.data

0	0	820	820
0	820	820	0
0	0	0	0

✔ offset_corr/0-end.data

0	0	-3	-1
0	-3	-3	-1
0	0	0	0

✔ marg_gap_shift/0-end.data

15	40	0	22
15	40	0	22
0	0	0	0

Quad origin coordinates

This info could be translated in marg_gap_shift and other corrections...



Interchange of quads is not accounted...

```

center x, y = 811.11 841.25
quad, x1, y1, dx, dy = 0    785.51    824.88    -25.61    -16.37
quad, x1, y1, dx, dy = 1    791.69    865.45    -19.42    24.19
quad, x1, y1, dx, dy = 2    835.79    859.52    24.67    18.26
quad, x1, y1, dx, dy = 3    831.48    815.17    20.36    -26.08

d1, d2 =    18.60    25.14

```

Test plot for CSPad using PyCSPadImage/src/Example 1

Images obtained using direct **center_global** and combination of alignment parameters for quads:

