

# 2014-09-24 CSPAD Camera1 Alignment

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## Optical measurements

Comments from Gabriel Blaj:

These replace the May 2014 versions and should be used for all experiments after September 24, 2014.

Changes in CXI-DS1:

- Quad 3 (zero based counting) reworked; metrology updated in the attached file: "DS1-Metrology-Sept-24-2014"
- Q3 Z values measured properly
- Mikhail, please double check Q3 values for consistency
- The other 3 quads (Q0, Q1, Q2) are unchanged (as in the previous metrology: May 15 2014).
- Please note that this camera has been renamed. Possible new name: "CXI Camera 1"+ version number. Jason, could you please confirm the exact name and version.

As always, these excel metrology files are NOT FOR DISTRIBUTION to avoid user confusion. Only Mikhail's curated version should be distributed and used.

Based on this comment the file 2014-05-15-CSPAD-CXI-DS1-Metrology-corr.txt is used and Quad 3 data is substituted.

Metrology files:

- [2014-09-24-CXI-DS1-Metrology.xlsx](#) - non-corrected data
- [2014-09-24-CSPAD-CXI-DS1-Metrology.txt](#) - non-corrected data
- [2014-09-24-CSPAD-CXI-DS1-Metrology-corr.txt](#) - corrected data

## Quality check in X-Y plane

First iteration for quad 3:

| segm:   | S1     | S2     | dS1  | dS2  | L1     | L2     | dL1 | dL2 | angle(deg) | D1    | D2    | dD | d |
|---------|--------|--------|------|------|--------|--------|-----|-----|------------|-------|-------|----|---|
| (dS)    | d(dL)  |        |      |      |        |        |     |     |            |       |       |    |   |
| Quad 3  |        |        |      |      |        |        |     |     |            |       |       |    |   |
| segm: 0 | -20908 | -20908 | -38  | -38  | 43543  | 43544  | -18 | -17 | -0.05000   | 48303 | 48302 |    |   |
| 1       | 0      | -1     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 1 | -20907 | -20908 | -61  | -62  | 43547  | 43547  | -30 | -30 | -0.08092   | 48305 | 48306 |    |   |
| -1      | 1      | 0      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 2 | -20914 | -20914 | 160  | 160  | -43547 | -43550 | -78 | -81 | 0.21051    | 48312 | 48308 |    |   |
| 4       | 0      | 3      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 3 | -20918 | -20734 | -258 | -74  | -43569 | -43546 | 39  | 62  | -0.21836   | 48306 | 48254 | 52 |   |
| -184    | -23    |        |      |      |        |        |     |     |            |       |       |    |   |
| segm: 4 | 20939  | 20910  | -45  | -74  | -43545 | -43546 | -35 | -36 | 0.07829    | 48318 | 48305 |    |   |
| 13      | 29     | 1      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 5 | 20933  | 20915  | -125 | -143 | -43566 | -43551 | -65 | -50 | 0.17626    | 48317 | 48329 |    |   |
| -12     | 18     | -15    |      |      |        |        |     |     |            |       |       |    |   |
| segm: 6 | -20927 | -20930 | -51  | -54  | -43548 | -43544 | 20  | 24  | -0.06908   | 48317 | 48311 |    |   |
| 6       | 3      | -4     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 7 | -20933 | -20928 | -67  | -62  | -43552 | -43546 | 37  | 43  | -0.08486   | 48309 | 48325 |    |   |
| -16     | -5     | -6     |      |      |        |        |     |     |            |       |       |    |   |

shows about 180um displacement of one point in segment 3. To fix it the point 12 data is changed

|       |        |       |       |    |
|-------|--------|-------|-------|----|
|       | Quad 3 |       |       |    |
|       | Point  | X     | Y     | Z  |
| From: | 12     | 21207 | 46580 | 25 |
| To:   | 12     | 21391 | 46603 | 25 |

Corrected file gives good quality table:

| Quality check in XY plane: |        |        |      |      |        |        |     |     |            |       |       |    |   |
|----------------------------|--------|--------|------|------|--------|--------|-----|-----|------------|-------|-------|----|---|
| segm:                      | S1     | S2     | dS1  | dS2  | L1     | L2     | dL1 | dL2 | angle(deg) | D1    | D2    | dD | d |
| (dS)                       | d(dL)  |        |      |      |        |        |     |     |            |       |       |    |   |
| Quad 0                     |        |        |      |      |        |        |     |     |            |       |       |    |   |
| segm: 0                    | -20913 | -20911 | 33   | 35   | 43545  | 43542  | 17  | 14  | 0.04474    | 48304 | 48305 |    |   |
| -1                         | -2     | 3      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 1                    | -20907 | -20911 | 10   | 6    | 43547  | 43544  | 6   | 3   | 0.01053    | 48305 | 48304 |    |   |
| 1                          | 4      | 3      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 2                    | -20908 | -20907 | -13  | -12  | -43545 | -43543 | 2   | 4   | -0.01645   | 48306 | 48300 |    |   |
| 6                          | -1     | -2     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 3                    | -20915 | -20914 | -22  | -21  | -43561 | -43552 | 10  | 19  | -0.02828   | 48313 | 48321 |    |   |
| -8                         | -1     | -9     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 4                    | 20909  | 20909  | 39   | 39   | -43597 | -43545 | -29 | 23  | -0.05128   | 48347 | 48308 |    |   |
| 39                         | 0      | -52    |      |      |        |        |     |     |            |       |       |    |   |
| segm: 5                    | 20898  | 20904  | 24   | 30   | -43557 | -43544 | 10  | 23  | -0.03552   | 48303 | 48309 |    |   |
| -6                         | -6     | -13    |      |      |        |        |     |     |            |       |       |    |   |
| segm: 6                    | -20934 | -20934 | -256 | -256 | -43580 | -43578 | 125 | 127 | -0.33657   | 48344 | 48349 |    |   |
| -5                         | 0      | -2     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 7                    | -20942 | -20912 | -63  | -33  | -43548 | -43550 | 25  | 23  | -0.06315   | 48315 | 48317 |    |   |
| -2                         | -30    | 2      |      |      |        |        |     |     |            |       |       |    |   |
| Quad 1                     |        |        |      |      |        |        |     |     |            |       |       |    |   |
| segm: 0                    | -20906 | -20905 | 67   | 68   | 43541  | 43535  | 34  | 28  | 0.08883    | 48295 | 48298 |    |   |
| -3                         | -1     | 6      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 1                    | -20904 | -20902 | -12  | -10  | 43537  | 43543  | -6  | 0   | -0.01448   | 48299 | 48295 |    |   |
| 4                          | -2     | -6     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 2                    | -20900 | -20907 | 24   | 17   | -43537 | -43538 | -10 | -11 | 0.02698    | 48296 | 48295 |    |   |
| 1                          | 7      | 1      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 3                    | -20903 | -20902 | 30   | 31   | -43537 | -43539 | -13 | -15 | 0.04014    | 48295 | 48296 |    |   |
| -1                         | -1     | 2      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 4                    | 20907  | 20906  | 1    | 0    | -43545 | -43545 | -1  | -1  | -0.00066   | 48304 | 48302 |    |   |
| 2                          | 1      | 0      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 5                    | 20909  | 20909  | -52  | -52  | -43542 | -43542 | -27 | -27 | 0.06843    | 48304 | 48300 |    |   |
| 4                          | 0      | 0      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 6                    | -20907 | -20907 | 45   | 45   | -43577 | -43542 | -21 | 14  | 0.05919    | 48300 | 48333 |    |   |
| -33                        | 0      | -35    |      |      |        |        |     |     |            |       |       |    |   |
| segm: 7                    | -20906 | -20908 | 59   | 57   | -43543 | -43541 | -29 | -27 | 0.07632    | 48301 | 48301 |    |   |
| 0                          | 2      | -2     |      |      |        |        |     |     |            |       |       |    |   |
| Quad 2                     |        |        |      |      |        |        |     |     |            |       |       |    |   |
| segm: 0                    | -20902 | -20908 | -43  | -49  | 43542  | 43546  | -26 | -22 | -0.06053   | 48300 | 48303 |    |   |
| -3                         | 6      | -4     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 1                    | -20906 | -20906 | 77   | 77   | 43546  | 43544  | 40  | 38  | 0.10132    | 48305 | 48301 |    |   |
| 4                          | 0      | 2      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 2                    | -20867 | -20916 | 78   | 29   | -43608 | -43528 | -74 | 6   | 0.07036    | 48325 | 48310 |    |   |
| 15                         | 49     | -80    |      |      |        |        |     |     |            |       |       |    |   |
| segm: 3                    | -20917 | -20909 | 1    | 9    | -43544 | -43546 | -5  | -7  | 0.00658    | 48309 | 48303 |    |   |
| 6                          | -8     | 2      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 4                    | 20921  | 20911  | -131 | -141 | -43544 | -43547 | -60 | -63 | 0.17894    | 48305 | 48311 |    |   |
| -6                         | 10     | 3      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 5                    | 20935  | 20901  | -74  | -108 | -43553 | -43547 | -47 | -41 | 0.11972    | 48313 | 48313 |    |   |
| 0                          | 34     | -6     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 6                    | -20924 | -20918 | -24  | -18  | -43570 | -43543 | -12 | 15  | -0.02762   | 48328 | 48312 |    |   |
| 16                         | -6     | -27    |      |      |        |        |     |     |            |       |       |    |   |
| segm: 7                    | -20918 | -20896 | 8    | 30   | -43548 | -43586 | 45  | 7   | 0.02499    | 48292 | 48355 |    |   |
| -63                        | -22    | 38     |      |      |        |        |     |     |            |       |       |    |   |
| Quad 3                     |        |        |      |      |        |        |     |     |            |       |       |    |   |
| segm: 0                    | -20908 | -20908 | -38  | -38  | 43543  | 43544  | -18 | -17 | -0.05000   | 48303 | 48302 |    |   |
| 1                          | 0      | -1     |      |      |        |        |     |     |            |       |       |    |   |
| segm: 1                    | -20907 | -20908 | -61  | -62  | 43547  | 43547  | -30 | -30 | -0.08092   | 48305 | 48306 |    |   |
| -1                         | 1      | 0      |      |      |        |        |     |     |            |       |       |    |   |
| segm: 2                    | -20914 | -20914 | 160  | 160  | -43547 | -43550 | -78 | -81 | 0.21051    | 48312 | 48308 |    |   |
| 4                          | 0      | 3      |      |      |        |        |     |     |            |       |       |    |   |

## Quality check in Z

|          |          |         |       |       |     |     |     |     |     |     |     |     |     |     |
|----------|----------|---------|-------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0.00000  | 0.00000  | 0.000   |       |       |     |     |     |     |     |     |     |     |     |     |
| Quad 3   |          |         |       |       |     |     |     |     |     |     |     |     |     |     |
| segm: 0  | -20908   | 43543   | 43543 | 20908 | -98 | 0   | -89 | 9   | -49 | -40 | -98 | -98 | -40 | -49 |
| -0.05263 | -0.13428 | 97.999  |       |       |     |     |     |     |     |     |     |     |     |     |
| segm: 1  | -20907   | 43547   | 43547 | 20907 | -18 | -29 | 30  | 19  | -23 | 24  | 11  | 11  | 24  | -23 |
| 0.03158  | -0.06303 | -10.999 |       |       |     |     |     |     |     |     |     |     |     |     |
| segm: 2  | -20914   | -43548  | 20914 | 43548 | 34  | -1  | 44  | 9   | 16  | 26  | 35  | 35  | 16  | 26  |
| 0.04383  | 0.03421  | 35.001  |       |       |     |     |     |     |     |     |     |     |     |     |
| segm: 3  | -20918   | -43546  | 20918 | 43546 | -13 | -1  | 23  | 35  | -7  | 29  | -12 | -12 | -7  | 29  |
| -0.01917 | 0.03816  | -12.000 |       |       |     |     |     |     |     |     |     |     |     |     |
| segm: 4  | 20924    | -43545  | 43545 | 20924 | -4  | 0   | 7   | 11  | -2  | 9   | -4  | -4  | 9   | -2  |
| 0.01184  | -0.00548 | 4.000   |       |       |     |     |     |     |     |     |     |     |     |     |
| segm: 5  | 20924    | -43558  | 43558 | 20924 | -12 | -13 | 19  | 18  | -12 | 18  | 1   | 1   | 18  | -12 |
| 0.02368  | -0.03286 | -1.005  |       |       |     |     |     |     |     |     |     |     |     |     |
| segm: 6  | -20928   | -43546  | 20928 | 43546 | 50  | 24  | -47 | -73 | 37  | -60 | 26  | 26  | 37  | -60 |
| 0.10130  | -0.07895 | 26.010  |       |       |     |     |     |     |     |     |     |     |     |     |
| segm: 7  | -20930   | -43549  | 20930 | 43549 | -33 | 34  | -76 | -9  | 0   | -42 | -67 | -67 | 0   | -42 |
| 0.00000  | -0.05526 | -67.007 |       |       |     |     |     |     |     |     |     |     |     |     |

All z- deviations in Quad 3 are less than pixel size.

## Constants

✓ Archive: /reg/g/psdm/detector/alignment/cspad/calib-cxi-camera1-2014-09-24/

✓ geometry/0-end.data

```
# TITLE      Geometry parameters of CSPAD-CXI
# DATE_TIME  2014-10-28 11:39:51 PDT
# METROLOGY  /reg/neh/home1/dubrovin/LCLS/CSPadMetrologyProc/2014-09-24-CSPAD-CXI-DS1-Metrology-corr.txt
# AUTHOR     dubrovin
# EXPERIMENT Any
# DETECTOR   CSPAD-CXI
# CALIB_TYPE geometry
# COMMENT:01 Table contains the list of geometry parameters for alignment of 2x1 sensors, quads, CSPAD, etc
# COMMENT:02 All translation and rotation pars of the object are defined w.r.t. parent object Cartesian frame
# PARAM:01 PARENT      - name and version of the parent object
# PARAM:02 PARENT_IND  - index of the parent object
# PARAM:03 OBJECT      - name and version of the object
# PARAM:04 OBJECT_IND  - index of the new object
# PARAM:05 X0          - x-coordinate [um] of the object origin in the parent frame
# PARAM:06 Y0          - y-coordinate [um] of the object origin in the parent frame
# PARAM:07 Z0          - z-coordinate [um] of the object origin in the parent frame
# PARAM:08 ROT_Z       - object design rotation angle [deg] around Z axis of the parent frame
# PARAM:09 ROT_Y       - object design rotation angle [deg] around Y axis of the parent frame
# PARAM:10 ROT_X       - object design rotation angle [deg] around X axis of the parent frame
# PARAM:11 TILT_Z      - object tilt angle [deg] around Z axis of the parent frame
# PARAM:12 TILT_Y      - object tilt angle [deg] around Y axis of the parent frame
# PARAM:13 TILT_X      - object tilt angle [deg] around X axis of the parent frame
```

| #        | HDR | PARENT | IND        | OBJECT | IND   | X0[um] | Y0[um] | Z0[um] | ROT-Z | ROT-Y | ROT-X    | TILT-Z   | TILT-Y | TILT-X |
|----------|-----|--------|------------|--------|-------|--------|--------|--------|-------|-------|----------|----------|--------|--------|
| QUAD:V1  |     | 0      | SENS2X1:V1 | 0      | 21757 | 33110  | 51     | 0      | 0     | 0     | 0.04474  | -0.14079 |        |        |
| -0.00274 |     |        |            |        |       |        |        |        |       |       |          |          |        |        |
| QUAD:V1  |     | 0      | SENS2X1:V1 | 1      | 21769 | 10457  | 18     | 0      | 0     | 0     | 0.01053  | -0.11974 |        |        |
| 0.00000  |     |        |            |        |       |        |        |        |       |       |          |          |        |        |
| QUAD:V1  |     | 0      | SENS2X1:V1 | 2      | 33464 | 68275  | -28    | 270    | 0     | 0     | -0.01645 | 0.10414  |        |        |
| 0.09737  |     |        |            |        |       |        |        |        |       |       |          |          |        |        |
| QUAD:V1  |     | 0      | SENS2X1:V1 | 3      | 10769 | 68299  | 18     | 270    | 0     | 0     | -0.02828 | 0.02740  |        |        |
| 0.13418  |     |        |            |        |       |        |        |        |       |       |          |          |        |        |
| QUAD:V1  |     | 0      | SENS2X1:V1 | 4      | 68489 | 56732  | 71     | 180    | 0     | 0     | -0.05128 | -0.11309 |        |        |
| 0.06303  |     |        |            |        |       |        |        |        |       |       |          |          |        |        |
| QUAD:V1  |     | 0      | SENS2X1:V1 | 5      | 68561 | 79628  | -20    | 180    | 0     | 0     | -0.03552 | 0.07104  |        |        |
| -0.11788 |     |        |            |        |       |        |        |        |       |       |          |          |        |        |
| QUAD:V1  |     | 0      | SENS2X1:V1 | 6      | 77637 | 21754  | -15    | 270    | 0     | 0     | -0.33657 | -0.00821 |        |        |
| 0.01183  |     |        |            |        |       |        |        |        |       |       |          |          |        |        |
| QUAD:V1  |     | 0      | SENS2X1:V1 | 7      | 54810 | 21558  | -54    | 270    | 0     | 0     | -0.06315 | 0.00000  |        |        |

|                     |   |            |   |       |       |     |     |   |   |          |          |
|---------------------|---|------------|---|-------|-------|-----|-----|---|---|----------|----------|
| QUAD:V1<br>-0.20830 | 1 | SENS2X1:V1 | 0 | 21757 | 33329 | 178 | 0   | 0 | 0 | 0.08883  | 0.03158  |
| QUAD:V1<br>-0.24943 | 1 | SENS2X1:V1 | 1 | 21773 | 10446 | 61  | 0   | 0 | 0 | -0.01448 | 0.04211  |
| QUAD:V1<br>-0.07370 | 1 | SENS2X1:V1 | 2 | 33430 | 68158 | 257 | 270 | 0 | 0 | 0.02698  | -0.04660 |
| QUAD:V1<br>-0.06448 | 1 | SENS2X1:V1 | 3 | 10628 | 68183 | 247 | 270 | 0 | 0 | 0.04014  | -0.08498 |
| QUAD:V1<br>0.05481  | 1 | SENS2X1:V1 | 4 | 68349 | 56949 | 161 | 180 | 0 | 0 | -0.00066 | -0.02895 |
| QUAD:V1<br>0.03836  | 1 | SENS2X1:V1 | 5 | 68345 | 79783 | 231 | 180 | 0 | 0 | 0.06843  | -0.13948 |
| QUAD:V1<br>-0.11707 | 1 | SENS2X1:V1 | 6 | 77454 | 21811 | 111 | 270 | 0 | 0 | 0.05919  | -0.06029 |
| QUAD:V1<br>-0.16580 | 1 | SENS2X1:V1 | 7 | 54729 | 21779 | 106 | 270 | 0 | 0 | 0.07632  | -0.04933 |

|                    |   |            |   |       |       |   |     |   |   |          |         |
|--------------------|---|------------|---|-------|-------|---|-----|---|---|----------|---------|
| QUAD:V1<br>0.00000 | 2 | SENS2X1:V1 | 0 | 21741 | 33265 | 0 | 0   | 0 | 0 | -0.06053 | 0.00000 |
| QUAD:V1<br>0.00000 | 2 | SENS2X1:V1 | 1 | 21752 | 10493 | 0 | 0   | 0 | 0 | 0.10132  | 0.00000 |
| QUAD:V1<br>0.00000 | 2 | SENS2X1:V1 | 2 | 32869 | 68638 | 0 | 270 | 0 | 0 | 0.07036  | 0.00000 |
| QUAD:V1<br>0.00000 | 2 | SENS2X1:V1 | 3 | 10462 | 68624 | 0 | 270 | 0 | 0 | 0.00658  | 0.00000 |
| QUAD:V1<br>0.00000 | 2 | SENS2X1:V1 | 4 | 68166 | 57261 | 0 | 180 | 0 | 0 | 0.17894  | 0.00000 |
| QUAD:V1<br>0.00000 | 2 | SENS2X1:V1 | 5 | 68109 | 79832 | 0 | 180 | 0 | 0 | 0.11972  | 0.00000 |
| QUAD:V1<br>0.00000 | 2 | SENS2X1:V1 | 6 | 77482 | 21698 | 0 | 270 | 0 | 0 | -0.02762 | 0.00000 |
| QUAD:V1<br>0.00000 | 2 | SENS2X1:V1 | 7 | 54709 | 21779 | 0 | 270 | 0 | 0 | 0.02499  | 0.00000 |

|                     |   |            |   |       |       |     |     |   |   |          |          |
|---------------------|---|------------|---|-------|-------|-----|-----|---|---|----------|----------|
| QUAD:V1<br>-0.13428 | 3 | SENS2X1:V1 | 0 | 21819 | 33049 | -9  | 0   | 0 | 0 | -0.05000 | -0.05263 |
| QUAD:V1<br>-0.06303 | 3 | SENS2X1:V1 | 1 | 21788 | 10421 | -15 | 0   | 0 | 0 | -0.08092 | 0.03158  |
| QUAD:V1<br>0.03421  | 3 | SENS2X1:V1 | 2 | 33263 | 68378 | 8   | 270 | 0 | 0 | 0.21051  | 0.04383  |
| QUAD:V1<br>0.03816  | 3 | SENS2X1:V1 | 3 | 10969 | 68395 | 10  | 270 | 0 | 0 | -0.09737 | -0.01917 |
| QUAD:V1<br>-0.00548 | 3 | SENS2X1:V1 | 4 | 68580 | 56762 | 13  | 180 | 0 | 0 | 0.07829  | 0.01184  |
| QUAD:V1<br>-0.03286 | 3 | SENS2X1:V1 | 5 | 68473 | 79517 | -16 | 180 | 0 | 0 | 0.17626  | 0.02368  |
| QUAD:V1<br>-0.07895 | 3 | SENS2X1:V1 | 6 | 77454 | 21512 | -7  | 270 | 0 | 0 | -0.06908 | 0.10130  |
| QUAD:V1<br>-0.05526 | 3 | SENS2X1:V1 | 7 | 54695 | 21635 | 45  | 270 | 0 | 0 | -0.08486 | 0.00000  |

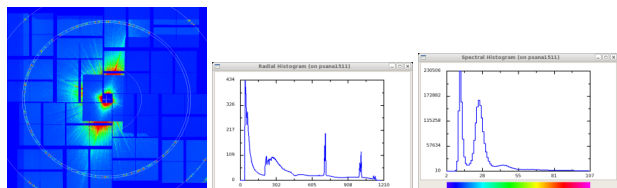
|                     |   |         |   |       |       |   |     |   |   |         |         |
|---------------------|---|---------|---|-------|-------|---|-----|---|---|---------|---------|
| CSPAD:V1<br>0.00000 | 0 | QUAD:V1 | 0 | -4500 | -4500 | 0 | 90  | 0 | 0 | 0.00000 | 0.00000 |
| CSPAD:V1<br>0.00000 | 0 | QUAD:V1 | 1 | -4500 | 4500  | 0 | 0   | 0 | 0 | 0.00000 | 0.00000 |
| CSPAD:V1<br>0.00000 | 0 | QUAD:V1 | 2 | 4500  | 4500  | 0 | 270 | 0 | 0 | 0.00000 | 0.00000 |
| CSPAD:V1<br>0.00000 | 0 | QUAD:V1 | 3 | 4500  | -4500 | 0 | 180 | 0 | 0 | 0.00000 | 0.00000 |

[illegible]

# Quads alignment

## 2015-06-02 cxih8015 run 0176

2015-06-02 quads alignment is done in geo using wide-ring image from exp=cxih8015:run=0176:



Aligned constants are in file `/reg/g/psdm/detector/alignment/cspad/calib-cxi-camera1-2014-09-24/calib/CsPad::CalibV1/CxiDs1.0:Cspad.0/geometry/geome`  
`try-camera1-in-ds2-cxih8015-r176.data` ([download](#)).

## 2016-06-03 cxi06216 run 25

Chuck complained that in quads alignment with geo internal and external rings can't be fitted in concentric rings simultaneously.

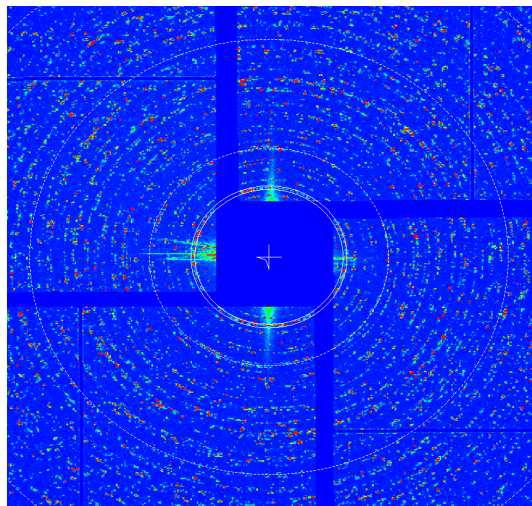
Assumption is that Z coordinate is involved in this experiment:

```
ds = DataSource('exp=cxi06216:run=25:smd')
epics_var = Detector('CXI:DS1:MMS:06.RBV')
```

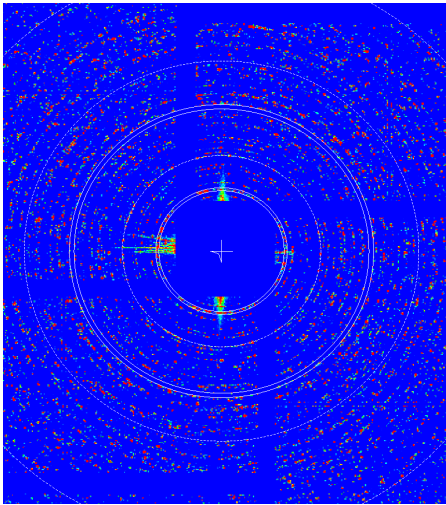
gives Z=-400 (D.1:MMS.0 -419.9924) so in this experiment sample-to-detector distance along Z should be 175mm

BTW, in g-optimized file `/reg/d/psdm/cxi/cxi06216/calib/CsPad::CalibV1/CxiDs1.0:Cspad.0/geometry/25-end.data`

Chuck uses Z= 578254um  Image obtained with this g-optimized file:

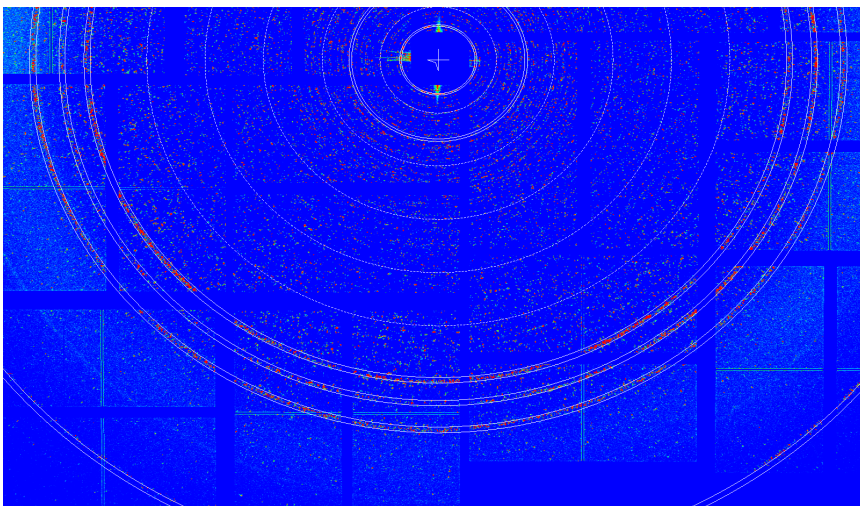
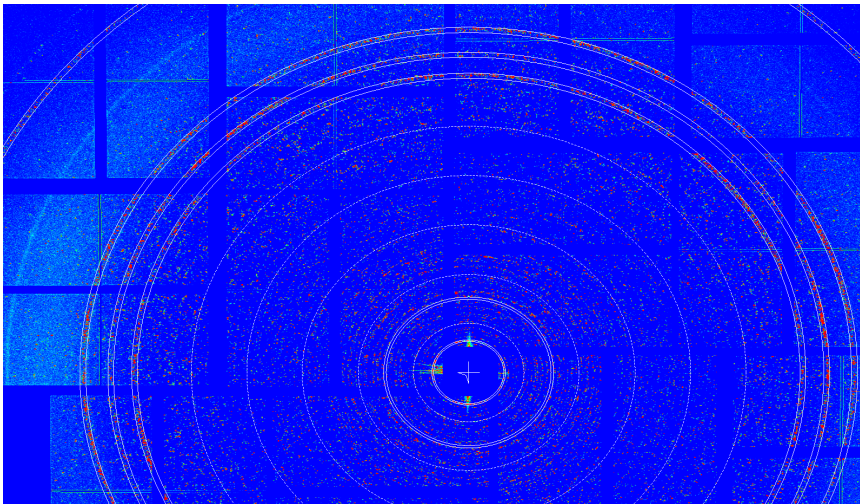


This image is used to set initial quad geometry in geo:



Progress with external rings "scale variation" was achieved using

- central projection of pixel x-y coordinates to the constant Z plane and
- applying small detector rotation  $\sim 0.5^\circ$  around X and Y axes:



geometry-cxi06216-r25-2016-06-03-camera1-z175mm.txt

## 2016-06-15 cxil0216 run 150

Nadia Zatsepin approved to use for alignment runs 145 - 150 in cxil0216.

CSPAD Z position is estimated from Chuck's measurement:

```
ds = DataSource('exp=cxil0216:run=146:smd')
epics_var = Detector('CXI:DS1:MMS:06.RBV')
```

```
# D.1:MMS.0 -479.9976
that gives Z=-480
```

Chuck's estimate:

Z-code z[mm]

0 577

-200 380

-400 175

-----

hence

-480 ~95mm

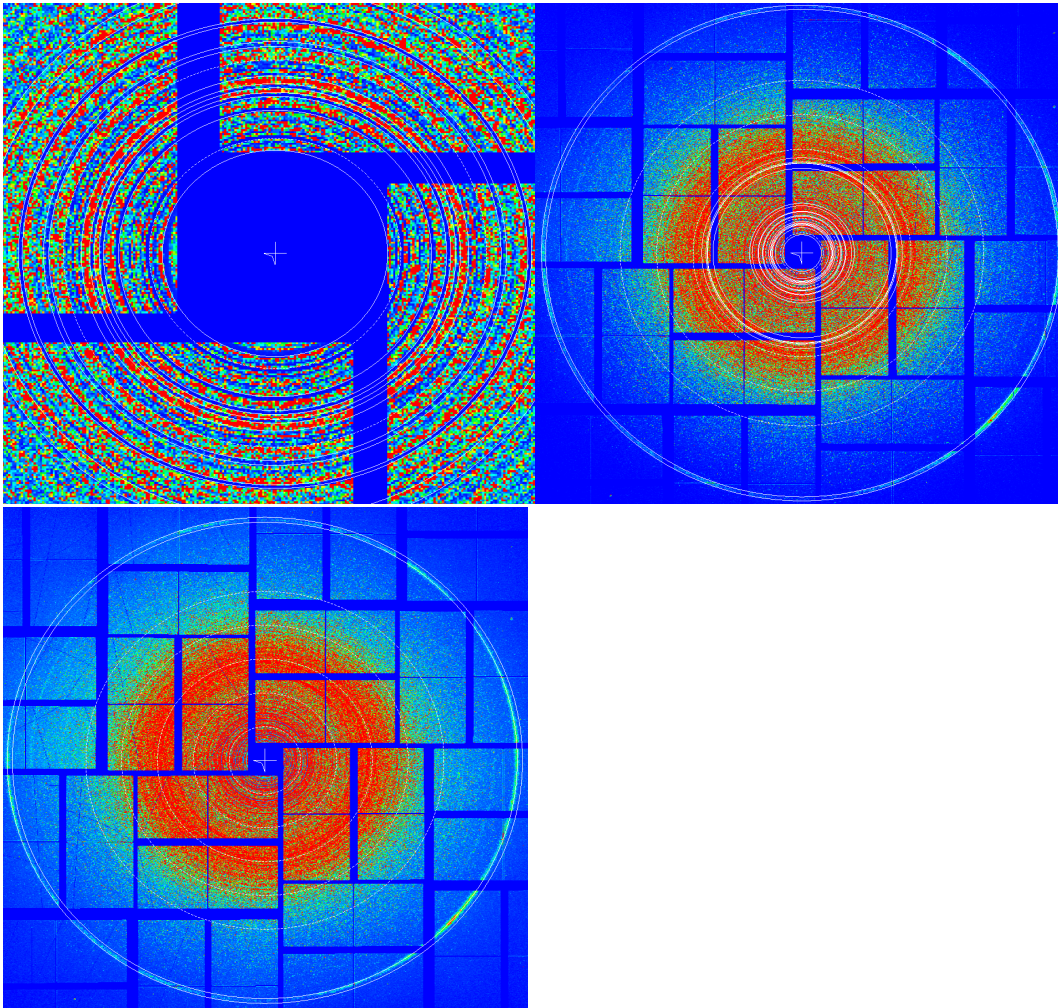
- Alignment directory: /reg/g/psdm/detector/alignment/cspad/calib-cxi-camera1-2014-09-24/
- Image array for alignment: 2016-06-15-cxil0216-r0150-e046288-CxiDs1-0-Cspad-0-max.txt
- Tuned geometry: 2016-06-15-geometry-cxil0216-r150-camera1-z95mm.txt
- deployed as: /reg/g/psdm/detector/alignment/cspad/calib-cxi-camera1-2014-09-24/2016-06-15-geometry-cxil0216-r150-camera1-z95mm.txt

In addition to optical metrology quads/detector tuning gives:

|          |   |          |   |       |       |       |       |     |     |         |         |          |
|----------|---|----------|---|-------|-------|-------|-------|-----|-----|---------|---------|----------|
| CSPAD:V1 | 0 | QUAD:V1  | 0 | -6500 | -2400 | 0     | 90.0  | 0.0 | 0.0 | 0.00000 | 0.00000 | 0.00000  |
| CSPAD:V1 | 0 | QUAD:V1  | 1 | -5300 | 6300  | 0     | 0.0   | 0.0 | 0.0 | 0.00000 | 0.00000 | 0.00000  |
| CSPAD:V1 | 0 | QUAD:V1  | 2 | 3700  | 5100  | 0     | 270.0 | 0.0 | 0.0 | 0.00000 | 0.00000 | 0.00000  |
| CSPAD:V1 | 0 | QUAD:V1  | 3 | 2600  | -4000 | 0     | 180.0 | 0.0 | 0.0 | 0.00000 | 0.00000 | 0.00000  |
| RAIL     | 0 | CSPAD:V1 | 0 | 1000  | -800  | 95000 | 0.0   | 0.0 | 0.0 | 0.00000 | 0.00000 | -0.30000 |
| IP       | 0 | RAIL     | 0 | 0     | 0     | 0     | 0.0   | 0.0 | 0.0 | 0.00000 | 0.00000 | 0.00000  |

Test images:

1. central rings
2. external ring for tilt -0.3° around x
3. external ring for tilt +0.3° around x (for cross-check)



Comments:

- cxi10216-r150 is very good for alignment - has bright internal rings and external from nozzle.
- tilt  $-0.3^\circ$  around x is required to inscribe external ring
- plot (3) for tilt  $+0.3^\circ$  around x shows sensitivity to this effect - it looks like external ring has a horizontal offset.

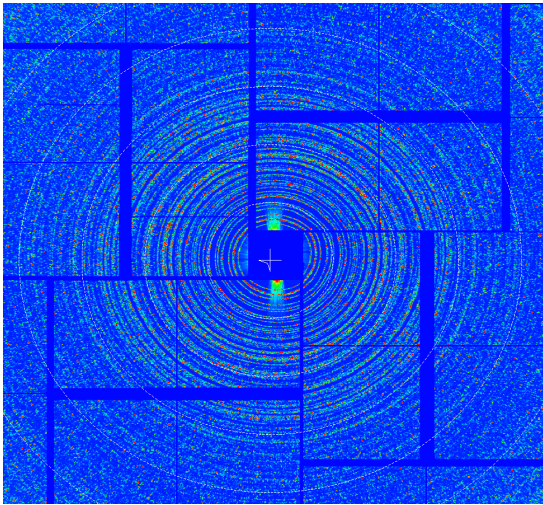
2017-06-07 cxi10416 run 28

Data:

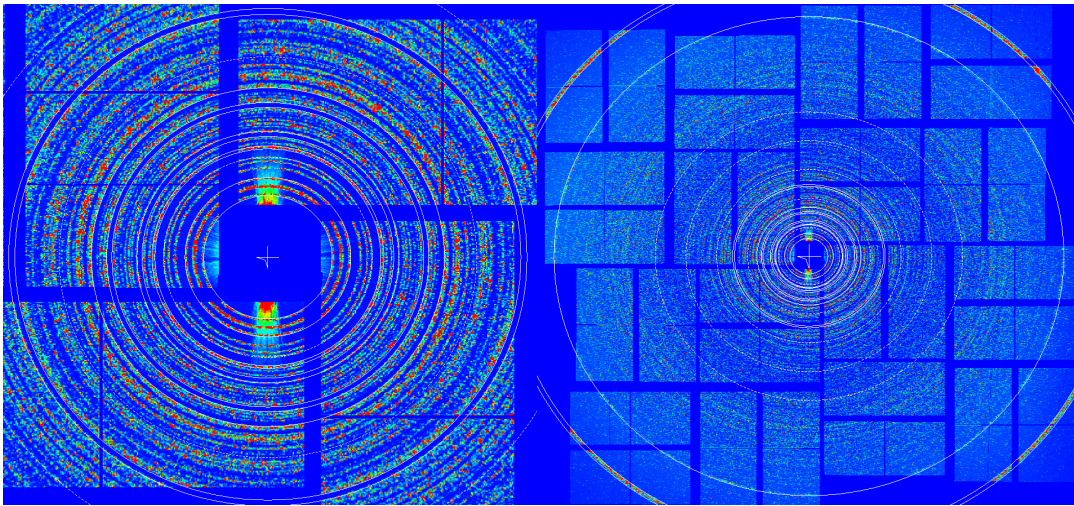
```
event_keys -d exp=cxi10416:run=28
EventKey(type=psana.CsPad.DataV2, src='DetInfo(CxiDs1.0:Cspad.0)', alias='DscCsPad')
```

Initial geometry:

```
/reg/g/psdm/detector/alignment/cspad/calib-cxi-camera1-2014-09-24/calib/CsPad::CalibV1/CxiDs1.0:Cspad.0/geometry
/geometry-camera1-in-ds2-cxih8015-r176.data
```



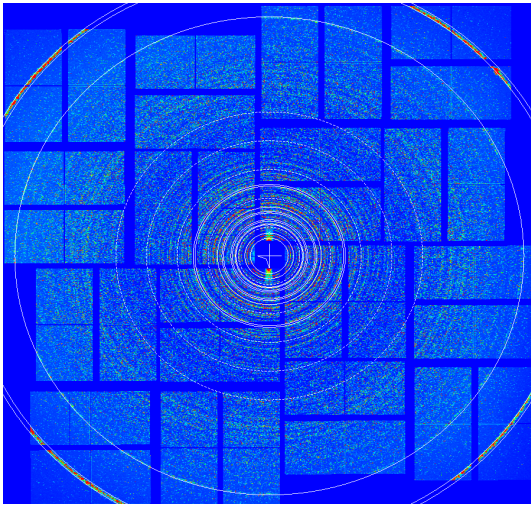
Aligned by geo central and full size images:



 To make consistent internal rinngs geometry with external (from nozzle?) tilt angles of entire detector were applied as shown below:

| #    | HDR | PARENT | IND | OBJECT   | IND | X0[um] | Y0[um] | Z0[um] | ROT-Z | ROT-Y | ROT-X | TILT-Z  | TILT-Y  | TILT-X   |
|------|-----|--------|-----|----------|-----|--------|--------|--------|-------|-------|-------|---------|---------|----------|
| RAIL |     |        | 0   | CSPAD:V1 | 0   | 0      | 0      | 111500 | 0.0   | 0.0   | 0.0   | 0.00000 | 0.05000 | -0.30000 |

Image without x-y tilts



shows a few pixel offset for large radius ring.

Aligned geometry constants are saved in

```
/reg/g/psdm/detector/alignment/cspad/calib-cxi-camera1-2014-09-24/calib/CsPad::CalibV1/CxiDs1.0:Cspad.0/geometry  
/geometry-camera1-in-ds1-cxi10416-r0028.data
```