

Detector geometry constants deployment

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Multi-panel composite detector needs in geometry constants to get arrays of pixel 3-d coordinates and derived objects. Mapping of correct constants with specific detector is a big issue if it is done manually. This note is about script automating/simplifying this job.

Command

To get current information about geometry constants deployment script and examples, use command:

```
geometry_deploy_constants -h
```

(development on ana-4.0.37) results of the command> geometry_deploy_constants -h

```
(ana-4.0.37) [<username>@psanagpu106:~/LCLS/con-py2]$ geometry_deploy_constants -e xpptut15 -r 320 -d XppGon.0:
Cspad.0 -D -c ./calib -h
usage:
geometry_deploy_constants -e <experiment> -d <detector> -r <run-number> [-D] [-L <logging-mode>] [...]
```

REGULAR COMMAND EXAMPLE:

```
geometry_deploy_constants -e cxilu9218 -d CxiDs1.0:Jungfrau.0 -r238 --posz -100000 --posx 0 --posy 0 --rotz
90 -D --runrange 10-20
```

TEST COMMANDS:

```
Ex.1 for Cspad CXI      : geometry_deploy_constants -e xpptut15 -r 380 -d CxiDs1.0:Cspad.0 -D -c ./calib
Ex.2 for Cspad CXI      : geometry_deploy_constants -e xpptut15 -r 380 -d CxiDs2.0:Cspad.0 -D -c ./calib
Ex.3 for Cspad XPP       : geometry_deploy_constants -e xpptut15 -r 320 -d XppGon.0:Cspad.0 -D -c ./calib
Ex.4 for cspad2x2        : geometry_deploy_constants -e xpptut15 -r 460 -d MecTargetChamber.0:Cspad2x2.3 -D -c .
./calib --posz -100000 --posx 10 --posy -20 --rotz 90
Ex.5 for jungfrau512k    : geometry_deploy_constants -e xpptut15 -r 410 -d MfxEndstation.0:Jungfrau.1 -D -c .
./calib
Ex.6 for jungfrau1M      : geometry_deploy_constants -e xpptut15 -r 430 -d MfxEndstation.0:Jungfrau.0 -D -c .
./calib
Ex.7 for jungfrau4M      : geometry_deploy_constants -e xpptut15 -r 530 -d DetLab.0:Jungfrau.2 -D -c ./calib
Ex.8 for epix10ka2m      : geometry_deploy_constants -e xpptut15 -r 570 -d MfxEndstation.0:Epix10ka2M.0 -D -c .
./calib
Ex.9 for epix100a        : geometry_deploy_constants -e xpptut15 -r 260 -d XcsEndstation.0:Epix100a.1 -D -c .
./calib
Ex.10 for pnCCD          : geometry_deploy_constants -e xpptut15 -r 450 -d Camp.0:pnCCD.1 -D -c ./calib
Ex.11 for epix10kaquad   : geometry_deploy_constants -e xpptut15 -r 590 -d MecTargetChamber.0:Epix10kaQuad.0 -D -
c ./calib
Ex.12 for epix10kaquad   : geometry_deploy_constants -e xpptut15 -r 590 -d MecTargetChamber.0:Epix10kaQuad.1 -D -
c ./calib
Ex.13 for epix10kaquad   : geometry_deploy_constants -e xpptut15 -r 590 -d MecTargetChamber.0:Epix10kaQuad.2 -D -
c ./calib
Ex.14 for epix10kaquad   : geometry_deploy_constants -e xpptut15 -r 590 -d MecTargetChamber.0:Epix10kaQuad.3 -D -
c ./calib
```

Help: geometry_deploy_constants -h

Deployment of geometry calibration parameters

optional arguments:

-h, --help	show this help message and exit
-e EXP, --exp EXP	experiment name, default = None
-d DET, --det DET	detector name, default = None
-r RUN, --run RUN	run number of the existing dataset to get run time- stamp, detector full name etc., default = None
-t TSTAMP, --timestamp TSTAMP	

```

        non-default time stamp (<YYYYmddHHMMSS>) or run
        number(<10000>) for constants selection in repo. By
        default run time is used, default = None
-s DSSUFFIX, --dssuffix DSSUFFIX
        dataset name suffix beyond
        exp=<expname>:run=<runnum><dssuffix>, for example
        ":smd:dir=<path>/xtc/", default = None
-x DSNAME, --dsname DSNAME
        overrides exp=<expname>:run=<runnum><dssuffix> if
        specified, e.g. path to *.xtc file, default = None
-o DIRREPO, --dirrepo DIRREPO
        non-default repository of calibration results, default
        = /reg/g/psdm/detector/calib/geometry/
-c DIRCALIB, --dircalib DIRCALIB
        deployment calib directory if different from standard
        one, default = None
-l LOGLEV, --loglev LOGLEV
        logging mode, one of INFO, CRITICAL, WARN, WARNING,
        ERROR, DEBUG, NOTSET, default = INFO
--dirmode DIRMODE
        mode for all mkdir, default = 511
--filemode FILEMODE
        mode for all saved files, default = 438
-D, --deploy
        deploy constants to the calib dir, default = False
-R RUNRANGE, --runrange RUNRANGE
        validity run range for output calibration file,
        default = 0-end
--parent PARENT
        parent frame name containing the detector geometry
        object, default = IP
--posx POSX
        detector position x[um] relative IP, default =
        0.000000
--posy POSY
        detector position y[um] relative IP, default =
        0.000000
--posz POSZ
        detector position z[um] relative IP, default =
        -100000.000000
--rotx ROTX
        detector rotation angle [degree] around axis x,
        default = 0.000000
--roty ROTY
        detector position angle [degree] around axis y,
        default = 0.000000
--rotz ROTZ
        detector position angle [degree] around axis z,
        default = 0.000000

```

Algorithm

Command `geometry_deploy_constants <parameters>` checks experiment (`-e, --exp`) run (`-r, --run`) information for requested detector (`-d, --det`), finds the run time stamp, finds appropriate file with geometry constants in the repository (`-o, --dirrepo`), changes detector orientation, apply translation relative IP (if parameters `--parent`, `--pos*`, `--rot*` specified) and deploys constants under `<experiment>/calib` directory, or directory specified by parameter (`-c, --calibdir`). Results of this command, depending on parameter (`-l, --loglev`), are dumped on terminal and preserved in the logfile

`<dirrepo>/logs/<year>/<time-stamp>_log_geometry_deploy_constants_<user-login-name>.txt`

Repository

Conventions about repository containing files with geometry calibration constants.

Currently `-o, --dirrepo` is set to `/reg/g/psdm/detector/calib/geometry/`

Current content of --dirrepo

```
(ana-4.0.37) [<username>@psanagpu106:/reg/g/psdm/detector/calib/geometry]$ ls -l
total 4
drwxr-xr-x 1 dubrovin br 0 Mar 22 14:13 andor
drwxr-xr-x 1 dubrovin br 0 Mar 22 14:08 andor3d
drwxrwxr-- 1 dubrovin br 0 Mar 24 11:30 cspad
drwxrwxr-- 1 dubrovin br 0 Mar 24 11:55 cspad2x2
drwxrwxr-- 1 dubrovin br 0 Mar 24 12:00 epix100a
drwxrwxr-- 1 dubrovin br 0 Mar 23 14:54 epix10ka
drwxr-xr-x 1 dubrovin br 0 Mar 24 12:14 epix10ka2m
drwxr-xr-x 1 dubrovin br 0 Mar 24 13:42 epix10kaquad
drwxrwxr-- 1 dubrovin br 0 Mar 23 10:14 jungfrau
drwxrwxrwx 1 dubrovin br 0 Mar 15 09:55 logs
drwxrwxr-- 1 dubrovin br 0 Mar 17 15:02 pnccd
drwxr-xr-x 1 dubrovin br 0 Mar 22 09:33 rayonix
```

and beside logfiles under subdirectory logs/ it contains directories for "all" detector types which need in geometry constants.

Currently repository is fully populated for cspad, cspad2x2, epix100a, epix10ka, epix10ka2m, epix10kaquad, jungfrau, pnccd. If other detector(s) required they need to be populated here.

Population of the directory epix10ka2m

```
/reg/g/psdm/detector/calib/geometry]$ ls -l epix10ka2m
total 68
-rw-r--r-- 1 dubrovin br 3662 Mar 22 13:16 2018-11-15-geometry-epix10ka2m.txt
-rw-r--r-- 1 dubrovin br 3720 Mar 22 13:15 2020-02-25-geometry-epix10ka2m.1-v0-z0.txt
-rw-r--r-- 1 dubrovin br 3350 Mar 22 13:15 2020-02-25-geometry-epix10ka2m.1-v1-mfxc00118-0044-z0.txt
-rw-r--r-- 1 dubrovin br 3355 Mar 22 13:14 2020-02-25-geometry-epix10ka2m.1-v1-mfxc00318-0013-z0.txt
-rw-r--r-- 1 dubrovin br 3268 Mar 22 13:15 2020-06-25-geometry-epix10ka2m.0-v1.txt
-rw-r--r-- 1 dubrovin br 3424 Mar 22 13:14 2020-09-10-geometry-epix10ka2m.1-v1-cortilt-center.txt
-rw-r--r-- 1 dubrovin br 3340 Mar 22 11:12 2021-02-02-geometry-epix10ks2m.1-recentred-for-psana.txt
-rw-r--r-- 1 dubrovin br 3267 Mar 22 11:12 2021-02-02-geometry-epix10ks2m.1.txt
-rw-r--r-- 1 dubrovin br 3355 Mar 22 13:21 epix10ka2m_default.data
lrwxrwxrwx 1 dubrovin br 42 Mar 22 10:50 epix10ka2m_MfxEndstation-0-Epix10ka2M-0_20200225.data -> 2020-02-25-
geometry-epix10ka2m.1-v0-z0.txt
lrwxrwxrwx 1 dubrovin br 54 Mar 22 10:55 epix10ka2m_MfxEndstation-0-Epix10ka2M-0_20200910.data -> 2020-09-10-
geometry-epix10ka2m.1-v1-cortilt-center.txt
lrwxrwxrwx 1 dubrovin br 56 Mar 22 13:09 epix10ka2m_MfxEndstation-0-Epix10ka2M-0_20210202.data -> 2021-02-02-
geometry-epix10ks2m.1-recentred-for-psana.txt
lrwxrwxrwx 1 dubrovin br 34 Mar 22 10:43 epix10ka2m_XcsEndstation-0-Epix10ka2M-0_20181115.data -> 2018-11-15-
geometry-epix10ka2m.txt
lrwxrwxrwx 1 dubrovin br 39 Mar 22 10:45 epix10ka2m_XppGon-0-Epix10ka2M-0_20200625.data -> 2020-06-25-
geometry-epix10ka2m.0-v1.txt
```

Script finds path to the geometry file using its name conventions:

<dirrepo>/<det-type>/<dettype>_<full-lcls1-detector-name>_<time-stamp>.data

where the time-stamp is presented in format YYYYMMDD (it is assumed that optical metrology or variation of geometry constants do not need to be changed more often than once per day...).

If geometry file for specified detector and time-stamp is missing, constants from <dettype>_default.data will be loaded.

Remarks

Default geometry modification

Command parameters allow to make a few modifications to the default geometry file before deployment. These modifications include detector position and orientation and Rayonix segment binning.

Position and orientation

Camera position and orientation parameters (--posx/y/z, and --rotx/y/z) are included in the geometry file line beginning with "IP" (which by default set in by parameter --parent IP). It is assumed that all files in repository should have the line beginning with "IP". Otherwise, parameter --parent can be changed.

Rayonix binning

Default geometry file for Rayonix /reg/g/psdm/detector/calib/geometry/rayonix/rayonix_default.data has pre-defined segment description like MTRX:V2:3840:3840:44.5:44.5, that can be changed by experiment dependent [binning](#). For detector of type rayonix this string parameters are compared with parameters from configuration object for specified experiment (-e EXP, --exp EXP) and run number (-r RUN, --run RUN). Segment binning values from configuration are substituted, e.g. for xpptut15 run 240 this line is replaced with MTRX:V2:1920:1920:88:88. For backward compatibility of already deployed geometry files similar check and substitution is done on flight at geometry loading in the [Detector.geoaccess](#), [check_rayonix_geo](#) methods (requested by Chuck).

Troubleshooting

From log-file or dump on terminal

example of script output

```

(ana-4.0.37) [dubrovin@psanagpu106:~/LCLS/con-py2]$ geometry_deploy_constants -e xpptut15 -r 460 -d
MecTargetChamber.0:Cspad2x2.3 -D -c ./calib --posz -100000 --posx 10 --posy -20 --rotz 90
Arguments: Namespace(deploy=True, det='MecTargetChamber.0:Cspad2x2.3', dircalib='./calib', dirmode=511,
dirrepo='/reg/g/psdm/detector/calib/geometry/', dsname=None, dssuffix=None, exp='xpptut15', filemode=438,
loglev='INFO', parent='IP', posx=10.0, posy=-20.0, posz=-100000.0, rotx=0, roty=0, rotz=90.0, run='460',
runrange='0-end', tstamp=None)

[I] geometry_deploy_constants L0131 log file: /reg/g/psdm/detector/calib/geometry/logs/2022/2022-03-
25T104317_log_geometry_deploy_constants_dubrovin.txt
[I] UtilsCalib.py L0305 record at start:
2022-03-25T10:43:17 user:dubrovin@psanagpu106 cwd:/cds/home/d/dubrovin/LCLS/con-py2 rel:ana-4.0.37 dirrepo:/reg
/g/psdm/detector/calib/geometry command:/cds/home/d/dubrovin/LCLS/con-py2/arch/x86_64-rhel7-gcc48-opt/bin
/geometry_deploy_constants -e xpptut15 -r 460 -d MecTargetChamber.0:Cspad2x2.3 -D -c ./calib --posz -100000 --
posx 10 --posy -20 --rotz 90
saved in: /reg/g/psdm/logs/atstart/2022/2022_lcls1_geometry_deploy_constants.txt
[I] UtilsGeometryDeploy.py L0032 input parameters
    roty : 0
    rotx : 0
    dirrepo : /reg/g/psdm/detector/calib/geometry/
    rotz : 90.0
    run : 460
    exp : xpptut15
    parent : IP
    deploy : True
    det : MecTargetChamber.0:Cspad2x2.3
    posy : -20.0
    dsname : None
    dircalib : ./calib
    tstamp : None
    loglev : INFO
    dssuffix : None
    dirmode : 511
    posx : 10.0
    filemode : 438
    posz : -100000.0
    runrange : 0-end
    repoman : <Detector.UtilsCalib.RepoManager object at 0x7f9443b06350>
[I] UtilsGeometryDeploy.py L0054 open dataset exp=xpptut15:run=460
[I] UtilsGeometryDeploy.py L0065 directory for dettype: /reg/g/psdm/detector/calib/geometry/cspad2x2
[I] UtilsGeometryDeploy.py L0070 list of found in repository geometry files for dettype_detname:
cspad2x2_MecTargetChamber-0-Cspad2x2-3
    cspad2x2_MecTargetChamber-0-Cspad2x2-3_20130213.data
    cspad2x2_MecTargetChamber-0-Cspad2x2-3_20150402.data
    cspad2x2_MecTargetChamber-0-Cspad2x2-3_20140425.data
[I] UtilsGeometryDeploy.py L0076 file_for_timestamp(tsruntime=20130428): /reg/g/psdm/detector/calib/geometry
/cspad2x2/cspad2x2_MecTargetChamber-0-Cspad2x2-3_20130213.data
[I] UtilsGeometryDeploy.py L0086 geo_det: parent: IP 0 geo: CSPAD2X2:V1 0 x0: 0 y0: 0
z0:-1000000 rot_z: 0.000 rot_y: 0.000 rot_x: 0.000 tilt_z: 0.00000 tilt_y: 0.00000 tilt_x: 0.00000
[I] UtilsGeometryDeploy.py L0095 geo_det updated: parent: IP 0 geo: CSPAD2X2:V1 0 x0: 10
y0: -20 z0: -1000000 rot_z: 90.000 rot_y: 0.000 rot_x: 0.000 tilt_z: 0.00000 tilt_y: 0.00000
tilt_x: 0.00000
[I] GeometryAccess.py L0263 Save file: /reg/g/psdm/detector/calib/geometry/cspad2x2/cspad2x2_tmp.data
[I] UtilsGeometryDeploy.py L0104 standard calib dir: /reg/d/psdm/XPP/xpptut15/calib
[I] UtilsGeometryDeploy.py L0105 non-default calib dir: ./calib
[I] UtilsGeometryDeploy.py L0114 deploy calib file /reg/g/psdm/detector/calib/geometry/cspad2x2/cspad2x2_tmp.
data under ./calib/CsPad2x2::CalibV1/MecTargetChamber.0:Cspad2x2.3/geometry
create_path: ./calib/CsPad2x2::CalibV1/MecTargetChamber.0:Cspad2x2.3/geometry/0-end.data
Directory exists: .
Directory exists: ./calib
Directory exists: ./calib/CsPad2x2::CalibV1
Directory exists: ./calib/CsPad2x2::CalibV1/MecTargetChamber.0:Cspad2x2.3
Directory exists: ./calib/CsPad2x2::CalibV1/MecTargetChamber.0:Cspad2x2.3/geometry
cmd: cat /reg/g/psdm/detector/calib/geometry/cspad2x2/cspad2x2_tmp.data > ./calib/CsPad2x2::CalibV1
/MecTargetChamber.0:Cspad2x2.3/geometry/0-end.data
cmd: echo "file:0-end.data copy_of:/reg/g/psdm/detector/calib/geometry/cspad2x2/cspad2x2_tmp.data ctype:
geometry user:dubrovin host:psanagpu106 cptime:2022-03-25T10:43:18 cwd:/cds/home/d/dubrovin/LCLS/con-py2 cmt:"
>> ./calib/CsPad2x2::CalibV1/MecTargetChamber.0:Cspad2x2.3/geometry/HISTORY
(ana-4.0.37) [dubrovin@psanagpu106:~/LCLS/con-py2]$

```

it should be quite clear what script is doing and what problem might be. Please pay attention that

- script grabs expected file for requested detector and time-stamp
- check if the geometry file in its final destination under the `calib/` directory is available and not empty
- please report about any issues

References

- [Detector Geometry](#)
- [Geometry history](#)
- [EPIX10KA2M/Quads Optical Metrology](#)
- [Jungfrau geometry](#)
- [CSPAD Alignment](#), [CSPAD Calibration](#)
- [Rayonix](#) binning