Method det.calib algorithms

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This note describes raw intensity correction algorithms in the method Detector.calib and their variation on detector type.

LCLS Detector Interface

- Detector interface in LCLS

Method calib

arr = det.calib(evt, cmpars=None, **kwargs)

Regular sequence of applied algorithms

- dark correction - pedestals subtraction using calib/.../pedestals
- common mode correction depending on cmpars or calib/.../common_mode or default from PSCalib.CalibParsBase*V1.py
- gain correction factors from calib/.../pixel_gain. Depending on detector pixel_gain calibration array may contain per-pixel gain in ADU/keV or gain correction factor gfactor in keV/ADU, where gfactor=1/gain.
- apply mask depending on **kwargs

Correction formula

(common_mode(raw - peds))/gain * mask(**kwargs)

or for gain factors in pixel_gain:

(common_mode(raw - peds))*gfactor * mask(**kwargs)

Mask

To construct the mask use **kwargs and algorithms from method mask_v2 from AreaDetector.

TURN OFF common mode correction

For cmpars = None - default constants are used

For regular detectors: cmpars = 0 or cmpars[0] = 0 `- OFF`

`For epix10ka and Jungfrau cmpars[1] = 0 - OFF`

`See also Common mode correction algorithms.`

Detector dependent algorithms

Spreadsheet below contains comments on detector specific application

Detector type	pedestal subtraction	common mode correction	pixel_gain content, by default gain factor	gain	mask	formula	comments
LCLS (1)							

CSPAD	+	default cmpars = (1, 25, 25, 100) cmpars = 0 or cmpars[0] = 0 - OFF	gain factor, keV /ADU	*gainmask det.set_gain_mask_factor (gfactor=6.85)	+		gain map extracted from detector configuration data and applied with gfactor gainmask is applied before regular gain factor
CSPAD2x2	+	shape=(185, 388, 2) common_mode shape=(2, 185, 388) back to (185, 388, 2) default cmpars = (1,25,25,100)	gain factor, keV /ADU	+	+		shape is converted before common mode correction in order to apply regular CSPAD algorithm then it is converted back to daq shape.
epix100a	+	default cmpars =(4,6,30,30)	gain factor, keV /ADU	+	+		
pnCCD	+	default cmpars =(3,350,350,128) or alg #8 (8,5,500)		+	+		
Andor3d	+	default cmpars =(2,10,10,cols)		+	+		
Princeton	+	default cmpars =(1,50,50,100,1, size,1)		+	+		
Camera	+	other Cameras default cmpars = (0,0,0,0), cmpars = 0 or cmpars [0] = 0 - OFF		+	+		

epix10ka	+	`applied for pixels in high gain mode only in combination with mask`
		
		`cmpars=None: default (7, 2,10,10)`
		
		`(*,0,...) - OFF`
			gain, ADU/keV	pixel_gain constants are used and per event depending on gain range	+	(common_mode(raw - peds) /gain * mask	UtilsEpix10ka.calib_epix10ka_any(det, evt, cmpars=None, **kwa)
							
							offsets are already accounted at deployment of pedestals in calib/.../pedestals

Jungfrau	+	applied for pixels in high gain mode only in combination with mask
		
		`cmpars=None: default cmpars = (7,1,100,0)`
		
		`(*,0,...) - OFF`
			gain, ADU/keV	pixel_gain and pixel_offset are used and per event depend on gain range	+	(common_mode(raw - peds - offset))/gain * mask	UtilsJungfrau.calib_jungfrau(det, evt, cmpars=(7,3,200,10), **kwa)

LCLS-II Detector Interface

- Detector interfase in LCLS-II

Method calib

arr = det.raw.calib(evt, **kwa)

Regular sequence of applied algorithms

- dark correction - pedestals subtraction using constants of ctype `pedestals` from DB
- common mode correction depending on cmpars or constants of ctype `common_mode` from DB
- gain correction with constants from DB for ctype pixel_gain. In LCLS-II we intend to always use in pixel_gain constants the gains in ADU/keV.
- mask is not applied by default (see below)

Correction formula

common_mode(raw-peds)/gain

Mask

In lcls2 mask is derived and applied separately as explained in Area detector mask examples or Detector interfase in LCLS-II.

TURN OFF common mode correction

- `cmpars=None - use constants from DB`
- `cmpars[1] = 0 - OFF`
- `both cmpars=None and common_mode constants are missing in DB - common mode correction is OFF`

Detector dependent algorithms

Spreadsheet below contains comments on detector specific application

Detector type	pedestal subtraction	common mode correction	gain	mask	formula	comments

LCLS-II						
epix10ka	+	default cmpars=None - search common_mode pars in DB. Correction is OFF if constants missing in DB. ex. (7,2,100,10)	+	-	(common_mode (raw - peds) /gain	calib_epix10ka_any(det.raw, evt, cmpars=None, **kwa) mask defined by **kwa is used in common_mode_correction see UtilsEpix10ka
epixhr2x2	+	+ the same as epix10ka	+	-		the same as epix10ka
epix100a	+	+ the same as epix10ka ex. (7,7,100,10)	+	-		calib_epix100(det.raw, evt, cmpars=None, **kwa) UtilsEpix100
opal	+	-	+	-	(raw-peds)/gain	opal_base
piranha4	+	-	+	-	(raw-peds)/gain	piranha4_base

References

- Detector interface in LCLS
- Detector interfase in LCLS-II
- Area Detector Interface (LCLS-II)
- Area detector mask examples