Test of Peak Finders - V2

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Data

exp=cxif5315:run=169

V2 News

V2 is done for test of peak finders after revision r1.
See for details

- Hit/Peak Finding - description of algorithms
- ImgAlgos.PyAlgos - peak finders API
- PSAS-147 - details about revision 1

We work with peak finder versions v2r1, v3r1, v4r1.
Data processing and peak finding is done in cxif5315/proc-cxif5315-r0169-data-pfvn-2016-04-19.py

Peak selection parameters

- selection parameters were set with as minimal number of parameters as possible.
- selection parameters of different peak finders were adjusted to get about the same yield of peaks in the file.
from ImgAlgos.PyAlgos import PyAlgos

alg_arc = PyAlgos(windows=winds_arc, mask=mask_arc, pbits=2)
#alg_arc.set_peak_selection_pars(npix_min=0, npix_max=1e6, amax_thr=0, atot_thr=500, son_min=6)  # for pfv2r1
alg_arc.set_peak_selection_pars(npix_min=0, npix_max=1e6, amax_thr=0, atot_thr=0, son_min=6)  # for pfv3r1, pfv4r1
alg_equ = ... # the same

# in the event loop:

# run peakfinders and get list of peak records for each region
#peaks_arc = alg_arc.peak_finder_v2r1(nda, thr=30, r0=6, dr=0.5)
peaks_arc = alg_arc.peak_finder_v3r1(nda, rank=5, r0=6, dr=0.5)
#peaks_arc = alg_arc.peak_finder_v4r1(nda, thr_low=10, thr_high=150, rank=5, r0=6, dr=0.5)
    #peaks_equ = alg_equ.peak_finder_v2r1(...)  # The same

Summary of peak selection parameters

peak finder specific parameters for seed peak finding

- v2: thr=30
- v3: rank=5
- v4: thr_low=10, thr_high=150, rank=5

use the same parameters for S/N calculation

- r0=6, dr=0.5

peak selection in the list

- common: son_min=6
- v2: atot_thr=500  # to keep the same number of peaks in the list as for v3,v4

Raw n-d array pre-processing before peak-finders

- get raw data
- subtract pedestals
- subtract radial background to polarization corrected data
- apply status mask
Common mode correction was tested before and after background subtraction.
For unknown reason it makes image visually worse...

Peak list
In revision 1 four parameters col_min, col_max, row_min, row_max were discarded.
For each peak finder we created list of peak parameters, beginning as
# Peak list processing

For peak list processing we use script:

```
cxif5315/proc-cxif5315-r0169-peaks-from-file-v6.py
```

## Peak pre-selection for histogramms

### ARC region
def procPeakDataArc(pk):
    """ Process peak for ARC region; accumulate peak statistics in histogram arrays. """
    #===================
    # discard from all histograms except its own
    sp.lst_arc_atot.append(pk.atot)
    if pk.atot<2000 : return
    #===================
    sp.lst_arc_amax.append(pk.amax)
    sp.lst_arc_npix.append(pk.npix)
    sp.lst_arc_r.append(pk.r)
    ...

Arc: Amax

Entries=23113
Mean=351.08 ± 28.36
RMS=194.45 ± 20.06
γ=1.286 χ²=1.083

Arc: Amax

Entries=32284
Mean=251.97 ± 41.12
RMS=196.34 ± 29.22
γ=1.688 χ²=2.237
def procPeakDataEqu(pk):
    # Process peak for EQU region; accumulate peak data
    #==================
    # discard from all histograms except its own
    sp.lst_equ_atot.append(pk.atot)
    if pk.atot<2000: return
    sp.lst_equ_r_raw.append(pk.r)
    if pk.r<100: return
    #==================
    sp.lst_equ_r.append(pk.r)
    sp.lst_equ_amax.append(pk.amax)
    sp.lst_equ_npix.append(pk.npix)
    ...

Arc: Number of peaks selected

Equ: Amax
Peak selection for fit

ARC region

def peakIsSelectedArc(pk):
    """Apply peak selection criteria to each peak from file
    """
    if pk.son<9      : return False
    if pk.amax<150   : return False
    if pk.atot<2000  : return False
    if pk.npix>500   : return False
    if pk.r<435      : return False
    if pk.r>443      : return False
    if pk.rms>80     : return False
    if pk.bkgd<-20   : return False
    if pk.bkgd>50    : return False
    return True
To fit peaks we use `funcy_l1_v0(x, phi_deg, bet_deg, DoR=433/sp.DETD, sgnrt=-1.)`
ARC: fit angle beta error

Entries=985
Mean=3.72 ± 1.21
RMS=4.60 ± 0.86
| =3.572, \phi=17.172

Entries=152
Mean=4.25 ± 1.26
RMS=3.83 ± 0.89
| =5.180, \phi=34.071

Entries=1048
Mean=4.27 ± 1.15
RMS=3.48 ± 0.81
| =4.890, \phi=31.154

Error on beta (deg)
EQU region
def peakIsSelectedEqu(pk):
    
    
    
    if pk.son<9 : return False
    if pk.amax<150 : return False
    if pk.atot<2000 : return False
    if pk.npix>500 : return False
    if pk.r<100 : return False
    if pk.r>454 : return False
    if pk.rms>80 : return False
    if math.fabs(pk.bkgd)>20 : return False
    return True

To fit peaks we use funcy_l0 which automatically select solution depending on sign of parameter B.
References

- **Hit/Peak Finding Details** - description of algorithms
- **ImgAlgos.PyAlgos** - interface methods
- **PSAS-147** - details about revision 1
- **Radial Background Subtraction Algorithm**