Test of Peak Finders - V2

Content

- Content
- Data
- V2 News
  - Peak selection parameters
  - Summary of peak selection parameters
  - Raw n-d array pre-processing before peak-finders
  - Peak list
  - Peak list processing
    - Peak pre-selection for histograms
      - ARC region
      - EQU region
    - Peak selection for fit
      - ARC region
      - EQU region
  - References

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
<table>
<thead>
<tr>
<th># Exp</th>
<th>Run</th>
<th>Date</th>
<th>Time</th>
<th>time(sec)</th>
<th>time(nsec)</th>
<th>fiduc</th>
<th>Evnum</th>
<th>Reg</th>
<th>Seg</th>
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</table>

**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  χ=1.083

Arc: Amax

Entries=32284
Mean=351.97 ± 41.32
RMS=196.34 ± 29.22
γ=1.688  χ=2.237
Arc: Amax

Entries=68483
Mean=231.15 ± 43.01
RMS=142.46 ± 30.41
γ=2.758 ρ=7.980

Arc: Atot

Entries=237265
Mean=1038.05 ± 413.43
RMS=1237.50 ± 290.34
γ=4.119 ρ=18.831

Arc: Atot

Entries=219540
Mean=1618.66 ± 170.16
RMS=975.74 ± 120.32
γ=4.102 ρ=22.873
Arc: S/N - for all peak pixels

- Entries: 70560
- Mean: 12.17 ± 1.92
- RMS: 6.43 ± 1.36
- T= 3.97 ± 0.70
- Q= 25.161

Arc: Number of pixels/peak

- Entries: 25107
- Mean: 69.88 ± 6.96
- RMS: 45.34 ± 4.92
- T= 2.501 ± 0.835
- Q= 8.355

Arc: Number of pixels/peak

- Entries: 34290
- Mean: 116.67 ± 6.34
- RMS: 9.09 ± 4.48
- T= 2.610 ± 0.710
- Q= 7.101
EQU region

```python
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)
    ...
```

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

Equ: Number of peaks selected

Entries=83366
Mean=0.05±0.28
RMS=0.30±0.20
σ=7.778 χ²=88.715

Equ: Number of peaks selected

Entries=80796
Mean=0.13±0.47
RMS=0.51±0.33
σ=6.109 χ²=54.780
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: 5.72 ± 1.21
RMS: 4.60 ± 0.86
γ = 3.572 μ = 17.172

Entries: 352
Mean: 4.25 ± 1.26
RMS: 3.83 ± 0.89
γ = 5.180 μ = 34.071

Entries: 1048
Mean: 4.27 ± 1.15
RMS: 3.48 ± 0.81
γ = 4.890 μ = 31.154
EQU region
def peakIsSelectedEqu(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<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.

![Equ: fit parameter p1=beta](image1)

![Equ: fit parameter p1=beta](image2)
Equ: fit parameter $p_1=\beta$

Entries: 1573
Mean: 17.66 ± 2.95
RMS: 14.81 ± 2.09
$\gamma = 0.475$, $\chi^2 = 4.896$

Equ: event fit angle beta error

Entries: 756
Mean: 2.65 ± 0.78
RMS: 2.56 ± 0.55
$\gamma = 2.516$, $\chi^2 = 9.500$

Equ: event fit angle beta error

Entries: 718
Mean: 4.57 ± 0.91
RMS: 3.92 ± 0.64
$\gamma = 1.817$, $\chi^2 = 5.473$
References

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