

# Test of Peak Finders

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In this note we show how peak finder versions v2,3,4 work on fiber diffraction experiment exp=cxif5315:run=169 data.

## Test data

exp=cxif5315:run=169

## Use of peak finders

See for detail

- Hit/Peak Finding Details - description of algorithms
  - ImgAlgos.PyAlgos - interface methods

We work with peak finder versions v2,3,4. Data processing and peak finding is done in

[cxif5315/proc-cxif5315-r0169-data-pfvn-2016-03-28.py](#)

```

from ImgAlgos.PyAlgos import PyAlgos

alg_arc = PyAlgos(windows=winds_arc, mask=mask_arc, pbites=2)
alg_arc.set_peak_selection_pars(npix_min=4, npix_max=500, amax_thr=0, atot_thr=600, son_min=5)    # for pfv2,4
#alg_arc.set_peak_selection_pars(npix_min=4, npix_max=500, amax_thr=0, atot_thr=600, son_min=10) # for pfv3

alg_equ = # all parameters are the same as for alg_arc

        peaks_arc = alg_arc.peak_finder_v2(ndc, thr=10, r0=6, dr=0.5)                      # Flood-
filling
        #peaks_arc = alg_arc.peak_finder_v3(ndc, rank=6, r0=6, dr=0.5)                      # Ranker
        #peaks_arc = alg_arc.peak_finder_v4(ndc, thr_low=10, thr_high=150, rank=5, r0=6, dr=0.5)  # Droplet-
finder

```

This script saves a peak list:

# Peak list processing

For further peak list processing we use script:

```
cxif5315/proc-cxif5315-r0169-peaks-from-file-v4.py
```

which uses peak selectors.

## Peak Selectors

In this section we list distribution of peak parameters right after peak finders and discuss parameter range for further selection stage in

### peakIsSelectedArc(pk)

```
def peakIsSelectedArc(pk) :
    """Apply peak selection criteria to each peak from file
    """
    if pk.rms>60      : return False
    if pk.sonc<5      : return False
    if pk.atot<1200   : return False
    if pk.r<435       : return False
    if pk.r>443       : return False
    if pk.npix>200    : return False
    if math.fabs(pk.bkgd)>20 : return False
    return True
```

and

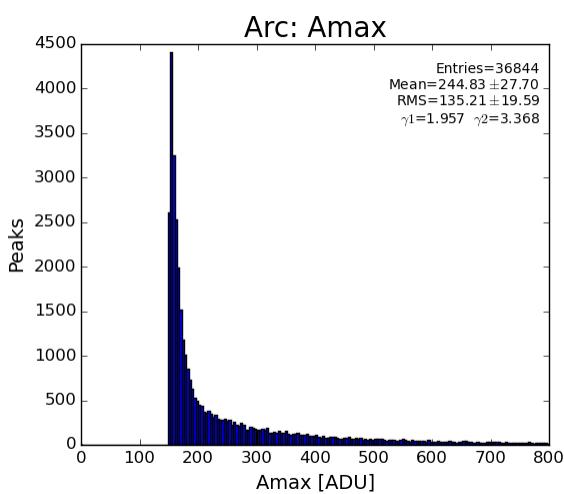
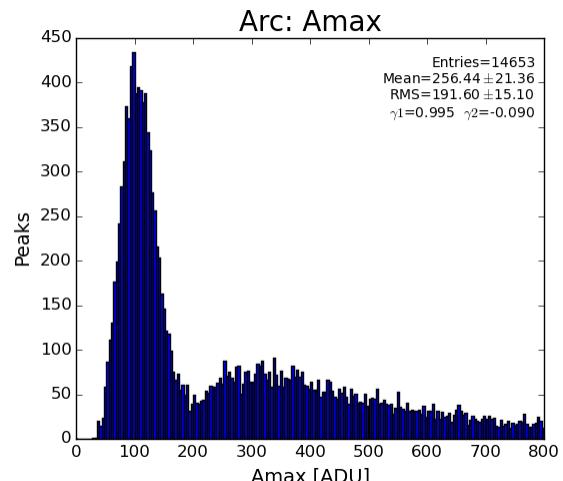
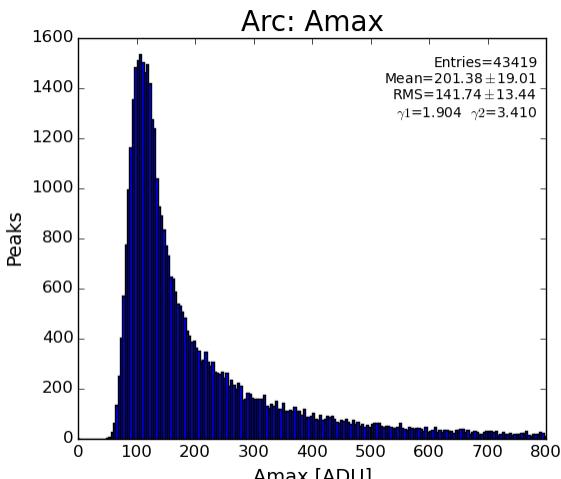
### peakIsSelectedEqu(pk)

```
def peakIsSelectedEqu(pk) :
    """Apply peak selection criteria to each peak from file
    """
    if pk.rms>60      : return False
    if pk.sonc<5      : return False
    if pk.atot<1800   : return False
    if pk.r<100       : return False
    if pk.r>454       : return False
    if pk.npix>200    : return False
    if math.fabs(pk.bkgd)>20 : return False
    return True
```

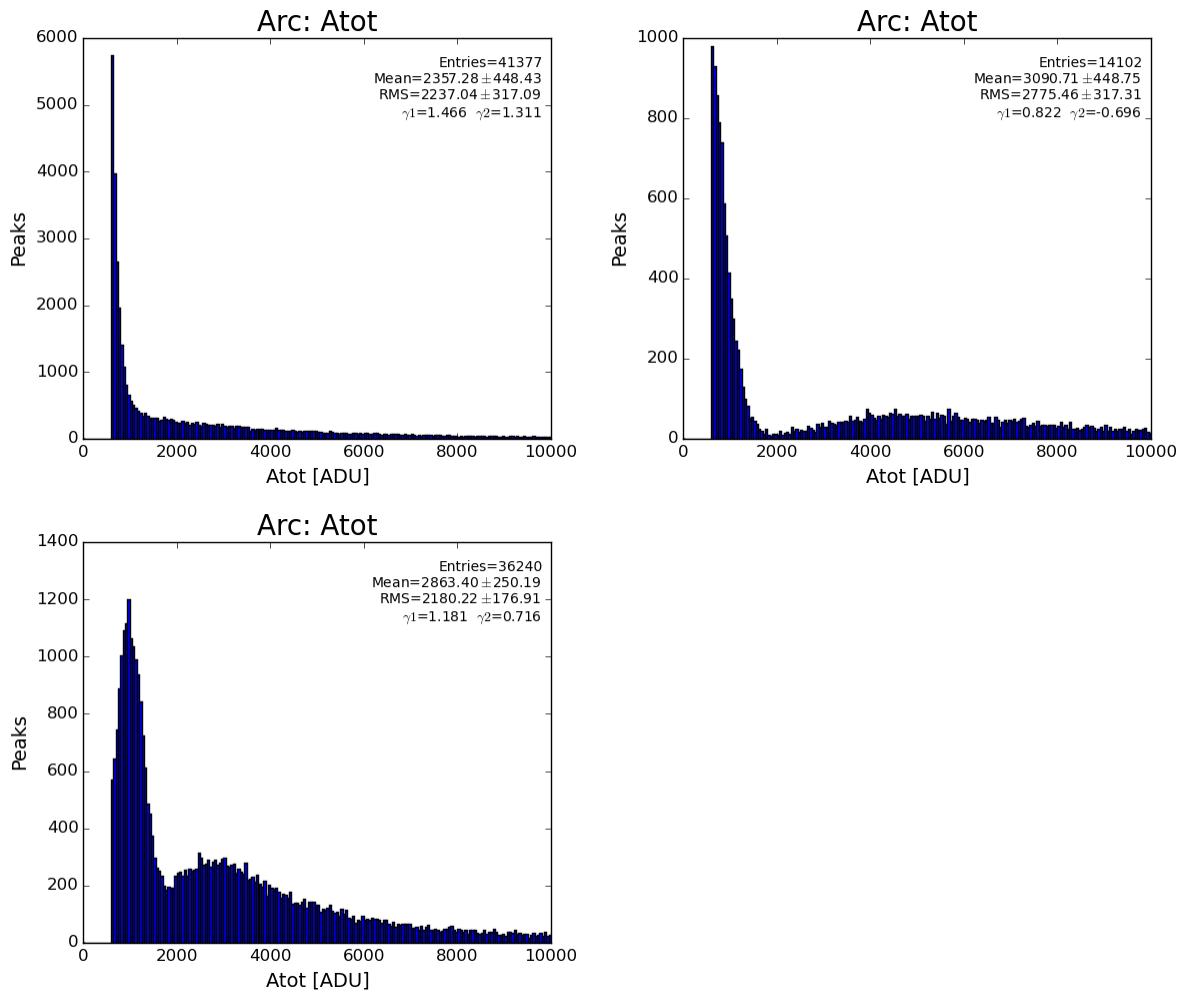
We process Data of cxif5315-r0169 for peaks in ARC and Equatorial region separately. Each triplet of histograms represents peak finder v2, v3, v4, respectively.

## peak\_finder\_v2, v3, v4: ARC

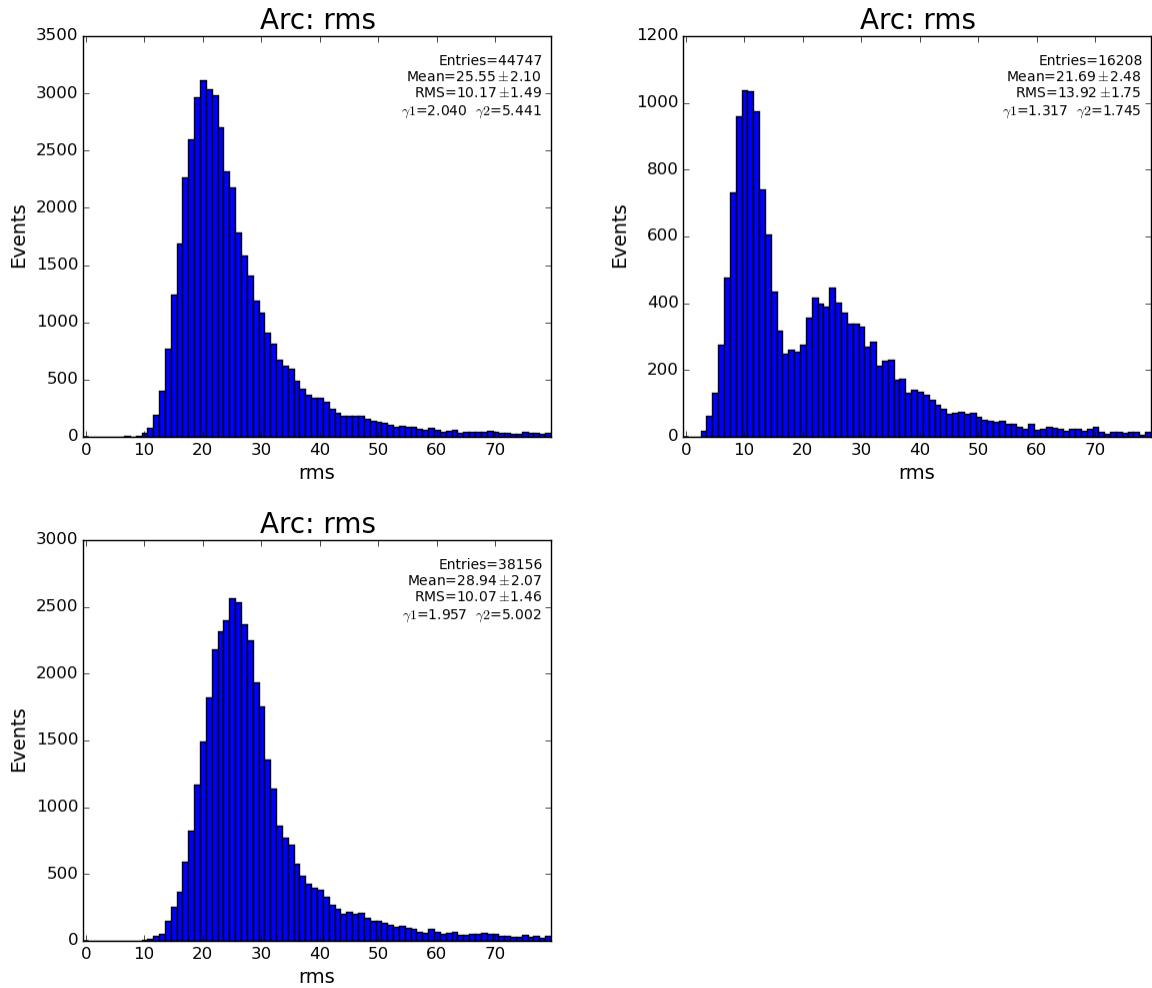
- Amax is only used in pfv4 as  
thr\_high=150  
that helps to reduce a number of seed peaks



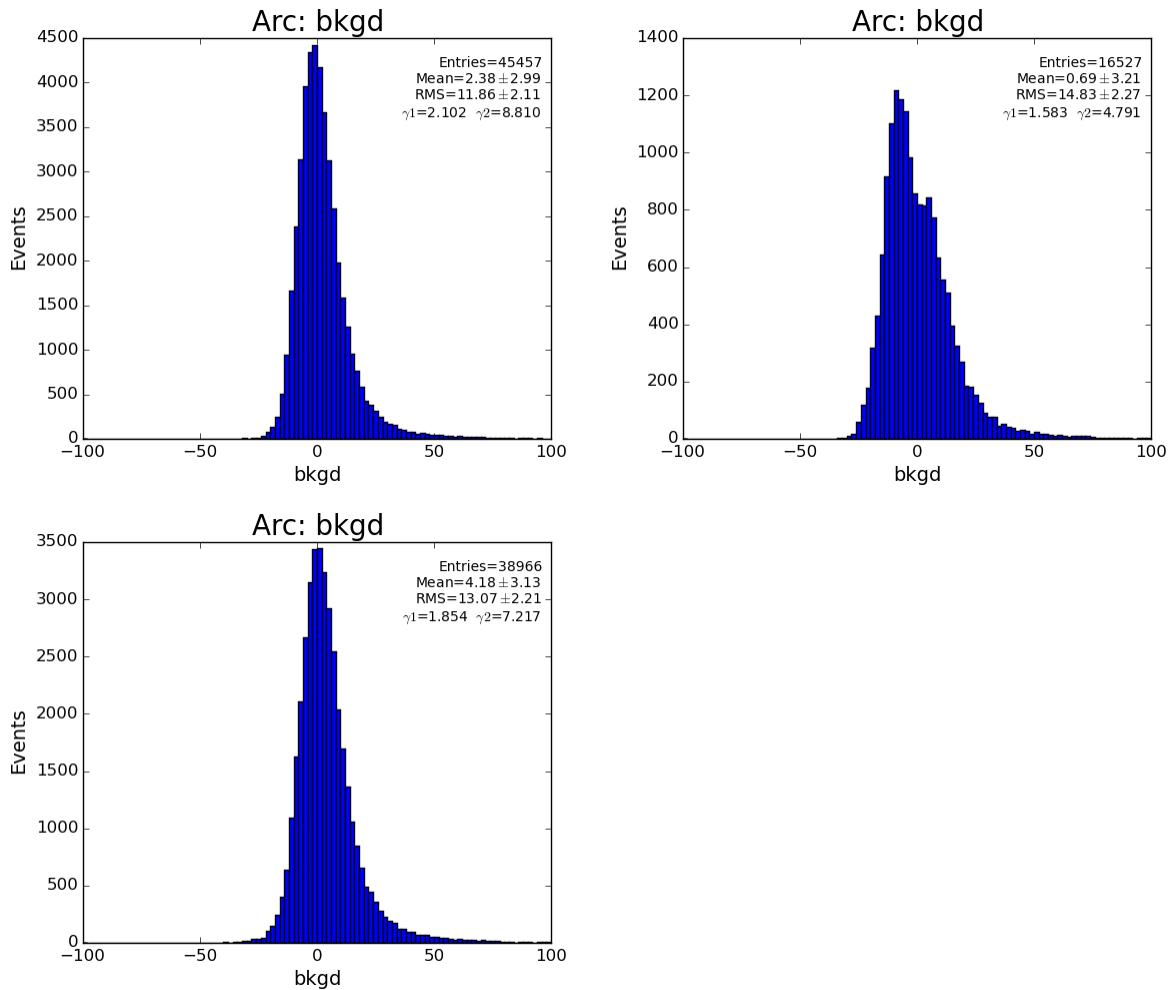
- Atot is used in all peak-finders as  
atot\_thr=600
- ```
if pk.atot<1200 : return False
```
- most likely can be harmlessly increased to 1500-1800ADU



- rms is used in all peak-finders at processing in peak selector  
if `pk.rms>60` : return False

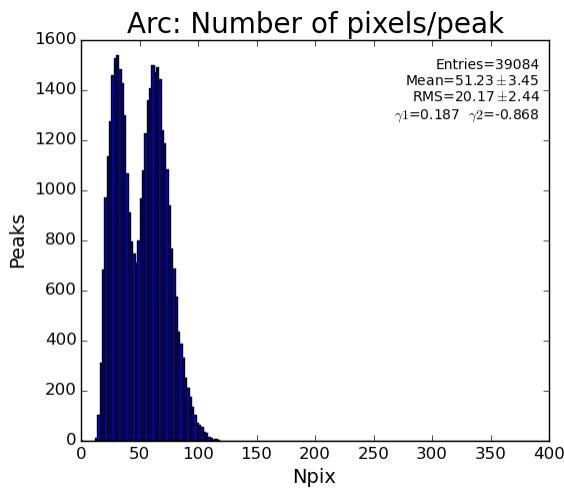
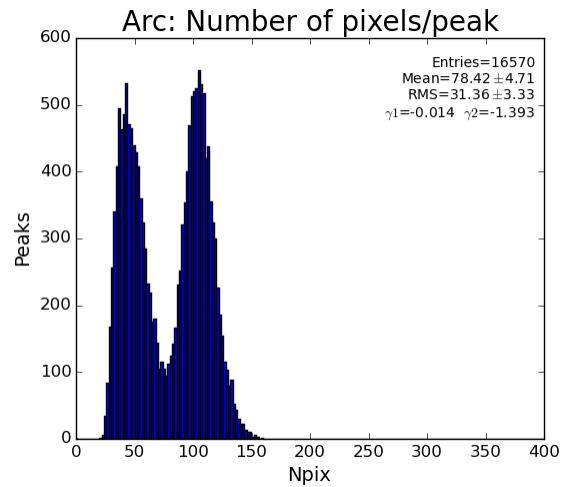
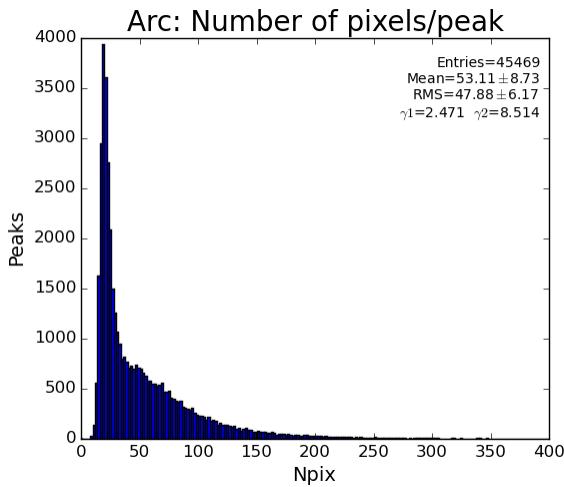


- bkgd is used in all peak-finders at processing in peak selector  
`if math.fabs(pk.bkgd)>20 : return False`

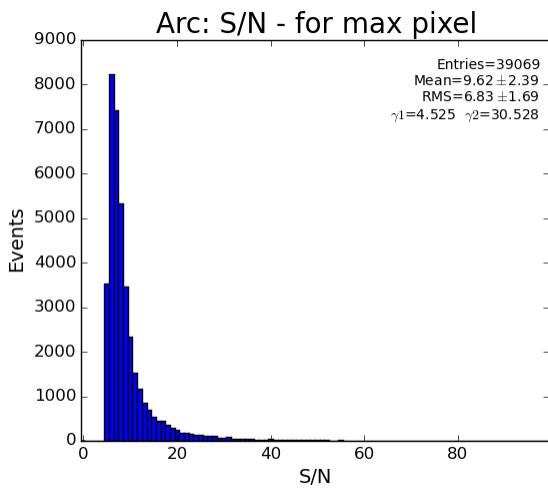
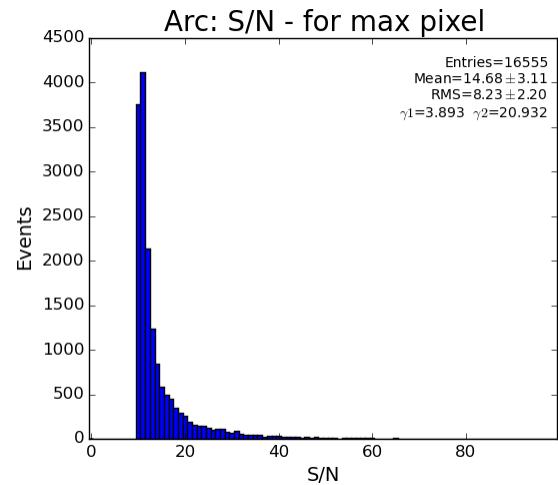
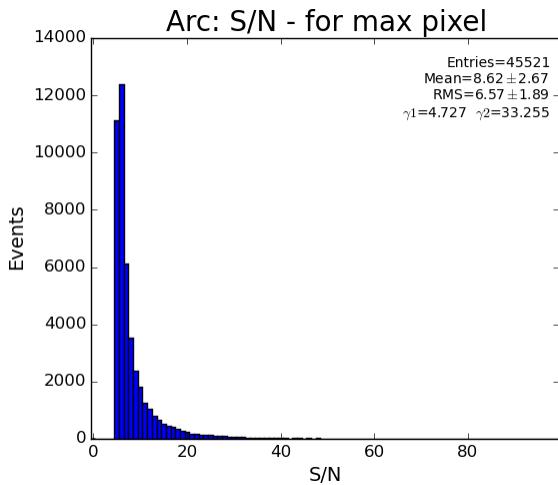


- npix is used in all peak-finders in peak selector  
 $\text{npix\_min}=4$ ,  $\text{npix\_max}=500$

```
if pk.npix>200 : return False
```

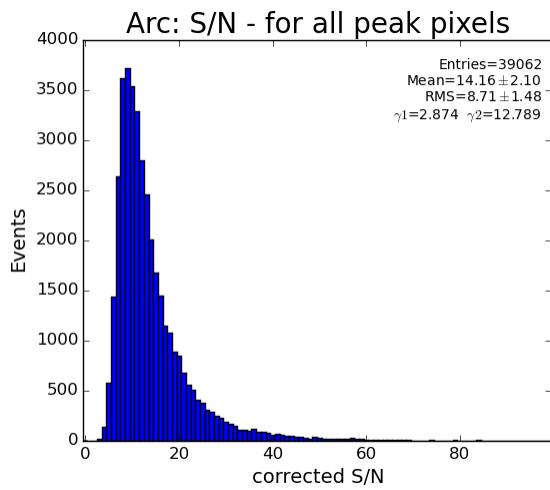
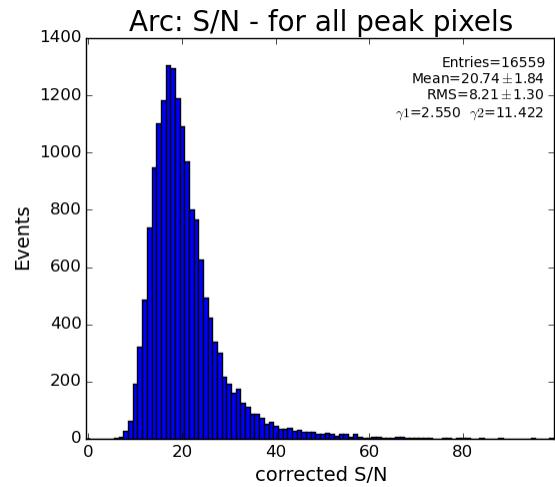
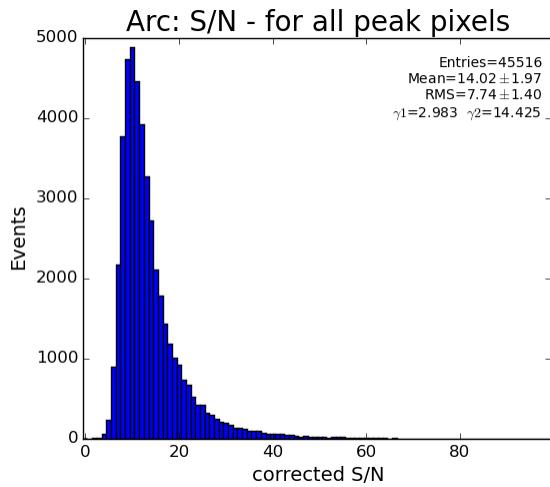


- S/N is used as  
son\_min=5 # for pfv2,4
- son\_min=10 # for pfv3 - Ranker - to eliminate large number of purely statistical seed peaks



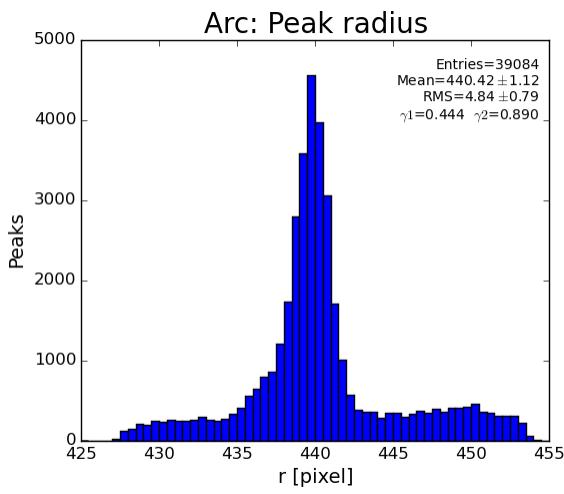
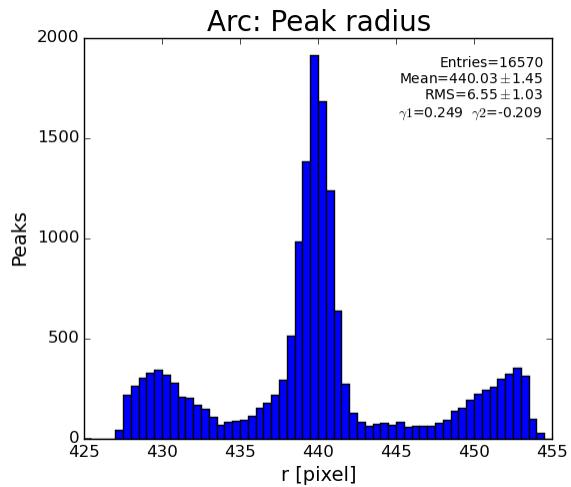
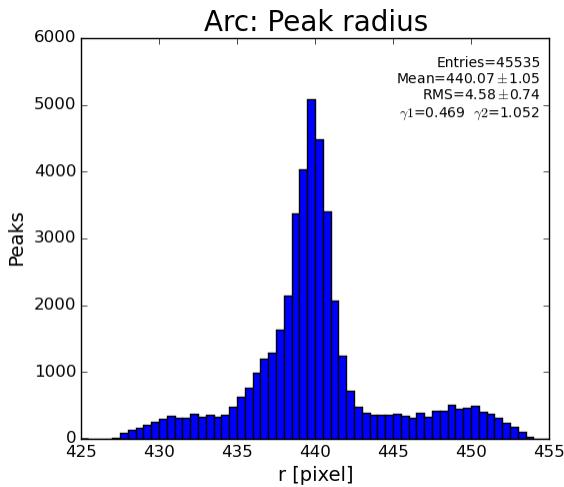
- S/N evaluated for all pixels

```
if pk.sonc<5 : return False
```

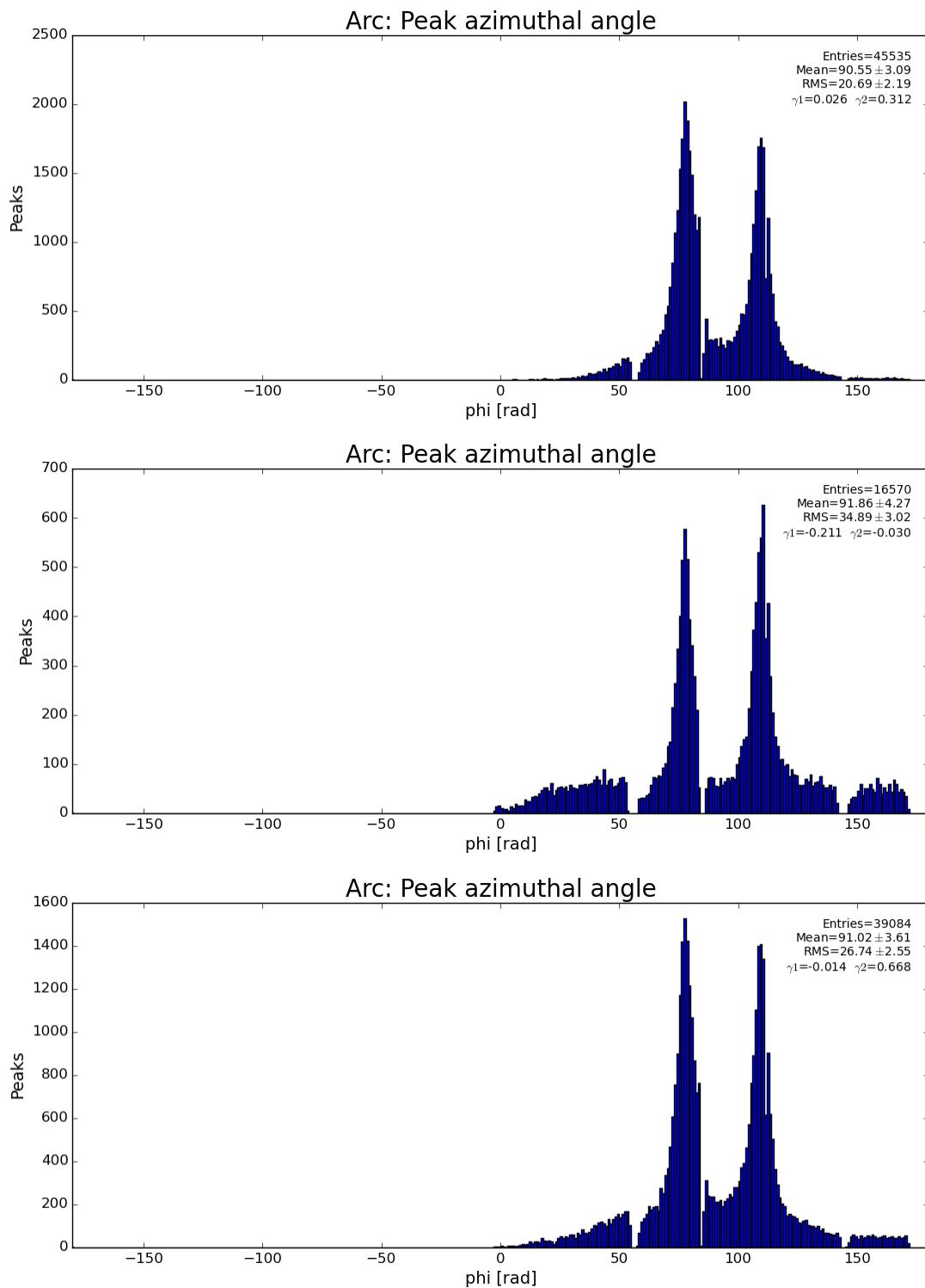


- Peak radius for ARC:

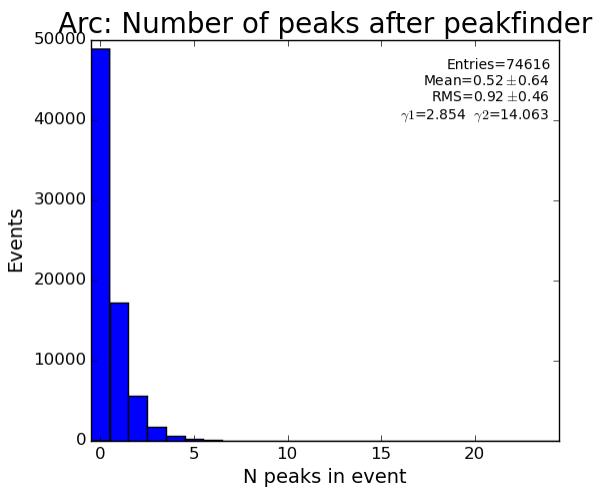
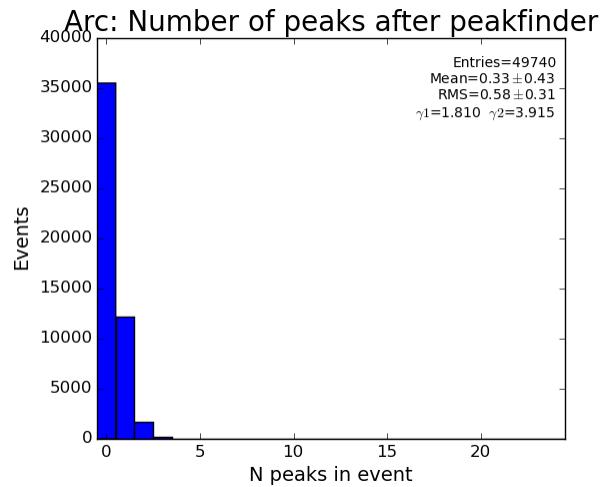
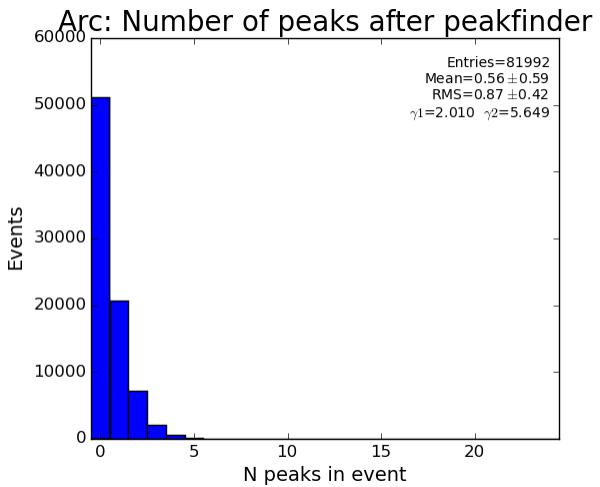
```
if pk.r<435 : return False
if pk.r>443 : return False
```



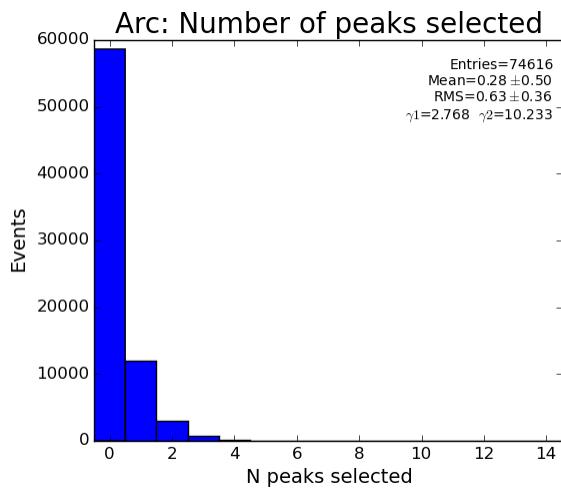
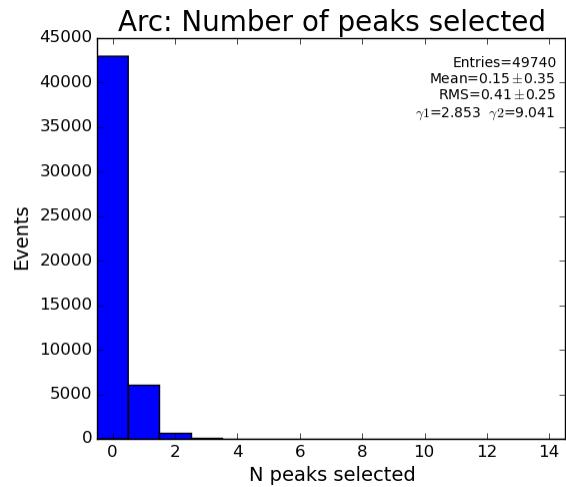
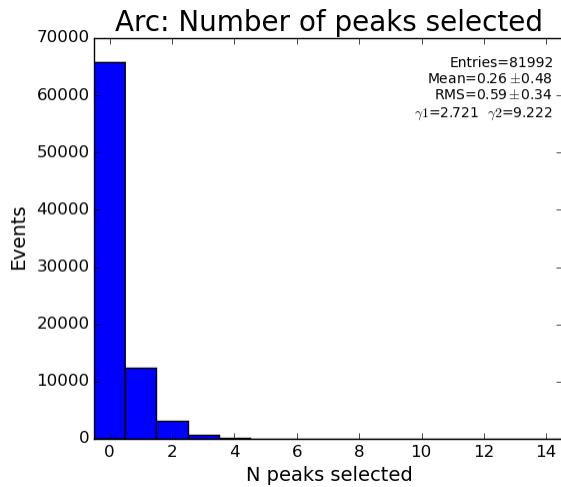
- Peak azimuthal angle is not used in selectors



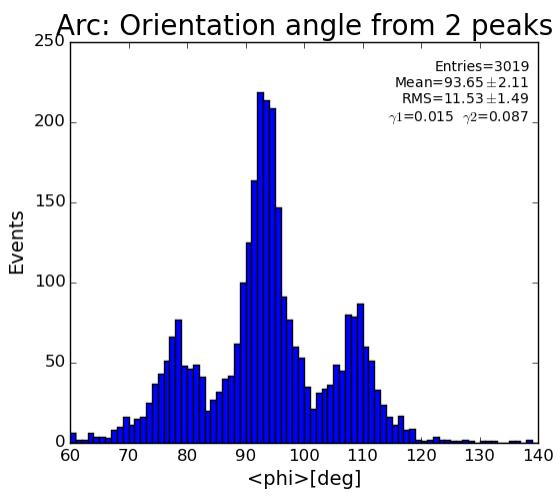
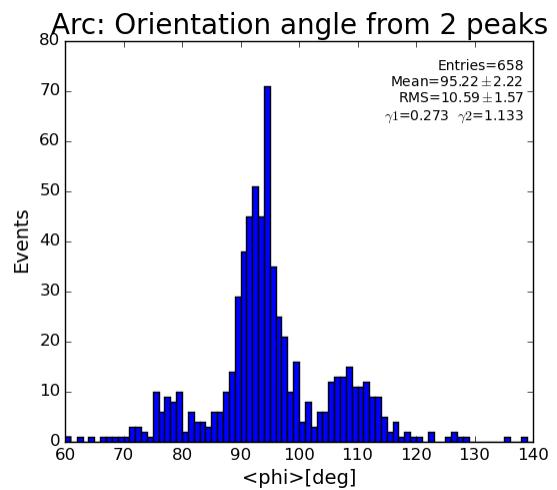
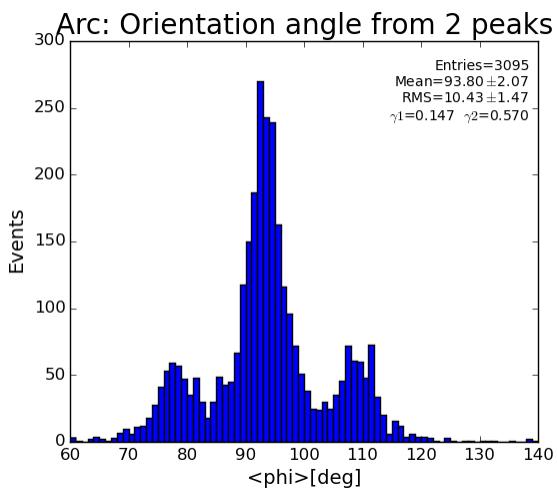
- Number of peaks after peak finder



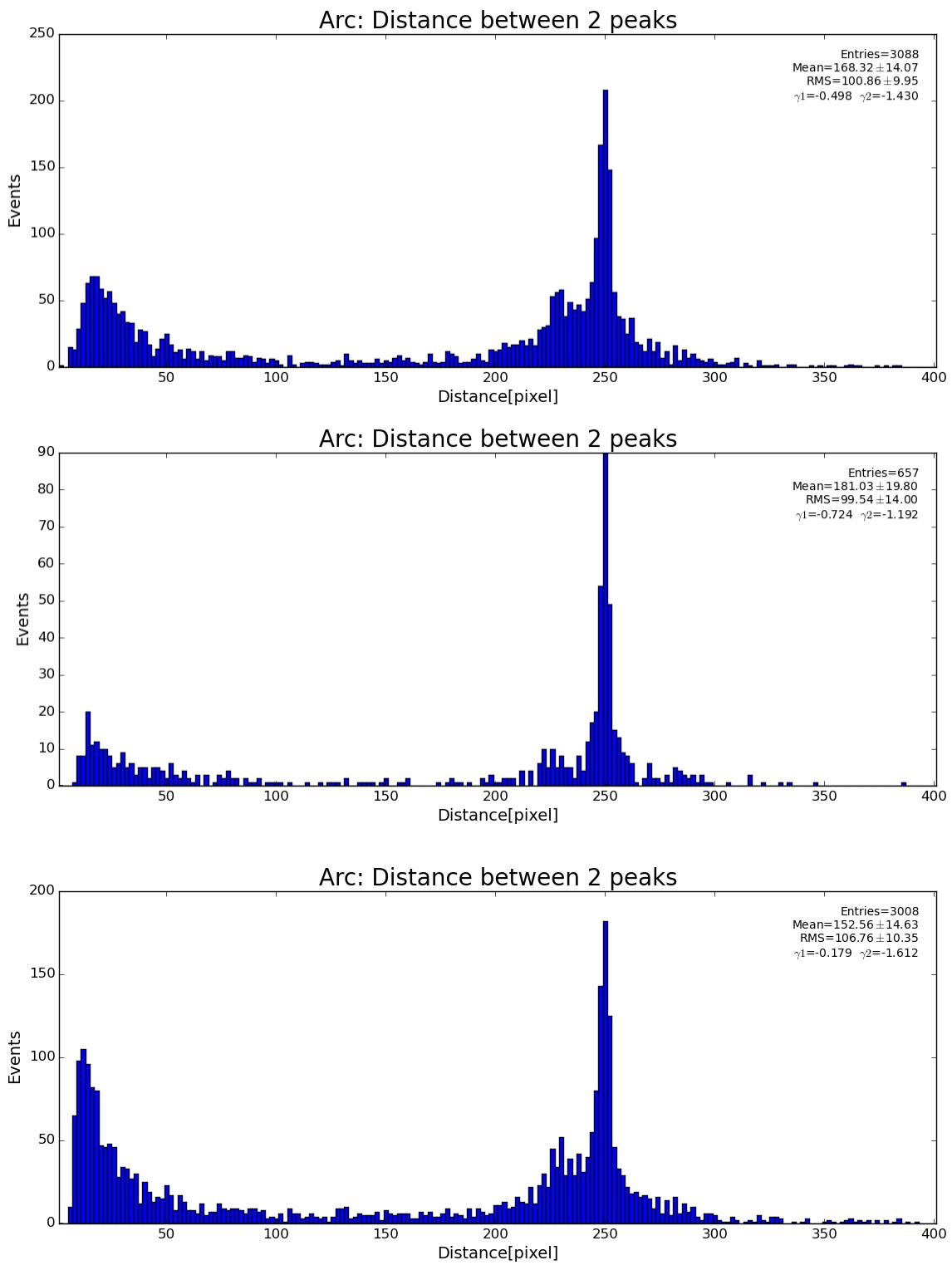
- Number of peaks after `peakIsSelectedArc(pk)`



- Mean orientation angle for two peaks selected in the ARC region

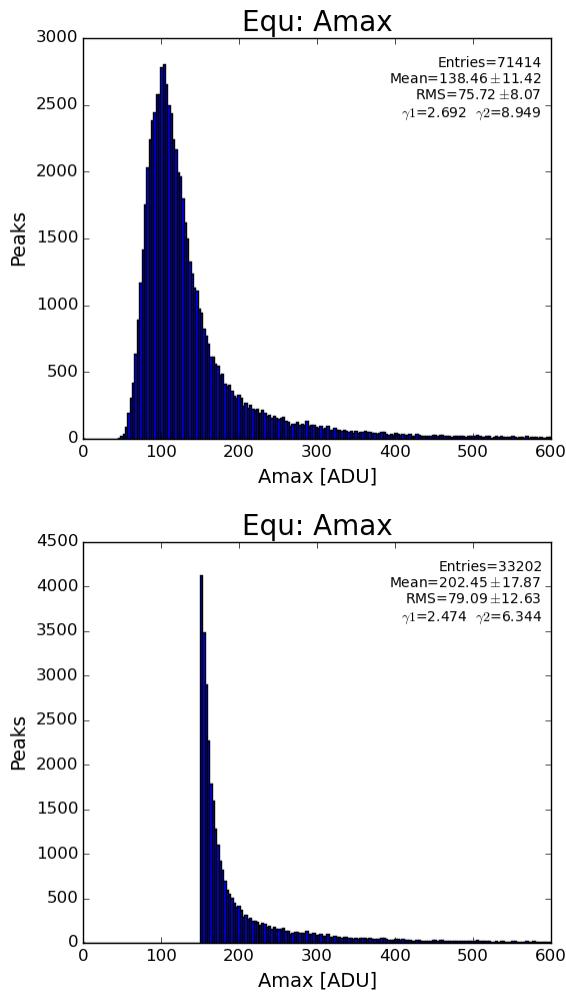


- Distance between two peaks selected in the ARC region

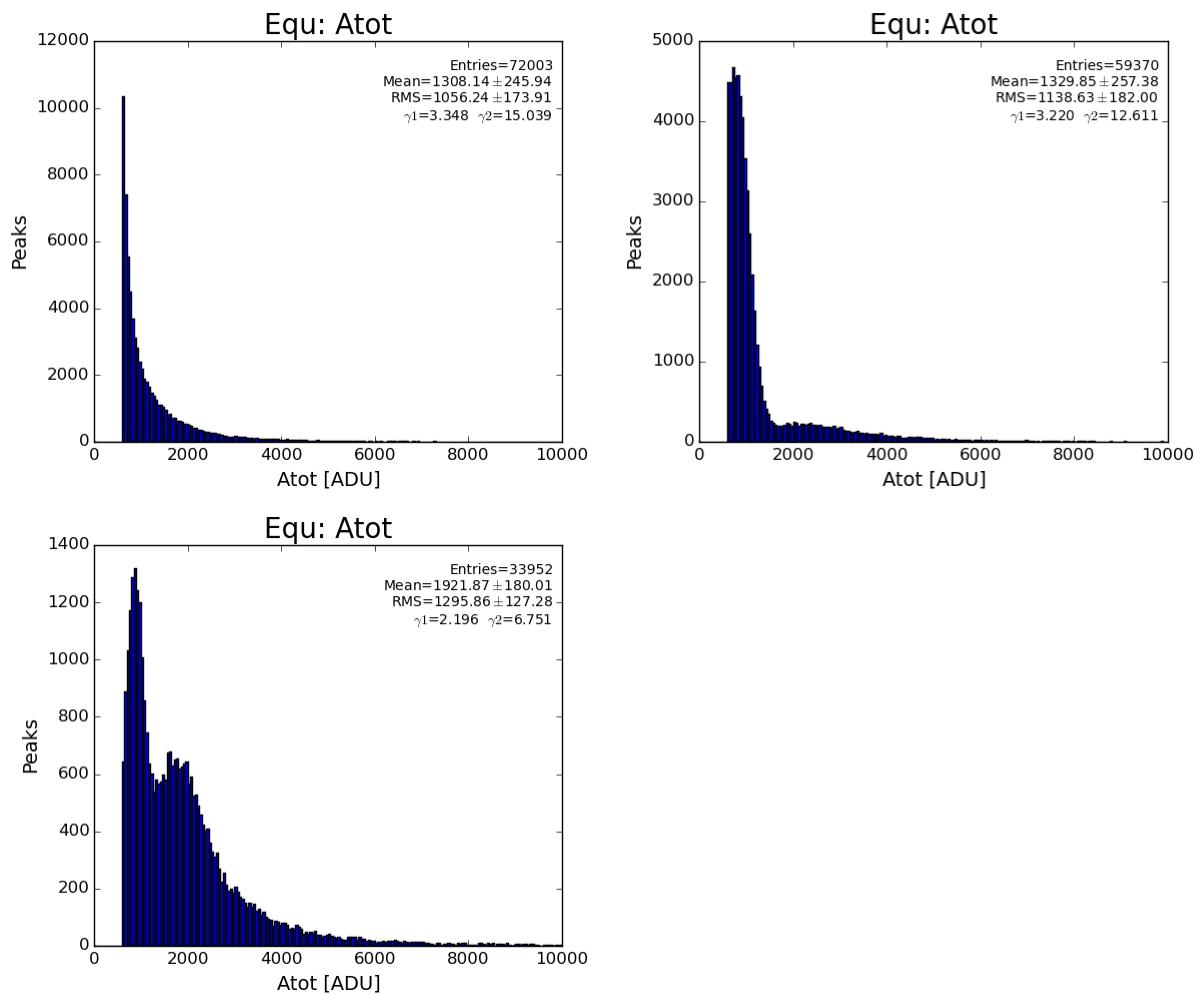


### **peak\_finder\_v2, v3, v4: EQU**

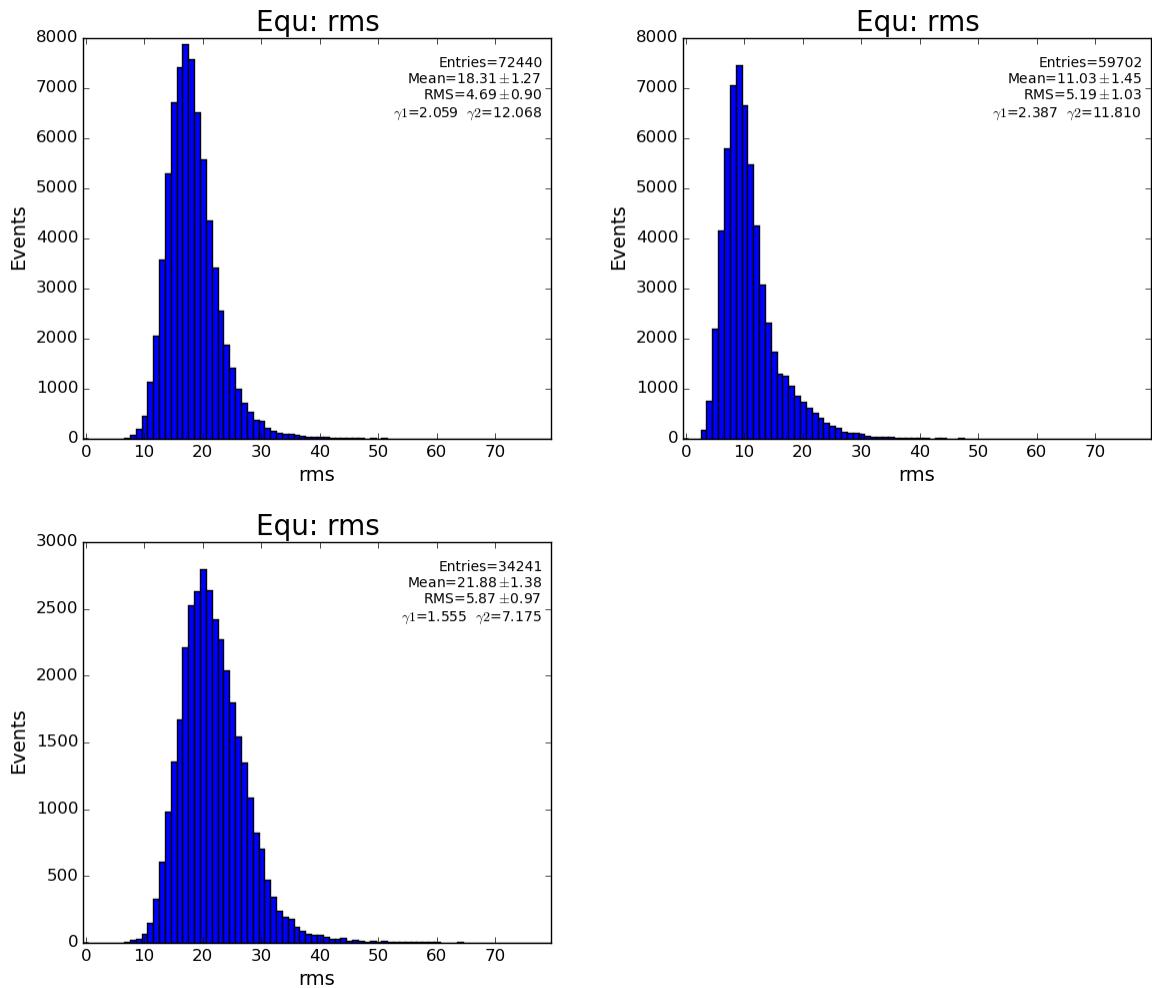
- Amax is only used in pfv4 as  
thr\_high=150



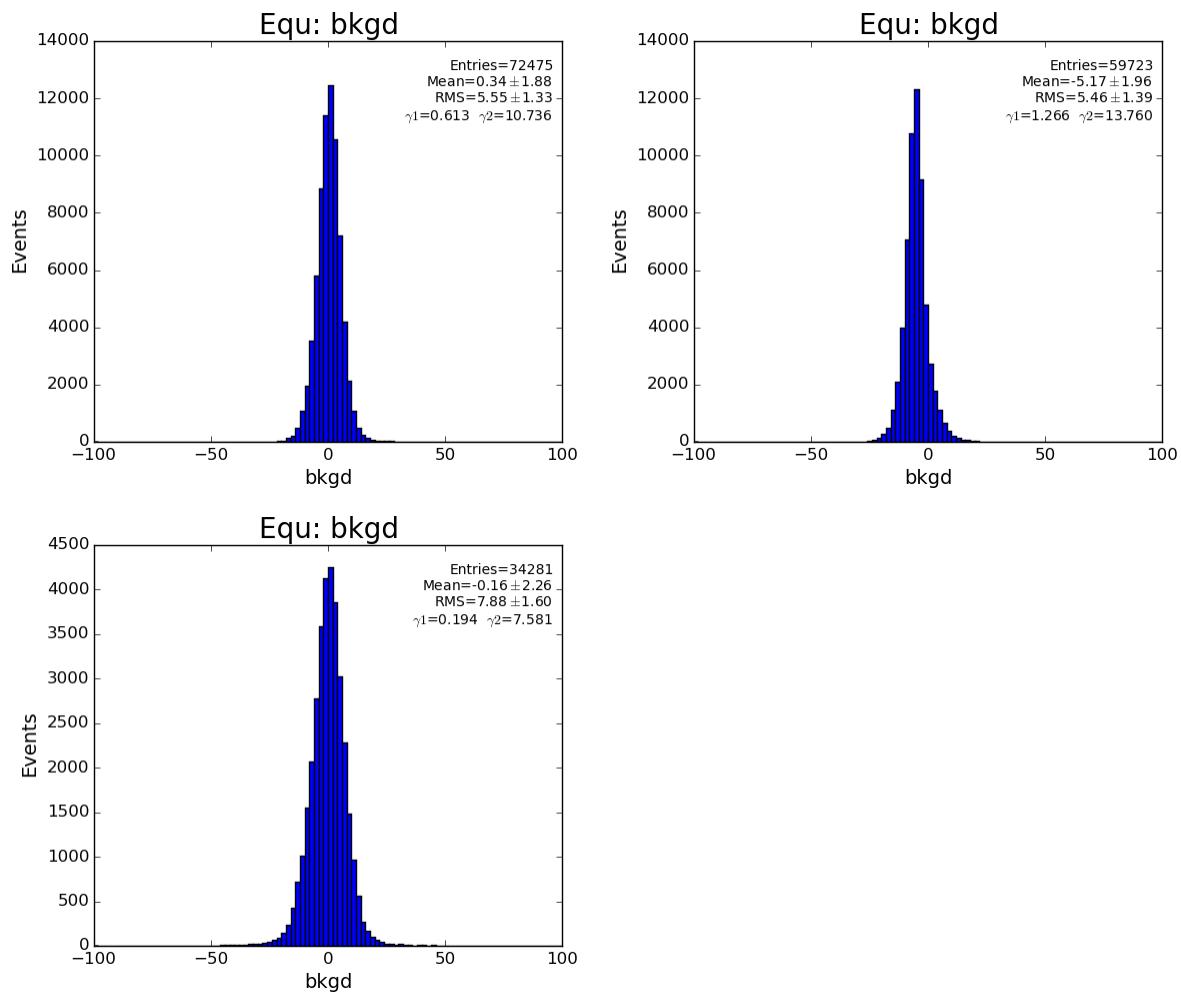
- Atot is used in all peak-finders as  
atot\_thr=600  
if pk.atot<1800 : return False



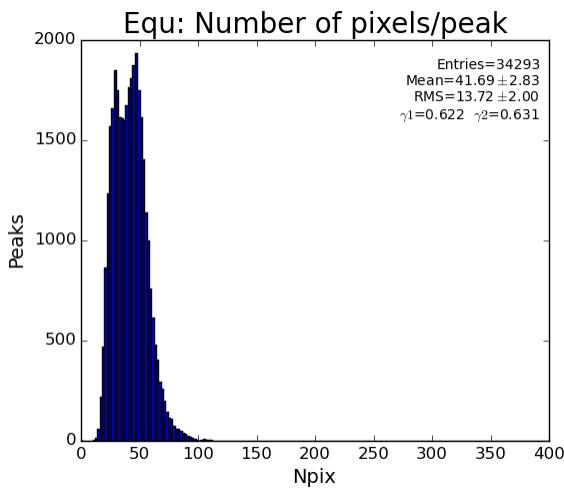
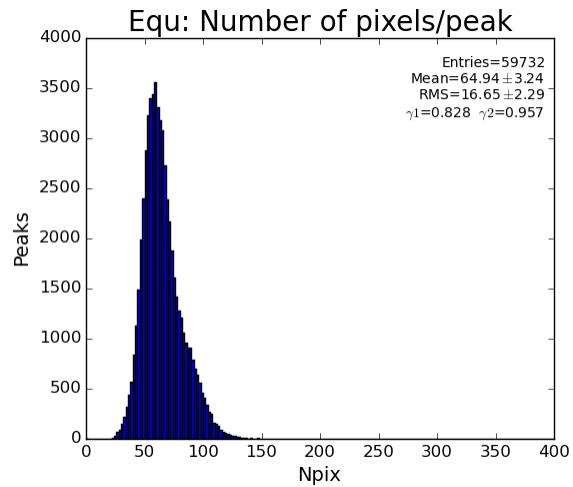
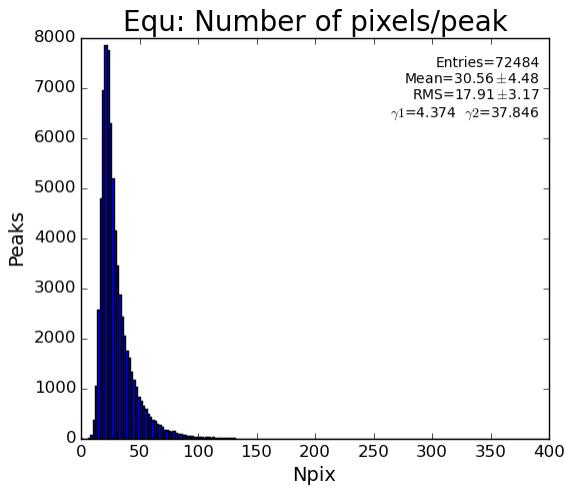
- rms is used in all peak-finders at processing in peak selector  
if `pk.rms>60` : return False



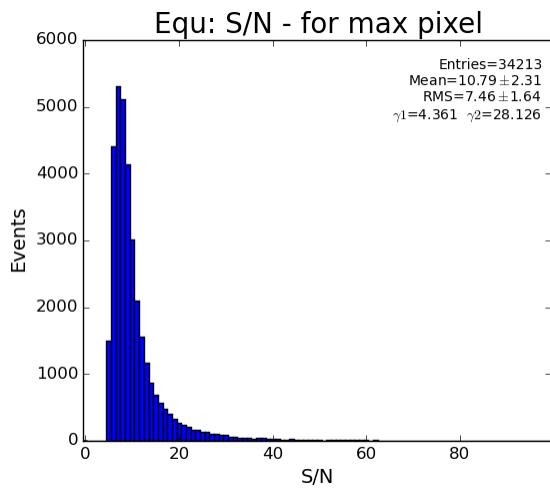
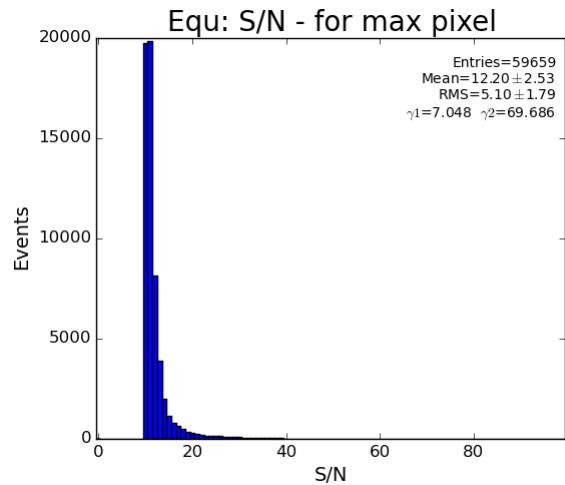
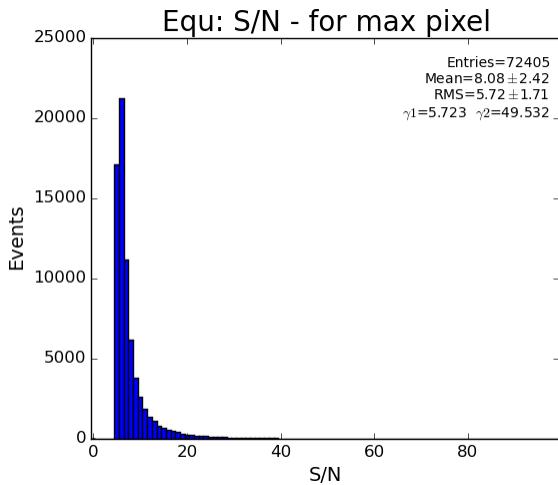
- bkgd is used in all peak-finders at processing in peak selector  
`if math.fabs(pk.bkgd)>20 : return False`



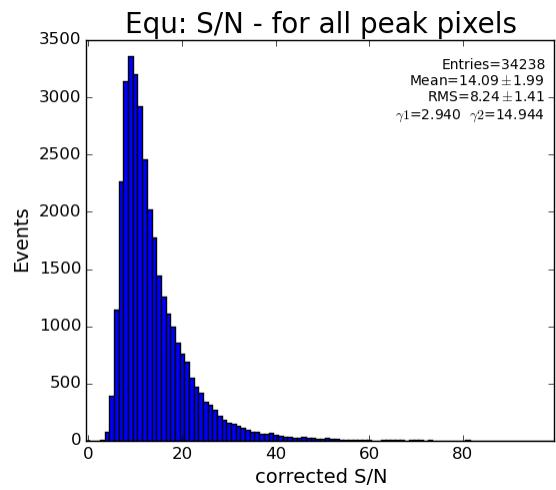
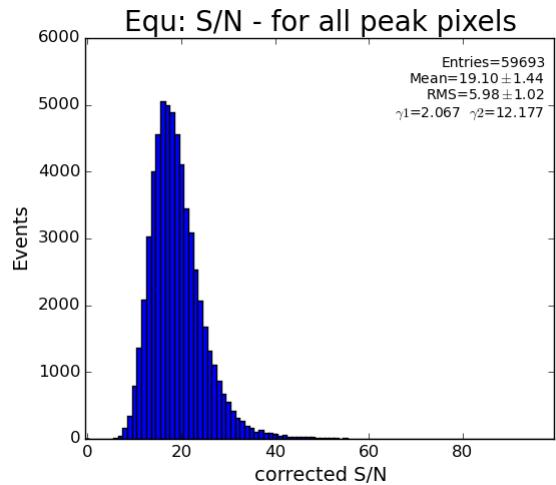
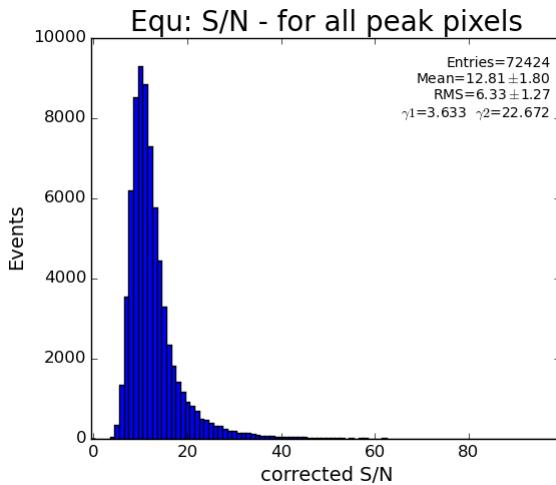
- npix is used in all peak finders in peak selector  
`npix_min=4, npix_max=500  
if pk.npix>200 : return False`



- S/N is used as  
`son_min=5 # for pfv2,4`  
`son_min=10 # for pfv3 - Ranker - to eliminate large number of purely statistical seed peaks`

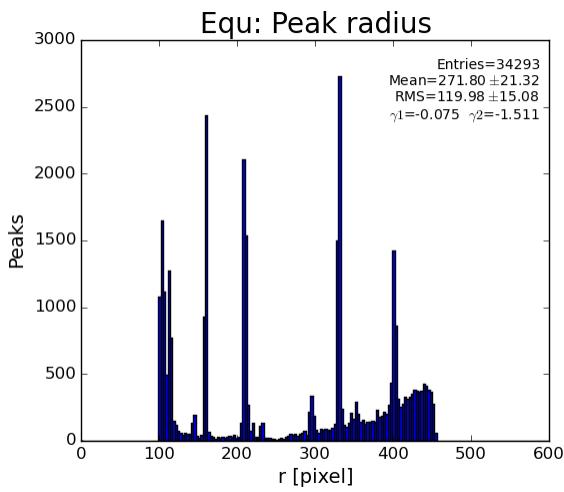
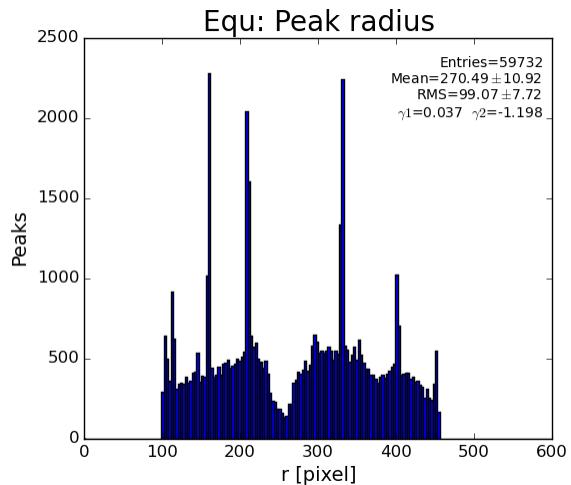
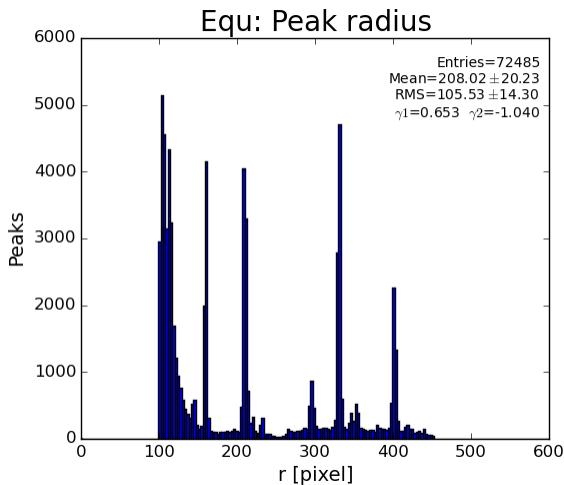


- S/N evaluated for all pixels  
if pk.sonc<5 : return False

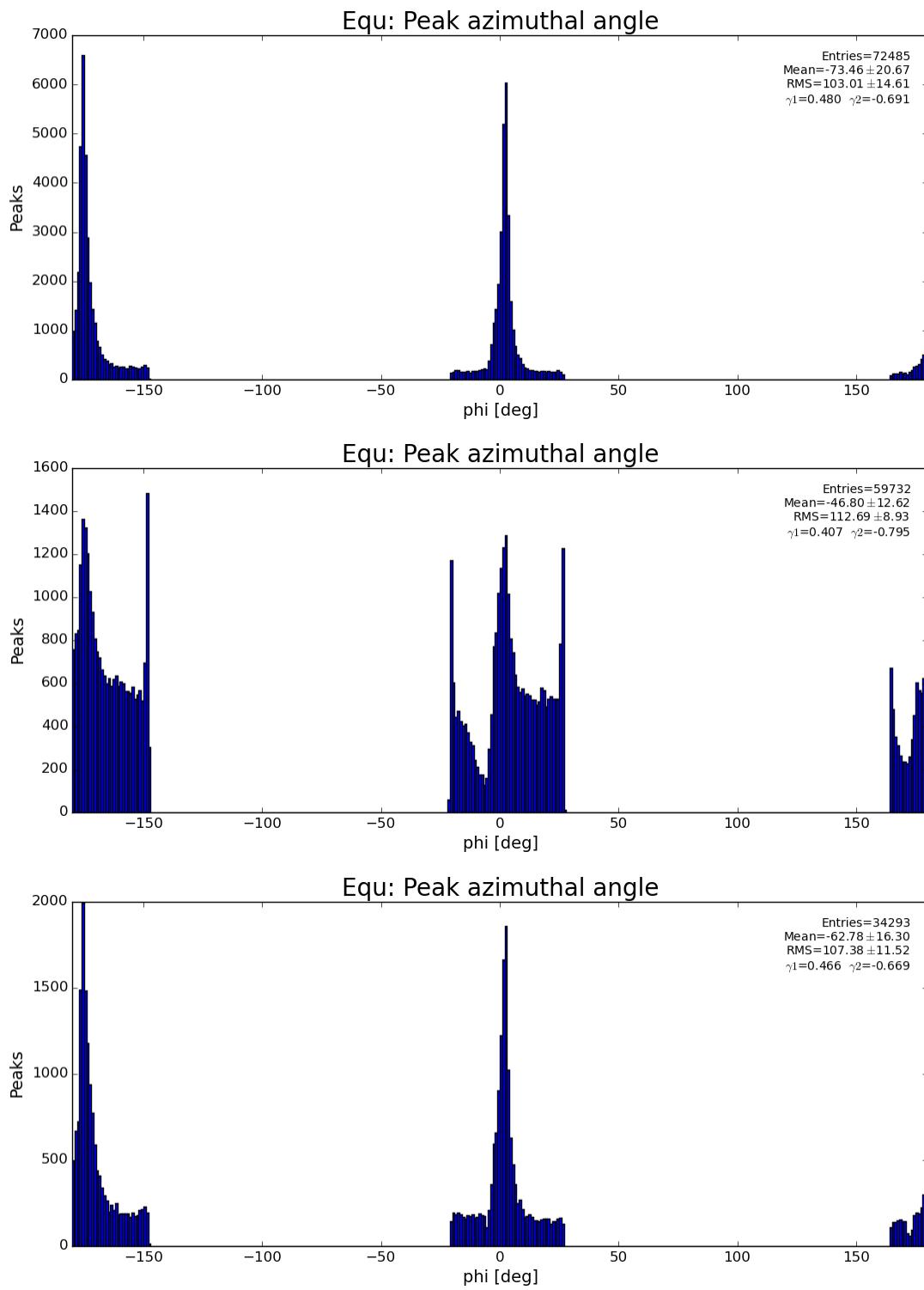


- Radial parameter for equatorial region:
 

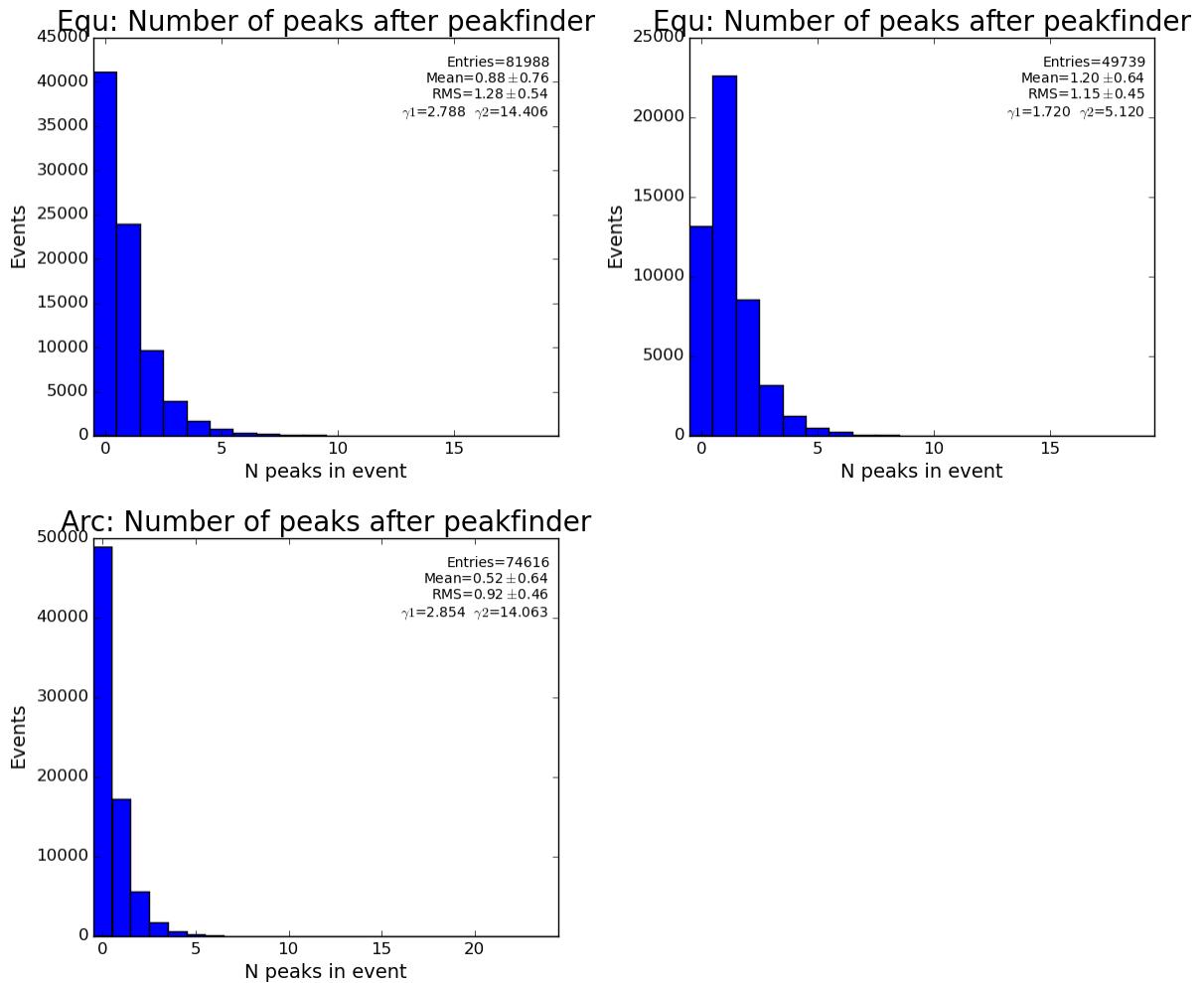
```
if pk.r<100 : return False
if pk.r>454 : return False
```



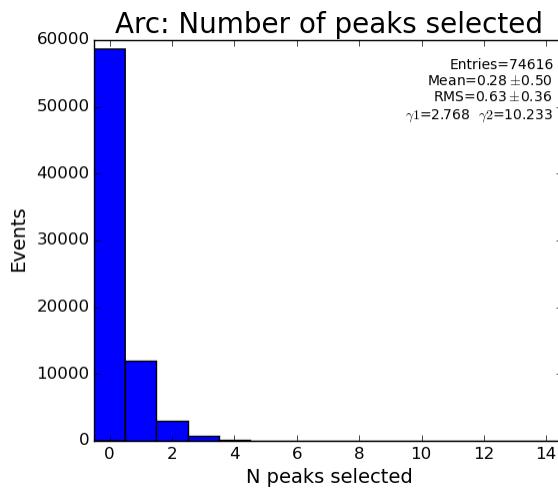
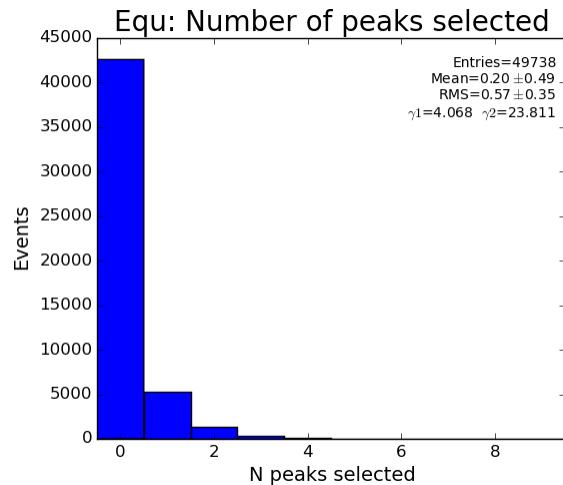
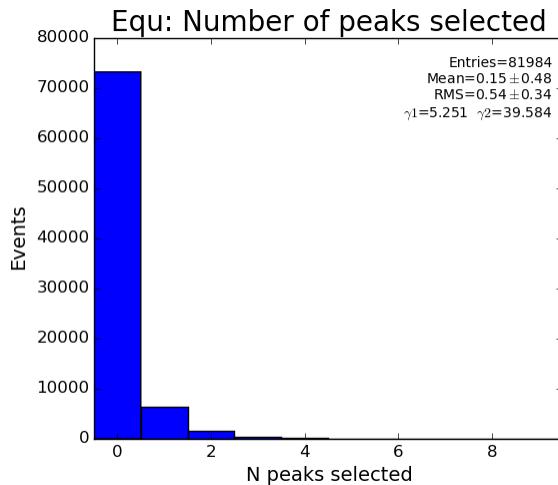
- Peak azimuthal angle is not used in selectors



- Number of peaks after peak finder



- Number of peaks after `peakIsSelectedArc(pk)`



## Comparison of the pfv2 with Cheetah list of peaks

Code for comparison: cxif5315/peak-list-comp-cheetah.py

Peak lists for comparison:

- peakfinder: pfv2-cxif5315-r0169-2016-03-28T15:02:47.txt
- cheetah: r0169-cheetah-peaks.txt - with unknown origin...

Comparison algorithm and conditions

Use pyimgalos.TDFFileContainer for both peakfinder and cheetah

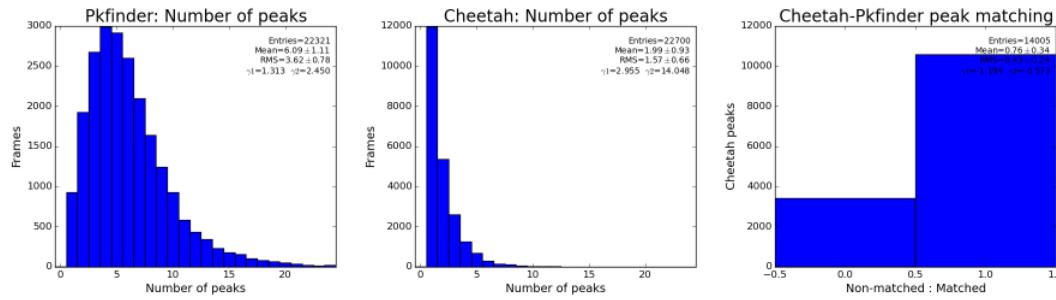
```
fc_ch = TDFFileContainer(fncheet, indhdr='frameNumber', objtype=TDCheetahPeakRecord) # , pbits=256)
fc_pf = TDFFileContainer(fnppeaks, indhdr='Evnum', objtype=TDPeakRecord) #, pbits=256)
```

- Loop over all groups (frames/events) in cheetah
  - Find associated peak-finder group: `gr_pf = fc_pf.group(evnum-1)` # accounts for -1 offset in event numeration in Cheetah and pf.
  - count cases when peak-finder group does not exist (peaks not found)
  - discard frames if fidelity do not match
  - discard frames with more than 5 peaks
  - loop over cheetah peaks
    - discard cheetah peaks outside ROI mask
    - loop over pf-peaks and check that cheetah peak can be matched with one of them by location (s, r, c)
    - if not-matched - print peak main features

Statistics for number of peaks:

- total in Cheetah: 14002
- matched: 10593
- not-matched: 3409
- fraction of matched: 0.757

Plots for number of peaks in peak-finder, Cheetah, and number of non-matched:matched Cheetah peaks.



Peak-finder number of peaks accounts for arc region.

## References

- [ImgAlgos.PyAlgos](#)
- [Hit/Peak Finding Details](#)