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Section 1

Running SMT Examine In the Control Room

1. To run examine, you should be on d0ol22 or d0ol28 and logged in as *d0smt*.
   (for login do: d0ssh <node name> or ssh -l <user name> <node name>)
2. Type commands:
   - cd /online/examines/t02.08.00/smt_examine
   - cd bin/Linux2.4-KCC_4_0
   - run_online.sh
3. Examine runs under interactive framework, so it understands framework commands.

   Type:

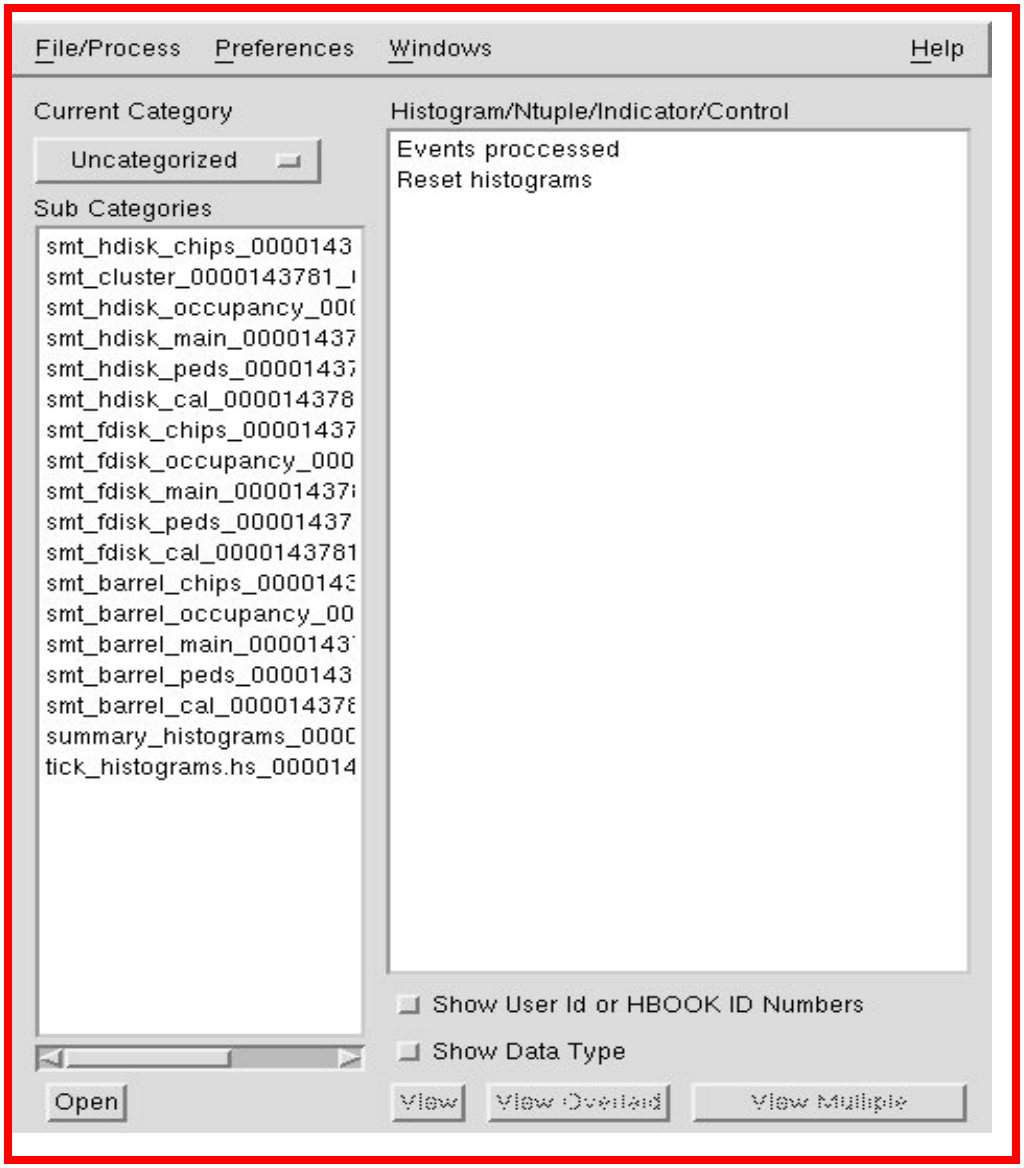
   - *init* to start Examine initialization. When init finished the Histo-Scope window will apear automatically.
   - *start* to start processing events.
   - *pause* to pause Examine and *resume* to resume.
   - *report smt_examine* to reset histograms. (Reseting also available from Histo-Scope).
   - *stop* to stop SMT Examine and *quit* to quit program.
4. In case of any problems occur, look in the *error.log* file and refer to errors and warnings page to understand what kind of error caused problems.
5. To run occupancy monitor type:
   ./examine_gui.py crates in the same directory where smt_examine is running. (Note: occupancy monitor runs only together with smt_examine because it uses smt_examine output.)

Section 2

How to look at a Histoscope window

(While reading this section keepr refering to Section 3 and Section 4)

- A histoscope window looks like the following(Window1):

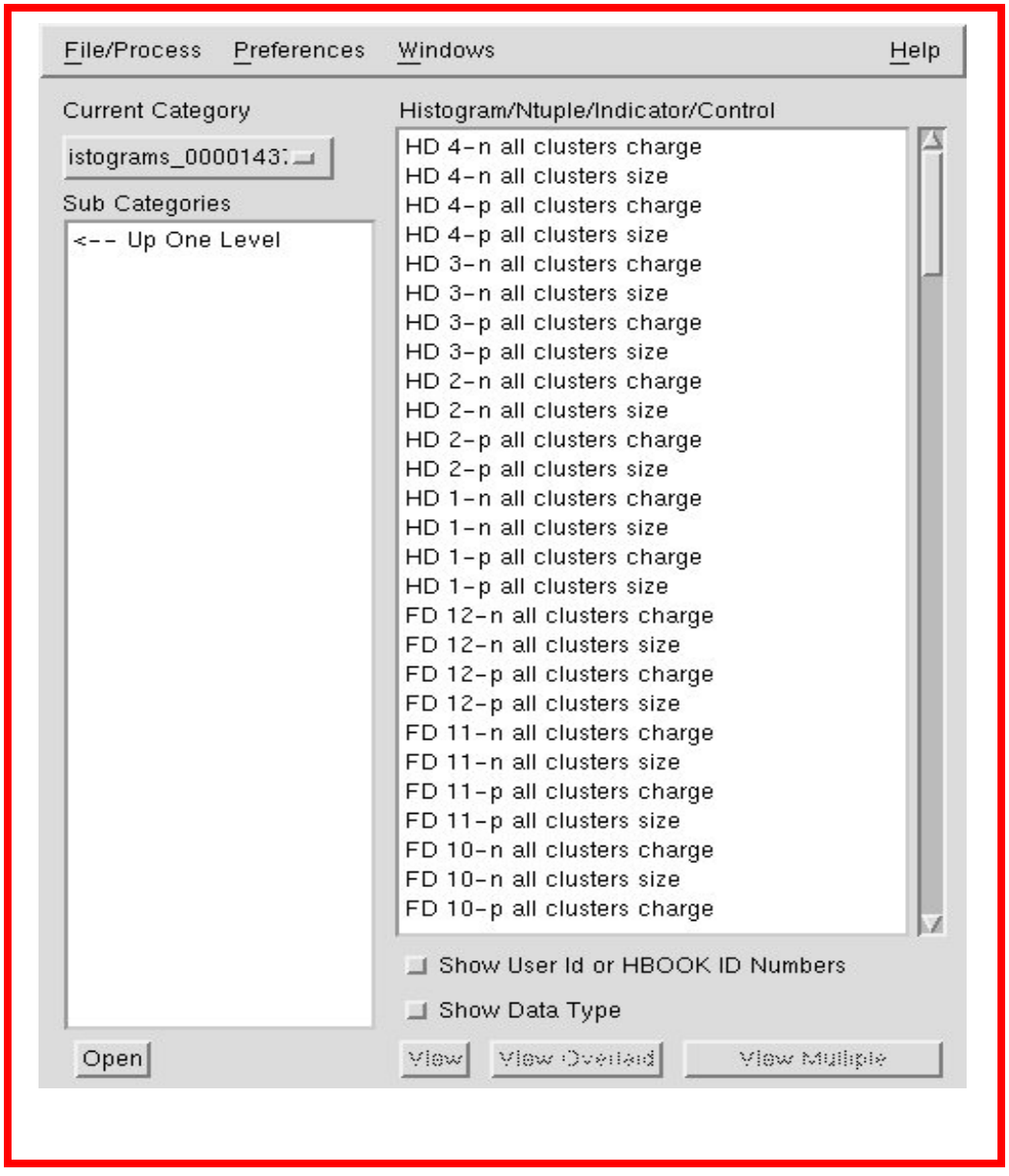


- If histoscope is running already, such a window should be present.
- You can see a list of histoscope files on the left part of the window. Each file name has the run number in it. An idea of the content of these files can be had by reading SECTION 3. Barrel, Fdisk, Hdisk files have similar names like

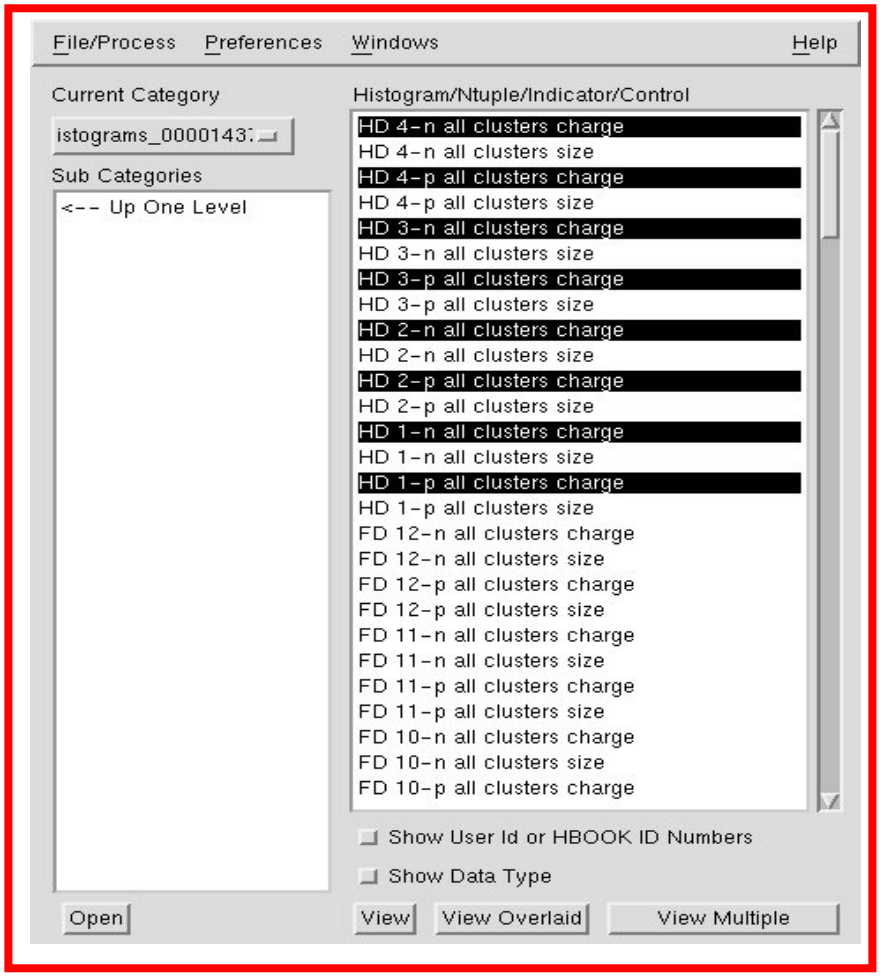
smt_barrel_occupancy_0000143781.hs
smt_fdisk_occupancy_0000143781.hs
smt_hdisk_occupancy_0000143781.hs

- A shifter should first look at summary_histograms_#####.hs file. These are the only plots that we are interested in saving besides the plots of the devices that you may find causing anomalous “spikes” in These cluster distributions.

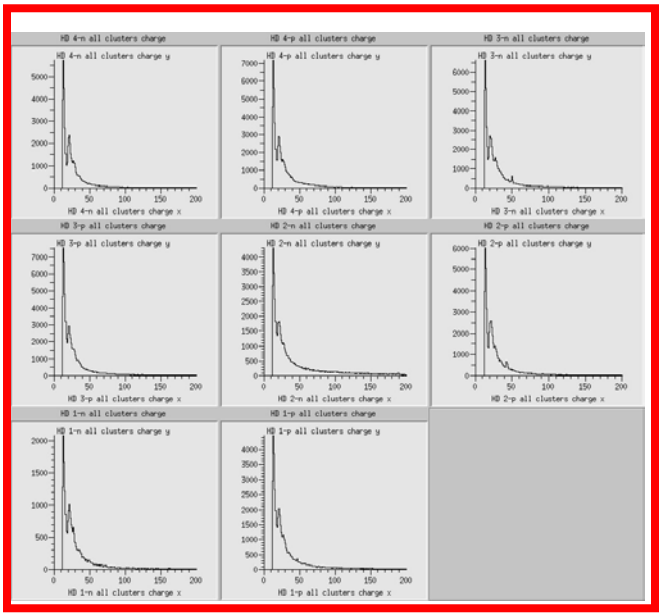
- Double click on its name. After this action the histoscope window would like the following(Window 2):



- By clicking on the "← up one level", you can go back to Window 1.
- Scroll down the window. It has plots of cluster size and cluster charge distributions for ladders/wedges of barrel, fdisk and hdisk. You can double click on the plot names to see them. A histoscope window will pop up showing the clicked plot.
- You can make a multiple selction also i.e. seeing more than one plot in a single window. Press "Ctrl" button and select for example hdisk cluster distributions the cluster charge distributions. After making selection, release the "Ctrl" button and click on "View Multiple" button in the histoscope window. At this instant you do this the histoscope window would look like the following(Window3):



- The result of above step would be a window(Window 4) like(for Hdisk). The contents of the plot this Window 4 are not important. This is just to show how the window looks like.



- You should also make such multiple selection for fdisk and barrel seperately. Simply select all the plot in which you find "cluster charge" and hit "view multiple" button.

- You should store plots of in the directory :

  /home/d0smt/SHIFTS/*year*/*month*/*date*/*shift*

  For e.g. /home/d0smt/SHIFTS/2002/mar/01/owl

- HOW TO SAVE THE PLOT WINDOW(Window 4) in a file

  - Go to the directory
    /home/d0smt/SHIFTS/*year*/*month*/*date*/*shift*

  - At the command prompt type(hdisk.jpg is just a file name)

    import hdisk.jpg

  - Go to the "Window 4" and click on the top with middle button

of the mouse. You will see that prompt returns in the the window where you typed " import hdisk.jpg". See if the file is there.

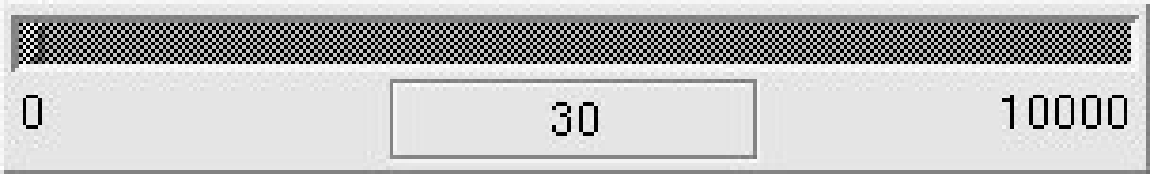
- HOW TO RESET HISTOSCOPE

  Double click on "Reset histograms" in Window 1. A very small window like the following pops up.

  Left-mouse-hit on it. All histoscope plots would be reset.

- HOW TO LOOK AT THE NUMBER OF EVENTS PROCESSED

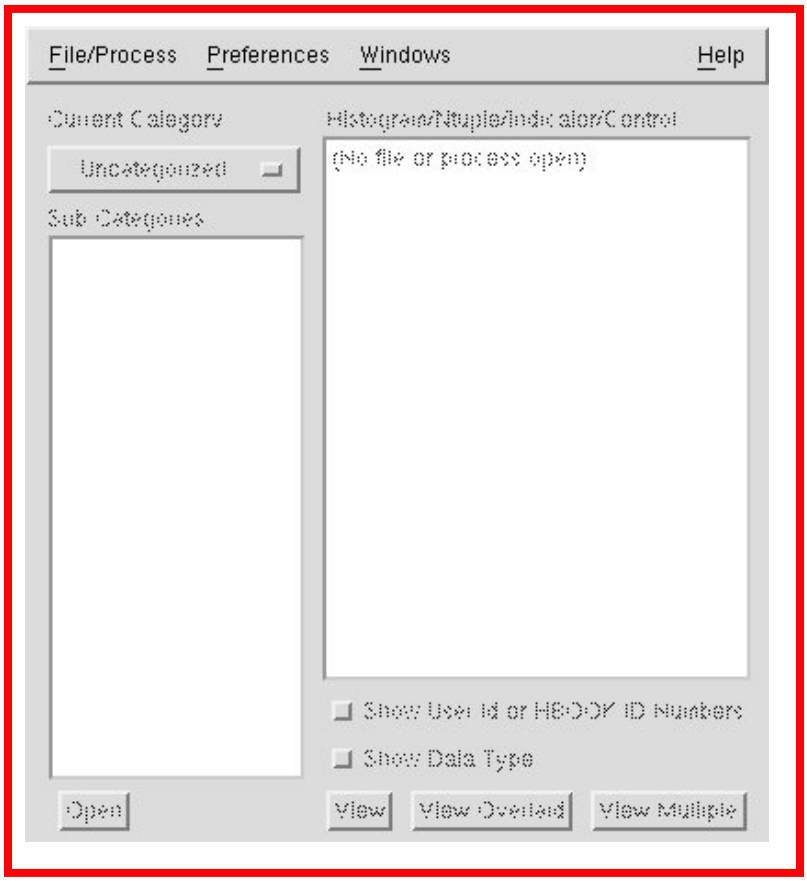
  Double click on "Events prosessed" in Window 1. A small window Pops up like



  Here 30 are the number of events processed.

- If you close this window by mistake you can open an x-window and start histoscope typing by typing *histo&* in the following directory */online/examines/t02.08.00/smt_examine/bin/Linux2.4-KCC_4_0*

- After typing histo& , histoscope will open like the following window From “File/Process” connect to the process running examine. Wait For a while till this window looks like Window 1.



Monitoring data quality in the Control Room with SMT Examine

1. Summary cluster distributions

- Open *summary_histograms_xxxx.hs* and look at *Summary cluster charge distributions* (see SMT Examine Histograms page). Compare histograms with the reference plots. If you do not see significant deviations in shape from the reference plots go to 2.
- If you observe an unusual shape or additional peaks in Landau distributions open *smt_cluster_xxxxx.hs* file and look at the individual ladder/wedge cluster charge distributions for a barrel/disk that shows the problem. Find the device responsible for it and make a log book entry. Look at the corresponding histogram for the position of the first strip in cluster. Are there any significant peaks?
- Open *smt_barrel_occupancy_xxxx.hs* (or the corresponding disk data file) and look at the occupancy vs event dependence for the ladder/wedge under consideration. Does the device have consistent high occupancy? Make an entry in the log book.
- Open *smt_barrel_main_xxxx.hs* (or the corresponding disk data file) and look at the number of fired strips distribution and the number of entries in each strip for the ladder/wedge under consideration. Does the device have many fired strips in each event? Does the entry histogram show high peaks in some channels? Make an entry in the log book.
- Open *smt_barrel_peds_xxxx.hs* (or the corresponding disk data file) and look at the pedestal vs channel snapshot histograms for the ladder/wedge under consideration. Compare p- and n-side response. Are there correlations between the charge detected on two sides? If no clusters observed check the list of underdepleted ladders:
    - cd ~/monitoring
      setup d0online
      list_underdepleted_hv.py

Make an entry in the log book.

- Open *smt_barrel_chips_xxxx.hs* (or the corresponding disk data file) and look at the pedestal distributions for each chip of the ladder/wedge under consideration. If you are running in GENERIC mode (default for smt_examine in the Control Room) the distributions have to have a peak at zero from neighbour readout and a tail towards higher pulses from the real clusters. Are the chip pedestals consistent with this shape? Is the problem (if any) observed in one chip? Make an entry in the log book.

2. Summary entries histograms

- Open *summary_histograms_xxxx.hs* and look at *Summary entries and average pulse histograms* (see SMT Examine Histograms page). Compare histograms with the reference plots and with the list of disabled HDIs. Make an entry in the log book.
- To make the list:
  - as d0smt,

```
cd  ~/monitoring
    ./listDisabledHDIs.py
```

SMT Examine Histograms

During usual operation, SMTExamine produces 6 histogram files for each SMT subsystem (barrel, F-disks, H-disks), one summary file and two files containing cluster level plots. This document briefly describes the histograms that can be found in each file.

Summary Plots

File *summary_histograms_xxxx.hs* contains

- summary cluster charge distributions
- summary cluster size distributions
- histograms for number of entries per ladder/wedge
- histograms for average pulse height per ladder/wedge

Summary cluster charge distributions

Cluster charge distributions are presented for each barrel. Histograms are split by detector type and side (3-chip ladders, 6-chip ladders p/n side and 9-chip ladders p/n side).
Summary charge distributions are expected to have Landau shape. Any deviations from this shape like extra peaks can be usually traced down using detailed cluster plots from *smt_cluster_xxxxx.hs* file (see below **Cluster plots** section)

Barrel cluster histogram names:
"Bar nb-side ladtype cluster charge"
"Bar nb-side ladtype cluster size"
where nb - barrel # (1,...,6)
side - p or n
ladtype - L3,L9 (for nb = 1,6); L6,L9 (for nb = 2,3,4,5)

F-disk cluster histogram names:
"FD nd-side cluster charge"
"FD nb-side cluster size"
where nd - F-disk # (1,...,12)
side - p or n

H-disk cluster histogram names:
"HD nd-side cluster charge"

"HD nb-side cluster size"
where nd - H-disk # (1,...,4)
side - p or n

Summary entries and average pulse histograms

For each barrel/disk side if at least one channel of a ladder/wedge is read out in an event the entry histogram
is filled with 1 for this ladder/wedge. If the entry histogram showes zero or very small number of entries for some ladder/wedge the device is either not read out (disabled) or has some problems with calibration or thresholds.
For each barrel/disk side for each event average pulse height per ladder/wedge enters the average pulse
histogram.
Histograms are arranged in the following way: entries for ladder *lad* from layer *lyr* go into channel number *20*(lyr-1)+lad+1* of the histogram containing all ladders of a particular barrel side. For example, number of entries for ladders 1 through 12 belonging to layer 5 barrel 4 p-side can be found in "Bar 4 p-side ladders entries" histogram in channels 81 through 92.
Average pulse height histograms for barrels are arranged in a similar way.
Each F-disk(H-disk) histogram contains entries for wedges 1 through 12 (1 through 24) in channels 1 though 12 (1 through 24).

Barrel entries and average pulse histogram names:

"Bar nb-side ladders entries"
"Bar nb-side ladders average pulse"
where nb - barrel # (1,...,6)
side - p or n

F-disk entries and average pulse histogram names:

"FD nd all wegdes entries"
"FD nb all wedges average pulses"
where nd - F-disk # (1,...,12)

H-disk entries and average pulse histogram names:

"HD nd all wegdes entries"
"HD nb all wedges average pulses"
where nd - H-disk # (1,...,4)
side - p or n

Summary cluster charge distributions and summary entries histograms are the main histograms that characterize SMT performance, efficiency and data quality. These histograms have to be looked at by a shifter and compared to the reference plots.

Cluster Plots

File *smt_cluster_xxxxx.hs* contains cluster charge distribution and the position of the first strip of the reconstructed cluster for each barrel ladder and each F- and H- disk wedge (p- and n-side separately).

Barrel cluster histogram names:
"Bar nb-lyr-lad-side cluster charge"
"Bar nb-lyr-lad-side first strip of cluster"
where nb - barrel # (1,...,6)
lyr - layer # (1,..., 8)
lad - ladder # (1,...,12)
side - p or n
F-disk clusters histogram names:
"FD nd-nw-side cluster charge"
"FD nd-nw-side first strip of cluster"
where nd - disk # (1,...,12)
nw - wedge # (1,..., 12)
side - p or n
H-disk clusters histogram names:
"HD nd-nw-side cluster charge"
"HD nd-nw-side first strip of cluster"
where nd - disk # (1,...,4)
nw - wedge # (1,..., 24)
side - p or n

Cluster charge distribution shapes have to represent Landau distrubution. For most of the ladders/wedges you'll see the peak at small cluster charge indicating the average noise contribution. Any other deviations from the Landau distribution is a signal of the problem.

Histograms containing the cluster first strip position are filled to ultimately show the noisy strips. If the ladder/wedge does not have any noisy strips the distribution has to be uniform. The peaks in certain channels indicate that this channel initiates fake (noisy) clusters at a rate higher than the real ones.

Tick plots

File
tick_histograms_xxxx.hs
contains cluster charge distribution split by barrel/disk, ladder/wedge type (see above) and side filled for each bunch crossing (tick) separately. These histograms appeared to be useful to make sure that the number of clusters and cluster charge for all bunch crossings are similar.

Barrel tick histogram names:
"Bar nb-side-XX-YY ladtype clusters charge"
where nb - barrel # (1,...,6)
side - p or n
ladtype - L3,L9 (for nb = 1,6); L6,L9 (for nb = 2,3,4,5)
XX - superbunch number (X0,X1,X2)
YY - bunch number (01,...,12)
F-disk tick histogram names:
"FD nd-side-XX-YY clusters charge"
where nd - disk # (1,...,12)
side - p or n
H-disk tick histogram names:
"HD nd-side-XX-YY clusters charge"
where nd - disk # (1,...,4)
side - p or n

Occupancy plots

Files
smt_barrel_occupancy_xxxx.hs
smt_fdisk_occupancy_xxxx.hs
smt_hdisk_occupancy_xxxx.hs
contain occupancy vs event distributions for each ladder/wedge. Occupancy is defined as a percentage of the channels which were read

out per ladder/wedge. The expected average occupancy is about 5%. Occupancy fluctuations above 30% indicate high common mode noise or many noisy channels on the ladder/wedge. Persistent high occupancy can be a result of the wrong threshold downloaded into the chip.

Barrel occupancy histogram names:
"Bar nb-lyr-lad-side occupancy vs event"
where nb - barrel # (1,...,6)
lyr - layer # (1,..., 8)
lad - ladder # (1,...,12)
side - p or n
F-disk occupancy histogram names:
"FD nd-nw-side occupancy vs event"
where nd - disk # (1,...,12)
nw - wedge # (1,..., 12)
side - p or n
H-disk occupancy histogram names:
"HD nd-nw-side occupancy vs event"
where nd - disk # (1,...,4)
nw - wedge # (1,..., 24)
side - p or n

Main plots

Files
smt_barrel_main_xxxx.hs
smt_fdisk_main_xxxx.hs
smt_hdisk_main_xxxx.hs
for each ladder/wedge contain number of entries vs channel number histograms and the distributions of the number of fired strips. First set of histograms allows to track down the channels that are readout more often than the others (noisy channels) while running in srapse mode of the SVX chip. The second set is another way to represent the occupancy.

Barrel channel entries histogram names:
"Bar nb-lyr-lad-side entries"
"Bar nb-lyr-lad-side fired channels"
where nb - barrel # (1,...,6)
lyr - layer # (1,..., 8)

lad - ladder # (1,...,12)
side - p or n

F-disk channel entries histogram names:

"FD nd-nw-side entries"
"FD nd-nw-side fired channels"
where nd - disk # (1,...,12)
nw - wedge # (1,..., 12)
side - p or n

H-disk channel entries histogram names:

"HD nd-nw-side entries"
"HD nd-nw-side fired channels"
where nd - disk # (1,...,4)
nw - wedge # (1,..., 24)
side - p or n

Pedestal plots

Files
smt_barrel_peds_xxxx.hs
smt_fdisk_peds_xxxx.hs
smt_hdisk_peds_xxxx.hs
contain average pedestal vs channel number histograms for each ladder/wedge. They also contain pedestal vs channel histograms updated for each event, in other words, the detector response snapshot. The last set of histogram is useful to observe charge correlations between p- and n-side of the same detector when a real particle goes through it.

Barrel pedestal histogram names:

"Bar nb-lyr-lad-side average pulse"
"Bar nb-lyr-lad-side event pulse"
where nb - barrel # (1,...,6)
lyr - layer # (1,..., 8)
lad - ladder # (1,...,12)
side - p or n

F-disk pedestal histogram names:

"FD nd-nw-side average pulse"
"FD nd-nw-side event pulse"
where nd - disk # (1,...,12)
nw - wedge # (1,..., 12)
side - p or n

H-disk pedestal histogram names:
"HD nd-nw-side average pulse"
"HD nd-nw-side event pulse"
where nd - disk # (1,...,4)
nw - wedge # (1,..., 24)
side - p or n

Standard deviation plots

Files
smt_barrel_sigma_xxxx.hs
smt_fdisk_sigma_xxxx.hs
smt_hdisk_sigma_xxxx.hs
contain sigma of pedestal vs channel number histograms for each ladder/wedge. These histograms are useful to identify the noisy channels (channels with large sigma) of each ladder/wedge. They make sense if data was taken in the readall mode of SVX chip and was processed in STATIC mode (see SmtRawUnp2Data.rcp).

Barrel sigma histogram names:
"Bar nb-lyr-lad-side std dev"
where nb - barrel # (1,...,6)
lyr - layer # (1,..., 8)
lad - ladder # (1,...,12)
side - p or n
F-disk sigma histogram names:
"FD nd-nw-side std dev"
where nd - disk # (1,...,12)
nw - wedge # (1,..., 12)
side - p or n
H-disk sigma histogram names:
"HD nd-nw-side std dev"
where nd - disk # (1,...,4)
nw - wedge # (1,..., 24)
side - p or n

Chip pedestal distributions

Files
smt_barrel_chips_xxxx.hs

smt_fdisk_chips_xxxx.hs
smt_hdisk_chips_xxxx.hs
contain chip pedestal distributions and average chip pedestal vs event for each chip of ladder/wedge. The first set of histograms is used to study total noise. The second set allows to extract common mode noise if data is taken in readall mode of SVX chip and processed in STATIC mode (see SmtRawUnp2Data.rcp).

Barrel chip pedestal histogram names:
"Bar nb-lyr-lad-side-chip nc pedestal"
"Bar nb-lyr-lad-side-chip nc average pulse vs event"
where nb - barrel # (1,...,6)
lyr - layer # (1,..., 8)
lad - ladder # (1,...,12)
side - p or n
nc - chip #
F-disk chip pedestal histogram names:
"FD nd-nw-side-chip nc pedestal"
"FD nd-nw-side-chip nc average pulse vs event"
where nd - disk # (1,...,12)
nw - wedge # (1,..., 12)
side - p or n
nc - chip #
H-disk chip pedestal histogram names:
"HD nd-nw-side-chip nc pedestal"
"HD nd-nw-side-chip nc average pulse vs event"
where nd - disk # (1,...,4)
nw - wedge # (1,..., 24)
side - p or n
nc - chip #

Calibration histograms

Files
smt_barrel_cal_xxxx.hs
smt_fdisk_cal_xxxx.hs
smt_hdisk_cal_xxxx.hs
contain histograms used to make the list of the noisy channels when smt_examine starts.

Errors and warnings

Errors and warning messages in Examine may come from ReadEvent, UnpackReco, SmtRaw, SmtExamine or Framework itself. The most errors is cought by the exeptions and can't cause core dump. The important thing: if you use incomplete configuration - be sure that your cfg.dat and translation.map are correct, because if it's not - the mismatch beetween configuration files and the data will result the messages from error logger. The usual errors and warnings are:

1. from UnpackReco:
   - %ERLOG-w Module count mismatch: crate id = 103 module count: raw data = 1 run config = 2 UnpackReco 20-Nov-2000 11:10:46 UnpackReco:UnpackReco Run number: 105941, Event Number: 4922

     The number of VRBs in this crate in the cfg.dat doesn't match the number of VRBs in the real data.
     (Note: if UnpackReco crashes in this case - it means the flag THROW_MISSING_CRATE_EXAPTION is 0 instead of 1. You should set it to 1 and recompile UnpackReco.cpp. I don't know why it's 0 by default...)

   - %ERLOG-e Error in SMT raw data: Invalid chip id word VRB id 0x36 HDI id 0x2 Invalid data 0xa202 SMTMCHModule 20-Nov-2000 11:06:38 UnpackReco:UnpackReco Run number: 105941, Event Number: 4871

     The chip ID is invalid in the raw data.

   - %ERLOG-e Error in SMT raw data: Invalid chip/channel ids found VRB id 0x38 HDI id 0x3 Chip id 0xffffffff Channel id 0x3 SMTMCHModule 20-Nov-2000 11:15:01 UnpackReco:UnpackReco Run number: 105941, Event Number: 4872

     The channel ID is invalid in the raw data.

   - %ERLOG-e Error in SMT raw data: EOR marker not found when expected VRB id 0x38 HDI id 0x3 SMTMCHModule 20-Nov-2000 11:15:01 UnpackReco:UnpackReco Run number: 105941, Event Number: 4872

     The EOR marker is mssing in the raw data.

2. from SmtRawUnp2Data:
   - %ERLOG-e Number of SMT modules different from expected: Found 2 expected 0 SmtRawUnp2Data 20-Nov-2000 11:06:38 SmtRawUnp2Data:SmtRawUnp2Data Run number: 105941, Event

Number: 4871

Number of SMT modules different from expected. (check your translation map)

%ERLOG-e Strip translation lookup failed: Strip FE Address : packed= 383038 Crate =3, VRB =8, HDI =3, Chip =0, Svx Channel =56 SmtRawUnp2Data 20-Nov-2000 11:15:59 SmtRawUnp2Data:SmtRawUnp2Data Run number: 105941, Event Number: 4872

This strip with given packed address is not present in the data - but exists in the translation.map.

%ERLOG-E Error limit reached: Ignoring the rest of this VRB SmtRawUnp2Data 20-Nov-2000 11:16:31 SmtRawUnp2Data:SmtRawUnp2Data Run number: 105941, Event Number: 4873

Error limit reached (MaximumErrors parameter in the SmtRawUnp2Data.rcp) - smtraw gives up processing of this VRB.

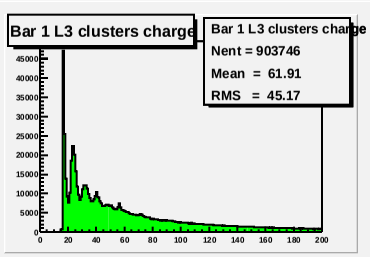
Section 6

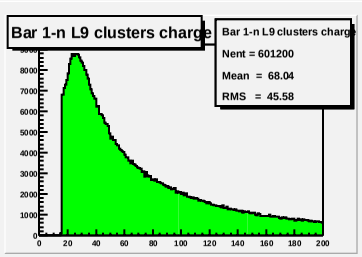
Reference Plots from SMT Examine

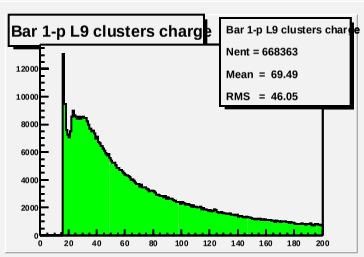
Following are the standard plots(cluster distributions) made from SMT_examine.

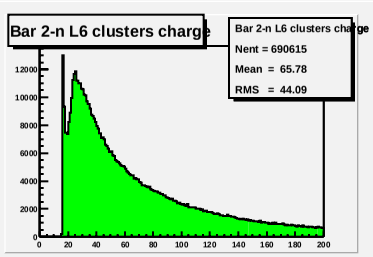
- The run number used was 143781.
- All 12 SMT crates were in the run.
- The details of the run can be found at
  http://www-d0online.fnal.gov/www/run/runQuery.htm
  by typing in the run number.
- The raw data files used to get the plots are all_0000143781_0*.raw where * is any of the following number
  02,04,06,08,15,16,17,18,20,22,24,26,27,28,31,
  39,40,45,48,50,57,59,60,61,65,66,67,69,72,76
- The version of base release used to compile the package was t02.04.00.
- The first set “Set I” are the standard plots.
- The second set “Set II” has cluster plots of those device that contribute to the anomalous peaks in “Set I ”.
- In the plots “Set I ”, typically, for example,
  Bar 1 L3 means Barrel no. 1 3-chippers in all layers.
  Bar 1-n L9 means Barrel 1 9-chippers n side.
  FD 03-n means F Disk No. 3 all wdges n-side.
  HD 4-n means H Disk all wedges n-side.
- In the plots “Set II ”, typically, for example,
  Bar 3-5-10-p means Barrel no. 3,layer 5, ladder 10, p-side
  FD 05-07-n, means FDisk 5,Wedge 7, n-side.

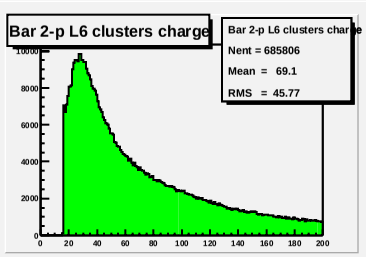
Set I

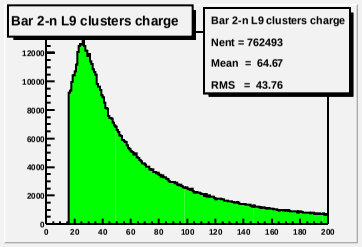

Bar 1 L3 clusters charge
Bar 1 L3 clusters charge
Nent = 903746
Mean = 61.91
RMS = 45.17

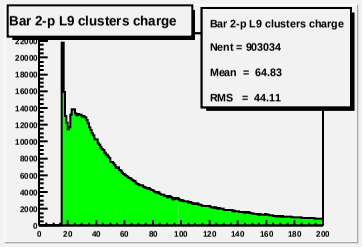

Bar 1-n L9 clusters charge
Bar 1-n L9 clusters charge
Nent = 601200
Mean = 68.04
RMS = 45.58

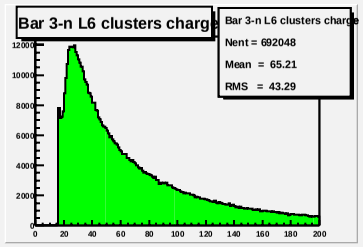

Bar 1-p L9 clusters charge
Bar 1-p L9 clusters charge
Nent = 668363
Mean = 69.49
RMS = 46.05

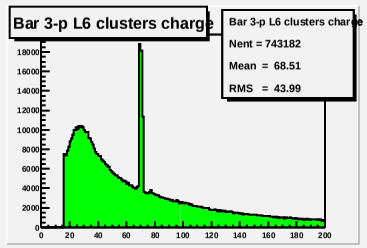

Bar 2-n L6 clusters charge
Bar 2-n L6 clusters charge
Nent = 690615
Mean = 65.78
RMS = 44.09

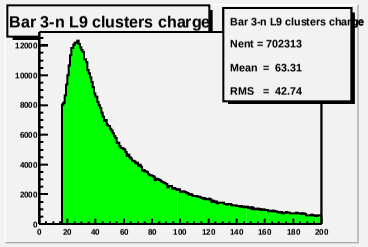

Bar 2-p L6 clusters charge
Bar 2-p L6 clusters charge
Nent = 685806
Mean = 69.1
RMS = 45.77

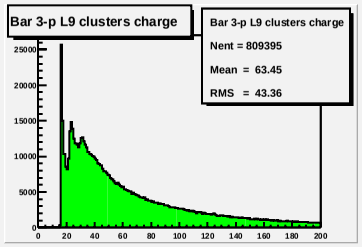

Bar 2-n L9 clusters charge
Bar 2-n L9 clusters charge
Nent = 762493
Mean = 64.67
RMS = 43.76

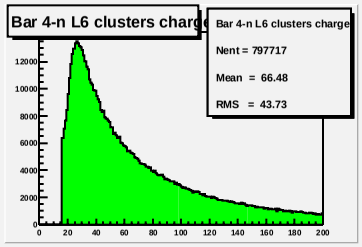

Bar 2-p L9 clusters charge
Bar 2-p L9 clusters charge
Nent = 903034
Mean = 64.83
RMS = 44.11

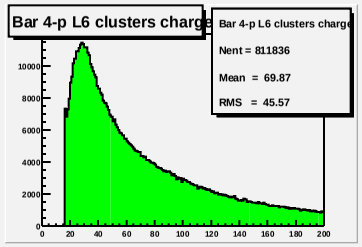

Bar 3-n L6 clusters charge
Bar 3-n L6 clusters charge
Nent = 692048
Mean = 65.21
RMS = 43.29

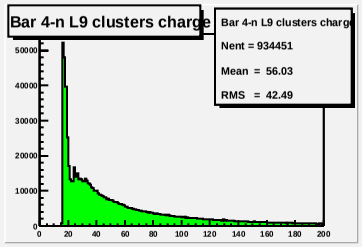

Bar 3-p L6 clusters charge
Bar 3-p L6 clusters charge
Nent = 743182
Mean = 68.51
RMS = 43.99

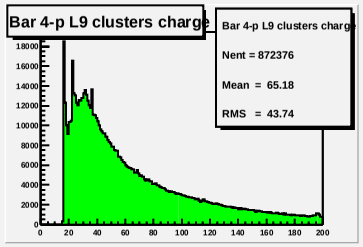

Bar 3-n L9 clusters charge
Bar 3-n L9 clusters charge
Nent = 702313
Mean = 63.31
RMS = 42.74

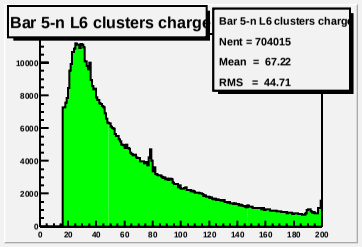

Bar 3-p L9 clusters charge
Bar 3-p L9 clusters charge
Nent = 809395
Mean = 63.45
RMS = 43.36

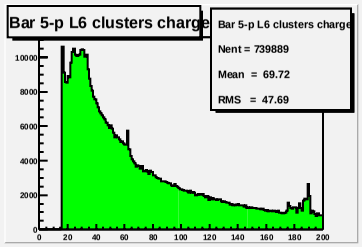

Bar 4-n L6 clusters charge
Bar 4-n L6 clusters charge
Nent = 797717
Mean = 66.48
RMS = 43.73

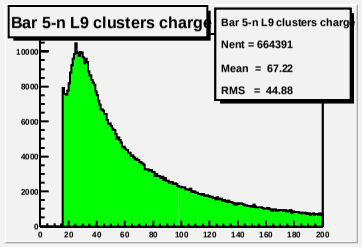

Bar 4-p L6 clusters charge
Bar 4-p L6 clusters charge
Nent = 811836
Mean = 69.87
RMS = 45.57

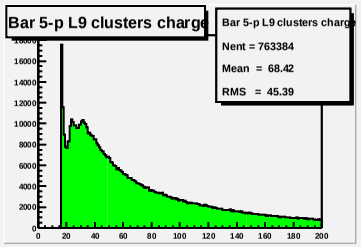

Bar 4-n L9 clusters charge
Bar 4-n L9 clusters charge
Nent = 934451
Mean = 56.03
RMS = 42.49

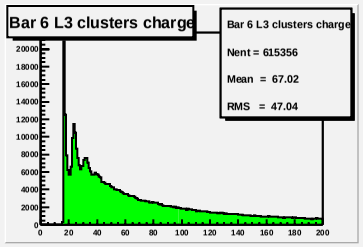

Bar 4-p L9 clusters charge
Bar 4-p L9 clusters charge
Nent = 872376
Mean = 65.18
RMS = 43.74

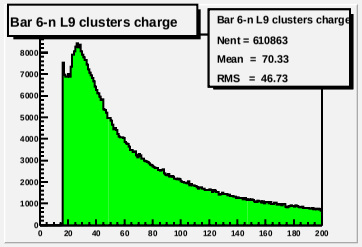

Bar 5-n L6 clusters charge
Bar 5-n L6 clusters charge
Nent = 704015
Mean = 67.22
RMS = 44.71

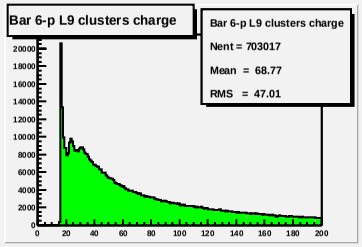

Bar 5-p L6 clusters charge
Bar 5-p L6 clusters charge
Nent = 739889
Mean = 69.72
RMS = 47.69

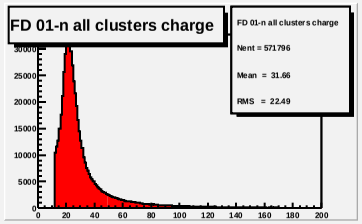

Bar 5-n L9 clusters charge
Bar 5-n L9 clusters charge
Nent = 664391
Mean = 67.22
RMS = 44.88

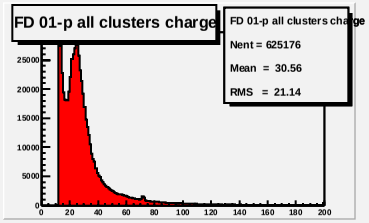

Bar 5-p L9 clusters charge
Bar 5-p L9 clusters charge
Nent = 763384
Mean = 68.42
RMS = 45.39


Bar 6 L3 clusters charge
Bar 6 L3 clusters charge
Nent = 615356
Mean = 67.02
RMS = 47.04


Bar 6-n L9 clusters charge
Bar 6-n L9 clusters charge
Nent = 610863
Mean = 70.33
RMS = 46.73


Bar 6-p L9 clusters charge
Bar 6-p L9 clusters charge
Nent = 703017
Mean = 68.77
RMS = 47.01


FD 01-n all clusters charge
FD 01-n all clusters charge
Nent = 571796
Mean = 31.66
RMS = 22.49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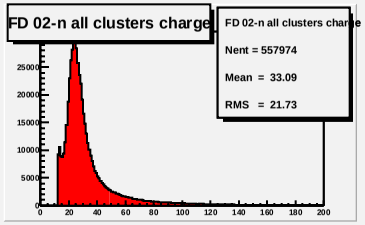
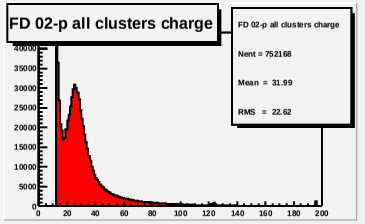
Nent = 625176
Mean = 30.56
RMS = 21.14


FD 02-n all clusters charge
FD 02-n all clusters charge
Nent = 557974
Mean = 33.09
RMS = 21.73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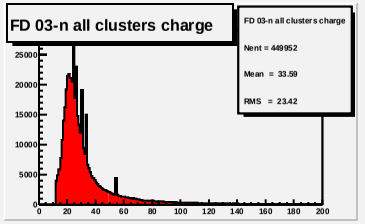
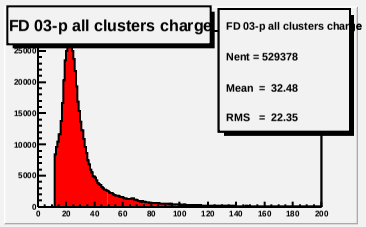
FD 02-p all clusters charge
Nent = 752168
Mean = 31.99
RMS = 22.62


FD 03-n all clusters charge
FD 03-n all clusters charge
Nent = 449952
Mean = 33.59
RMS = 23.42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Nent = 529378
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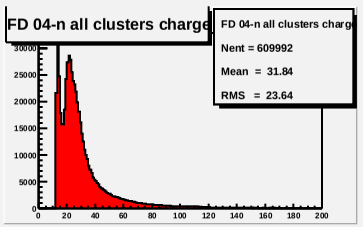
RMS = 22.35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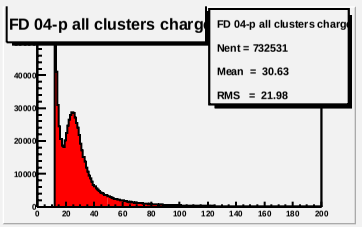
Nent = 609992
Mean = 31.84
RMS = 23.64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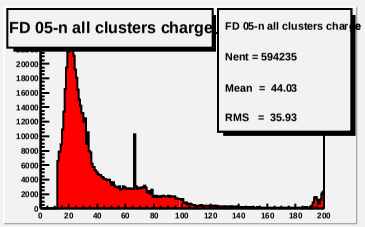
Nent = 732531
Mean = 30.63
RMS = 21.98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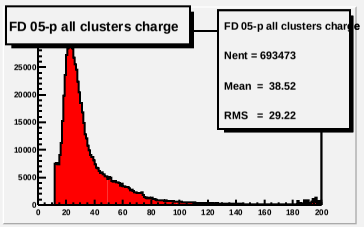
Nent = 594235
Mean = 44.03
RMS = 35.93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Nent = 693473
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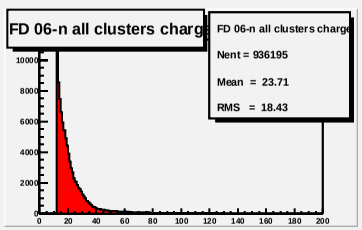
RMS = 29.22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Nent = 936195
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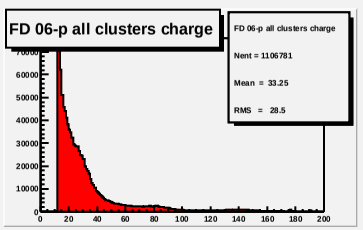
RMS = 18.43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Nent = 1106781
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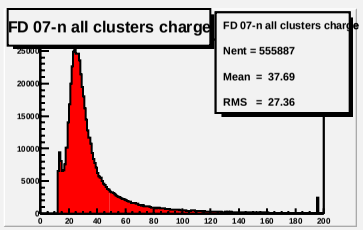
RMS = 28.5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Nent = 555887
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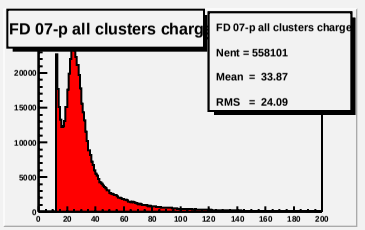
RMS = 27.36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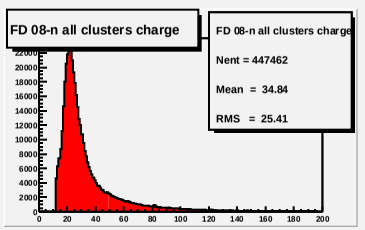
Nent = 558101
Mean = 33.87
RMS = 24.09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Nent = 447462
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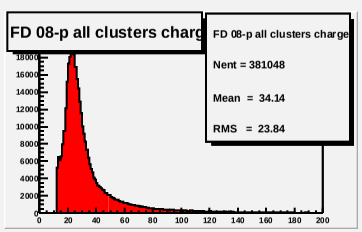
RMS = 25.41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Nent = 381048
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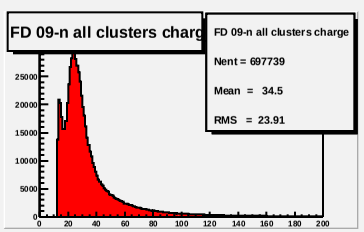
RMS = 23.84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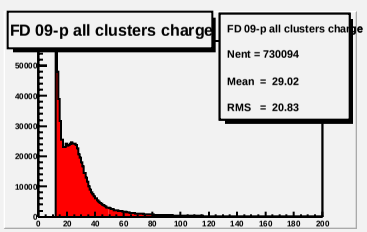
FD 09-n all clusters charge
Nent = 697739
Mean = 34.5
RMS = 23.91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Nent = 730094
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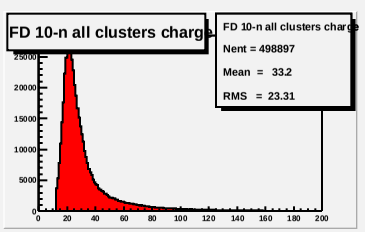
RMS = 20.83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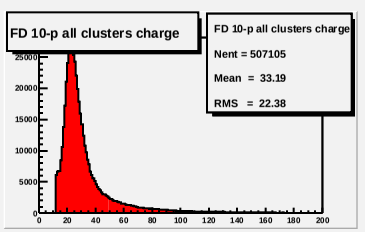
Nent = 498897
Mean = 33.2
RMS = 23.31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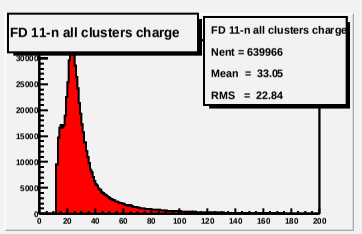
FD 10-p all clusters charge
Nent = 507105
Mean = 33.19
RMS = 22.38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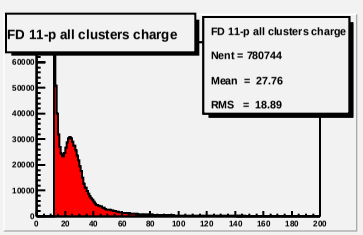
Nent = 639966
Mean = 33.05
RMS = 22.84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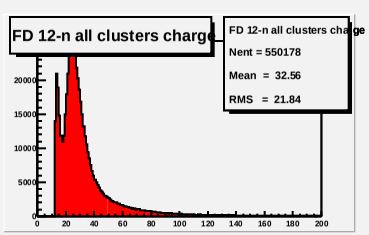
Nent = 780744
Mean = 27.76
RMS = 18.89


FD 12-n all clusters charge
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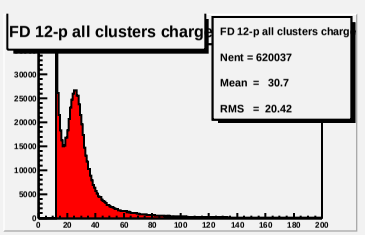
Nent = 550178
Mean = 32.56
RMS = 21.84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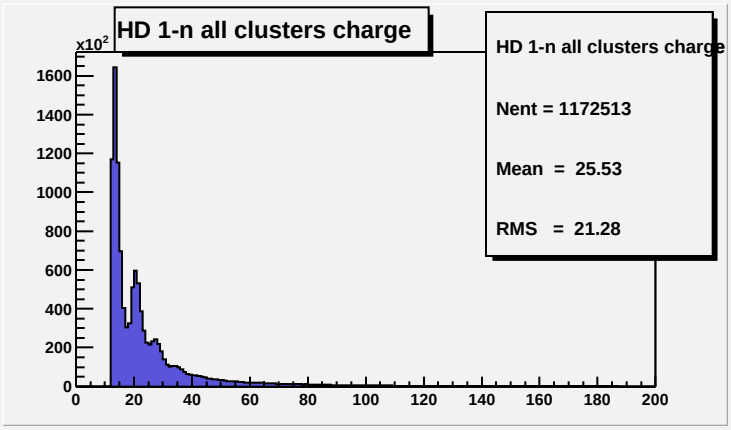
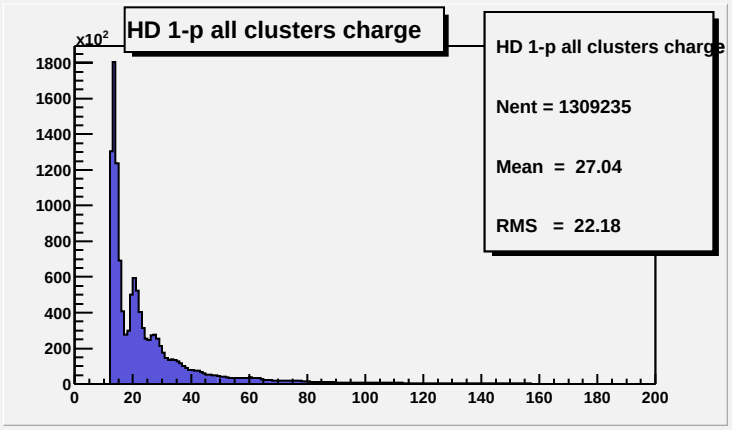
Nent = 620037
Mean = 30.7
RMS = 20.42


HD 1-n all clusters charge
x10²
HD 1-n all clusters charge
Nent = 1172513
Mean = 25.53
RMS = 21.28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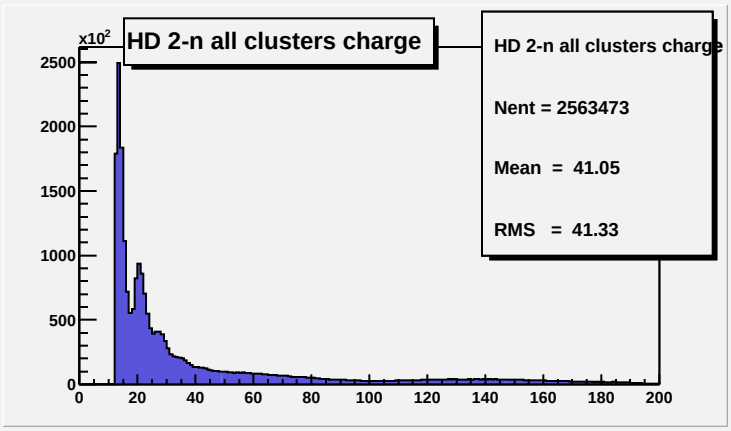
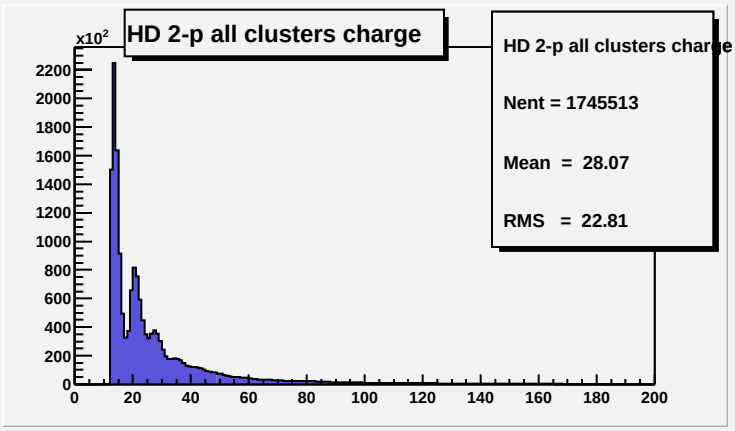
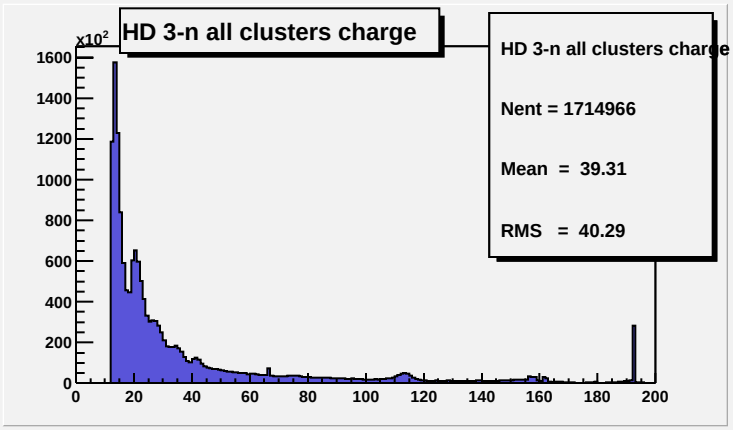
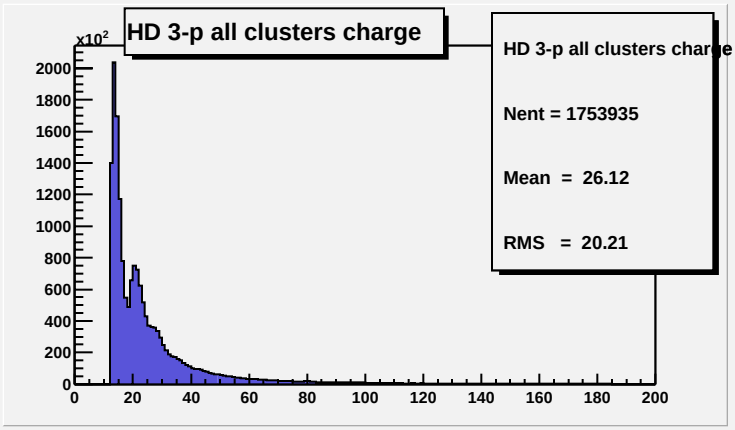
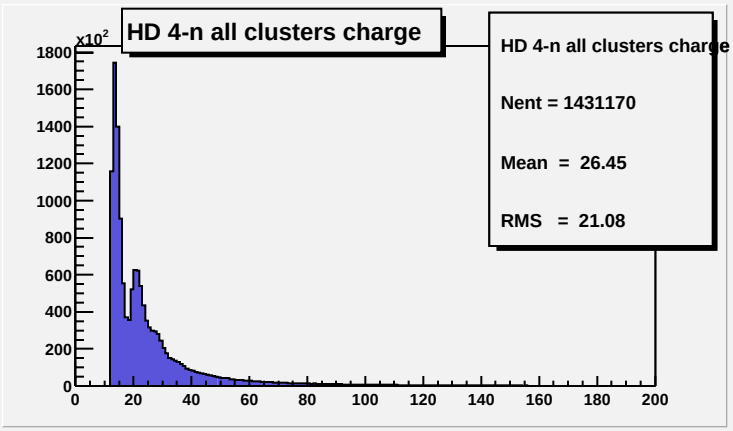
x10²
HD 1-p all clusters charge
Nent = 1309235
Mean = 27.04
RMS = 22.18

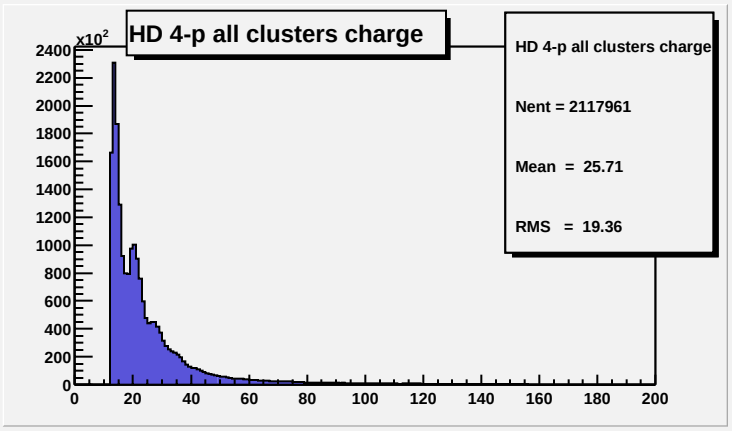

HD 2-n all clusters charge
x10²
HD 2-n all clusters charge
Nent = 2563473
Mean = 41.05
RMS = 41.33


HD 2-p all clusters charge
x10²
HD 2-p all clusters charge
Nent = 1745513
Mean = 28.07
RMS = 22.81

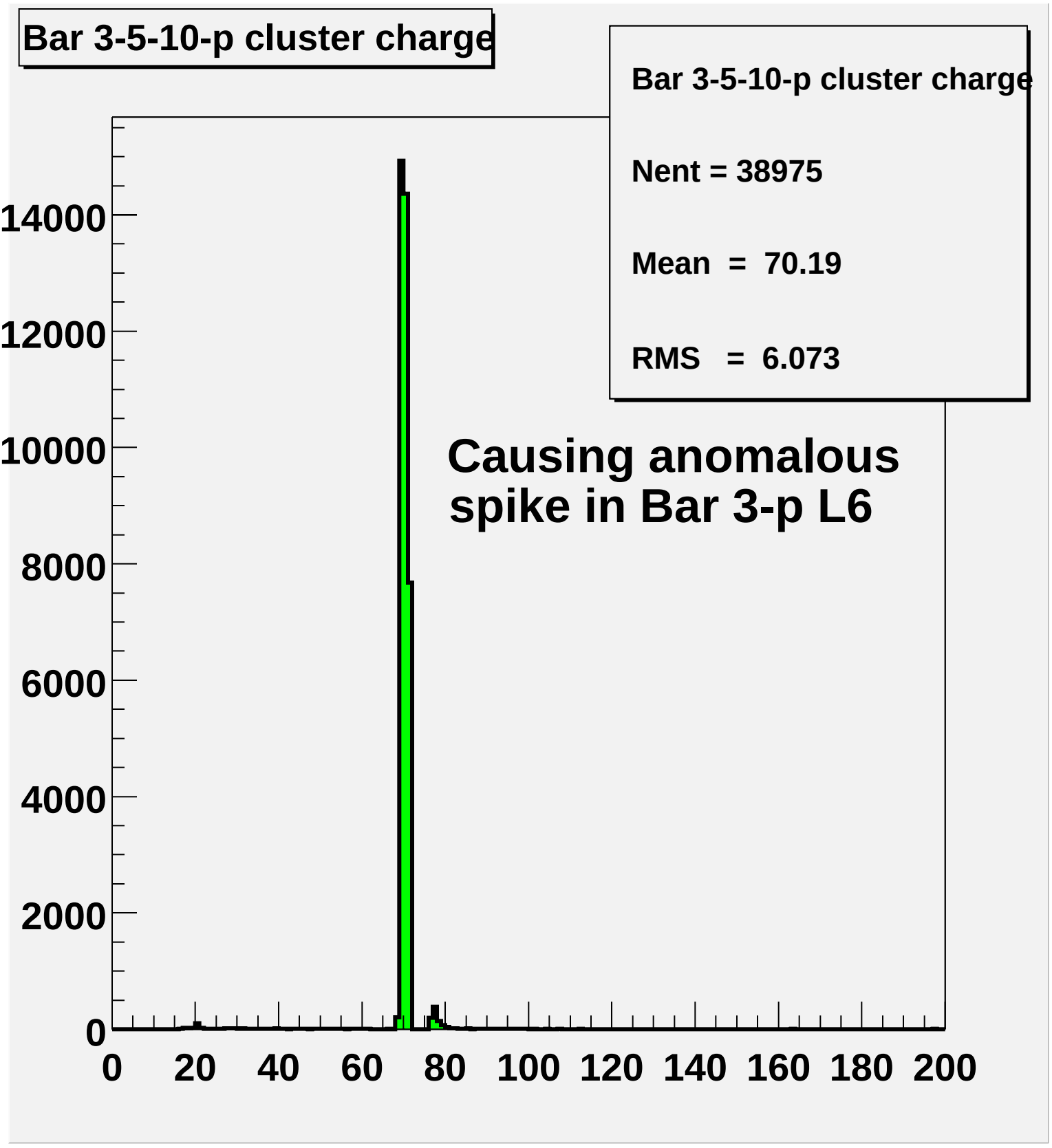

HD 3-n all clusters charge
x10²
HD 3-n all clusters charge
Nent = 1714966
Mean = 39.31
RMS = 40.29

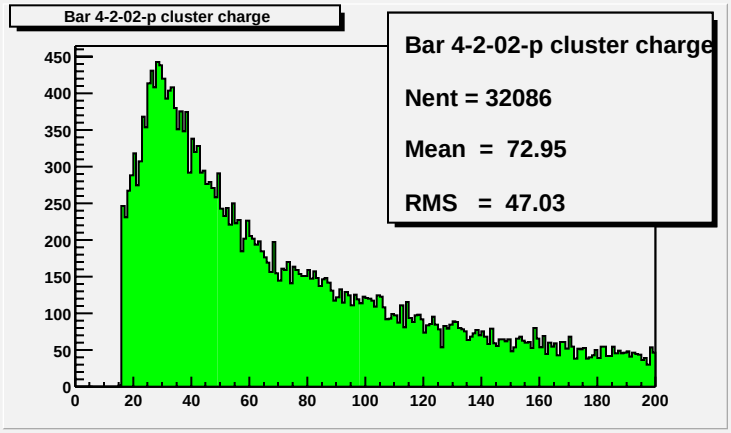

HD 3-p all clusters charge
x10²
HD 3-p all clusters charge
Nent = 1753935
Mean = 26.12
RMS = 20.21

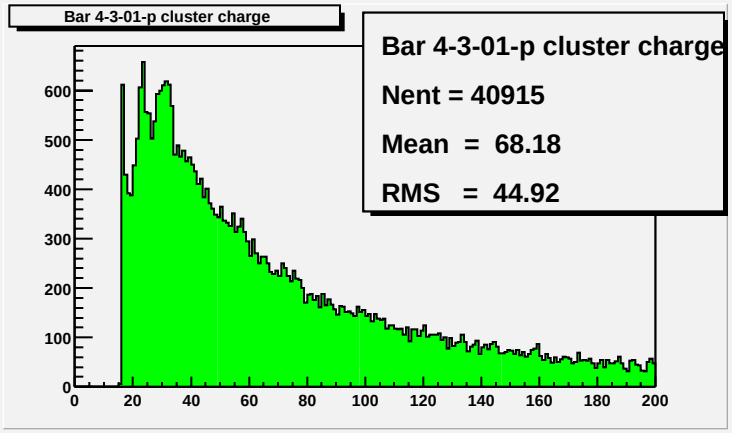

HD 4-n all clusters charge
x10²
HD 4-n all clusters charge
Nent = 1431170
Mean = 26.45
RMS = 21.08

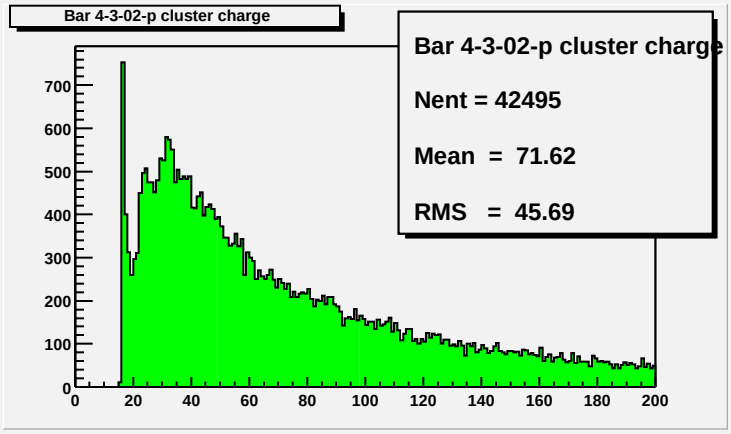

HD 4-p all clusters charge
x10²
HD 4-p all clusters charge
Nent = 2117961
Mean = 25.71
RMS = 19.36

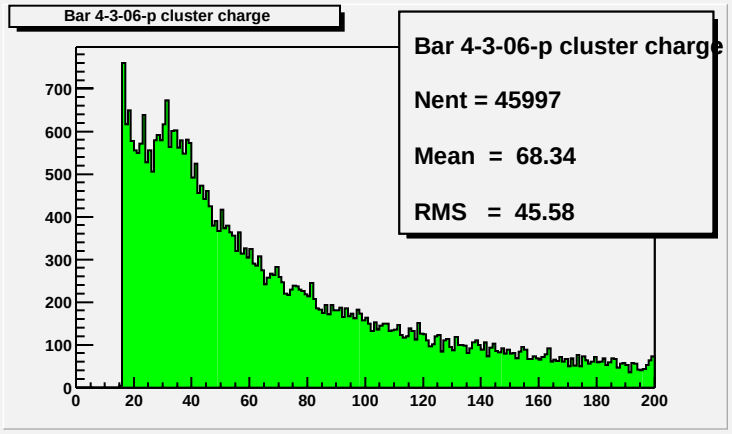
Set 2

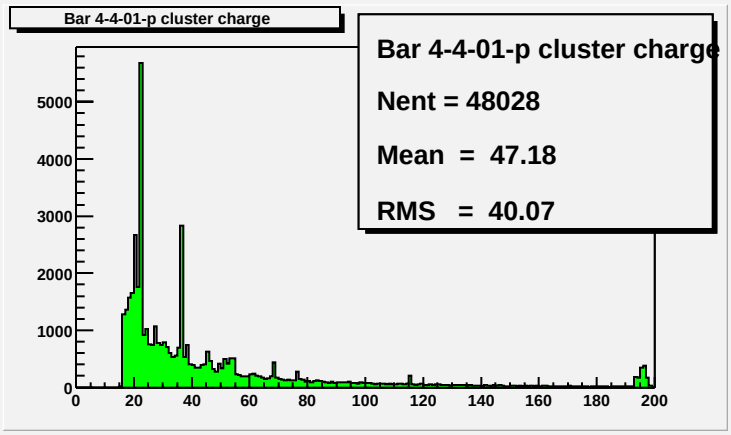

Bar 3-5-10-p cluster charge
Bar 3-5-10-p cluster charge
Nent = 38975
Mean = 70.19
RMS = 6.073
Causing anomalous spike in Bar 3-p L6
14000
12000
10000
8000
6000
4000
2000
0
0
20
40
60
80
100
120
140
160
180
200

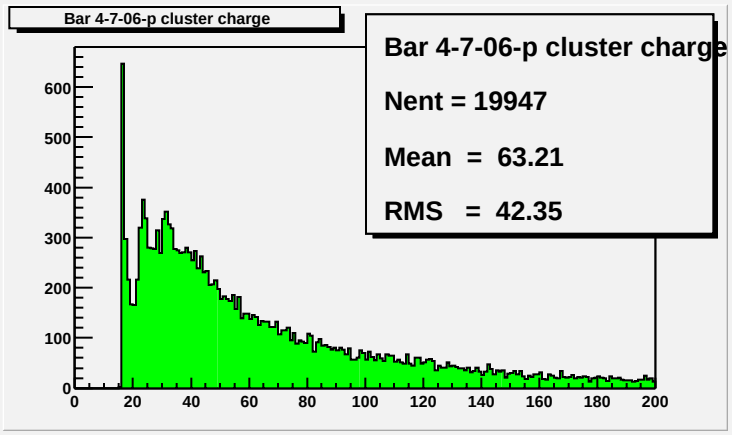

Bar 4-2-02-p cluster charge
Bar 4-2-02-p cluster charge
Nent = 32086
Mean = 72.95
RMS = 47.03

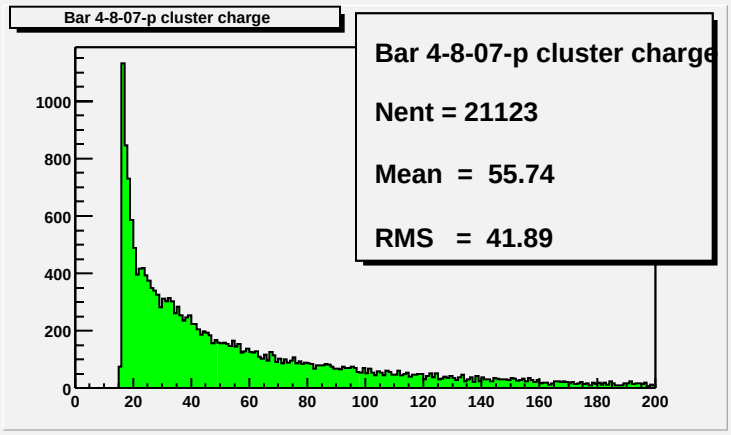

Bar 4-3-01-p cluster charge
Bar 4-3-01-p cluster charge
Nent = 40915
Mean = 68.18
RMS = 44.92

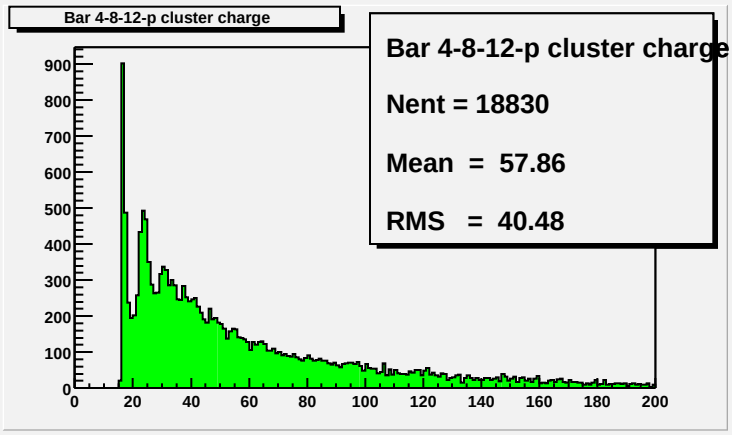

Bar 4-3-02-p cluster charge
Bar 4-3-02-p cluster charge
Nent = 42495
Mean = 71.62
RMS = 45.69

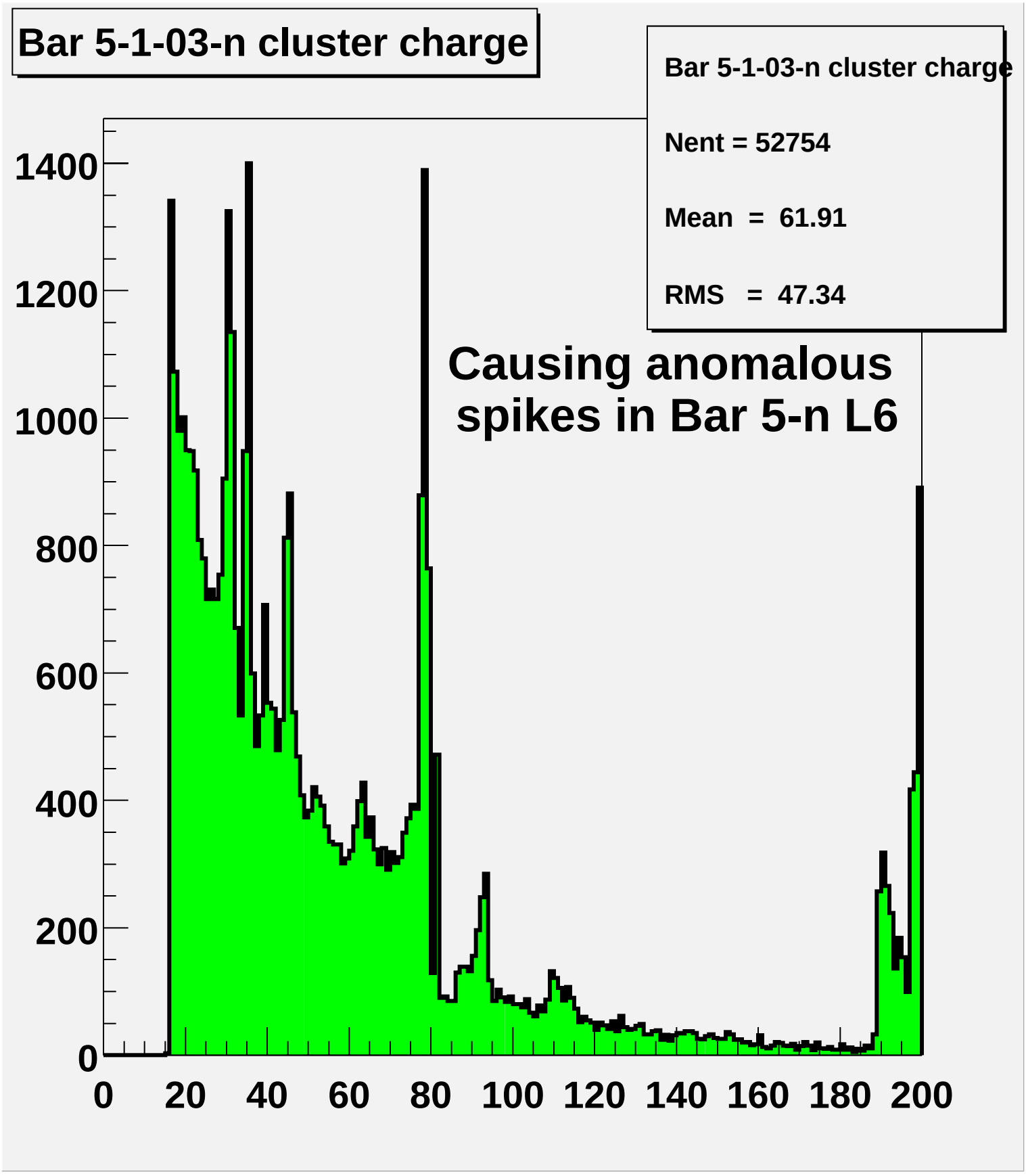

Bar 4-3-06-p cluster charge
Bar 4-3-06-p cluster charge
Nent = 45997
Mean = 68.34
RMS = 45.58

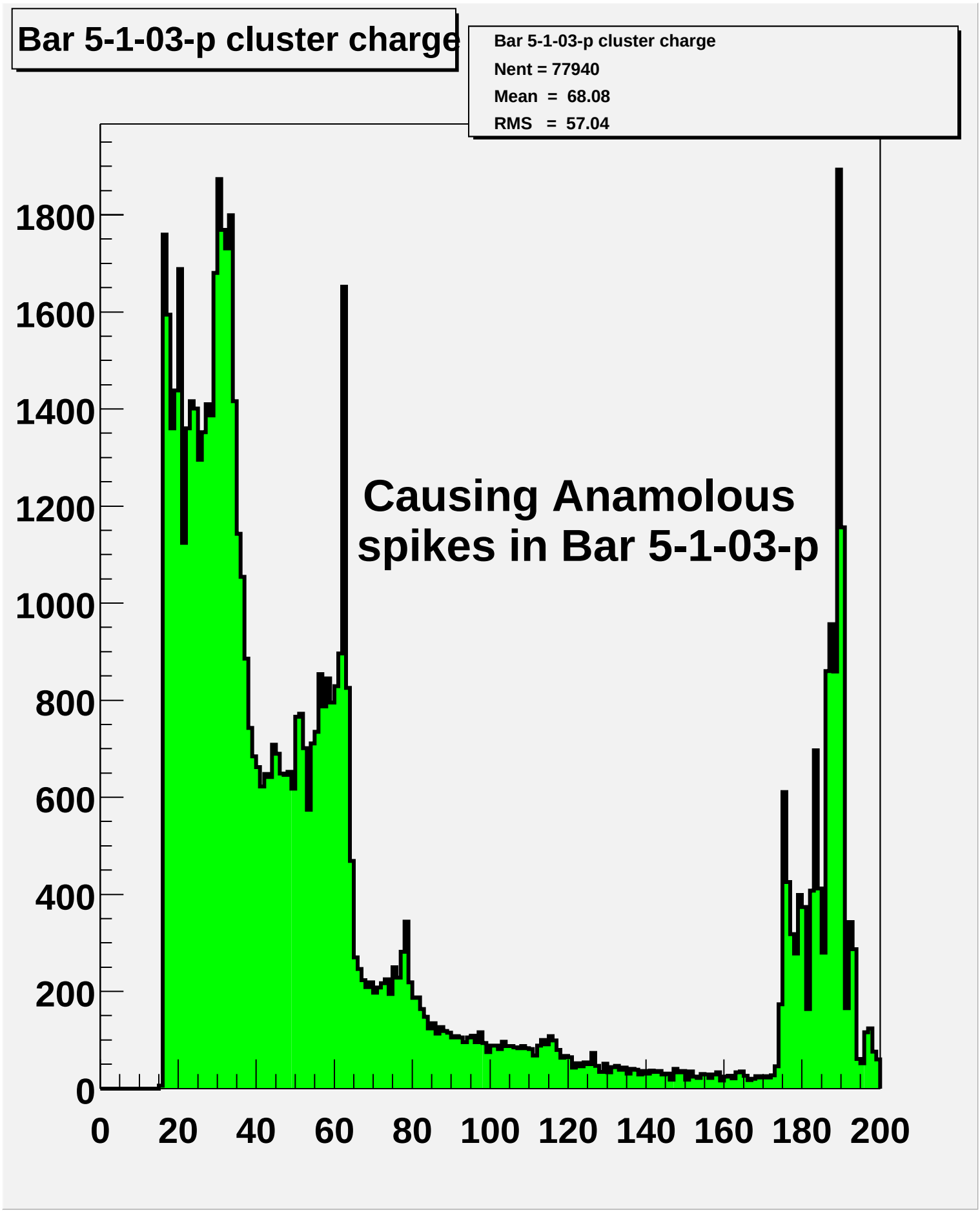

Bar 4-4-01-p cluster charge
Bar 4-4-01-p cluster charge
Nent = 48028
Mean = 47.18
RMS = 40.07

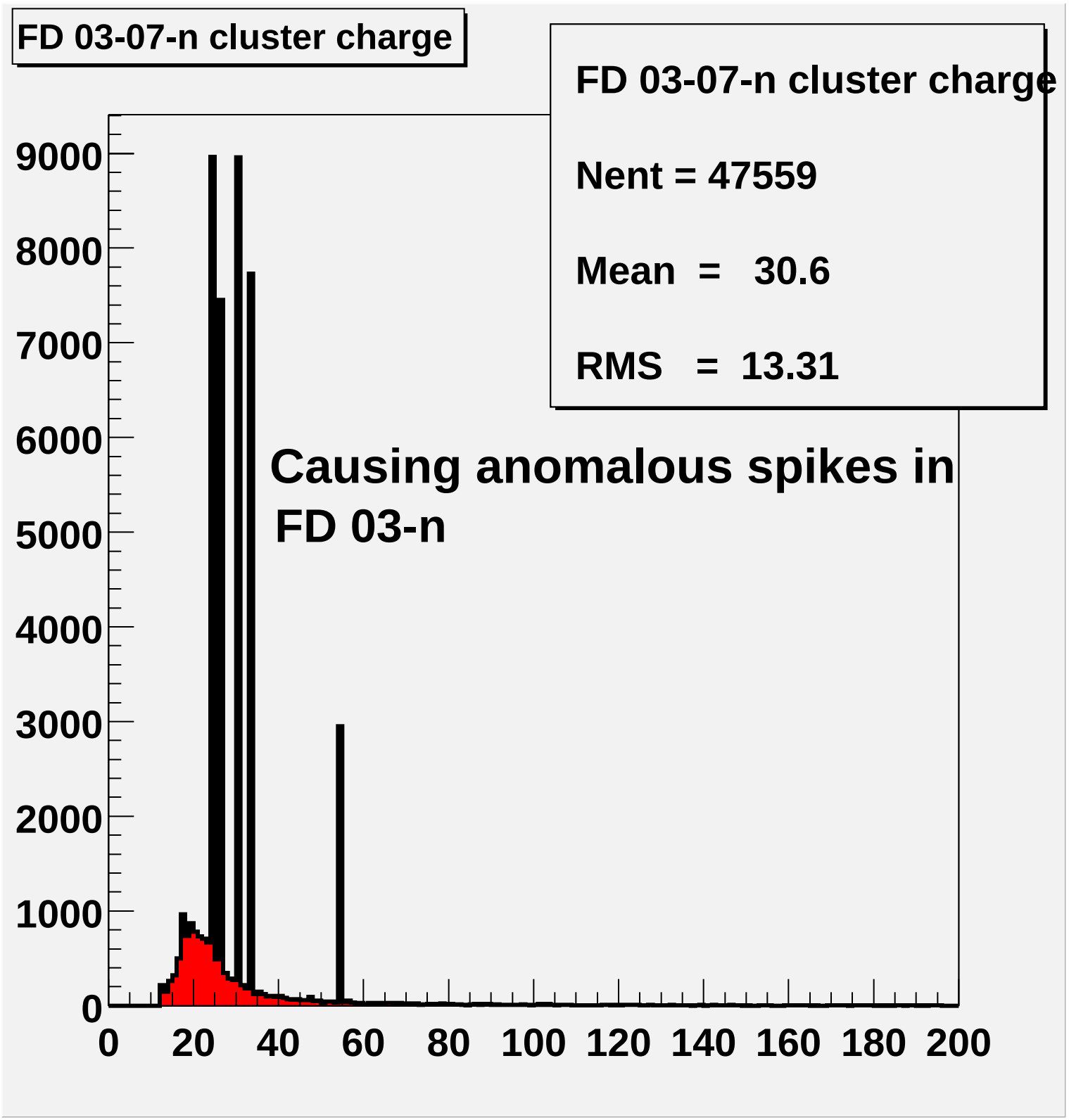

Bar 4-7-06-p cluster charge
Bar 4-7-06-p cluster charge
Nent = 19947
Mean = 63.21
RMS = 42.35

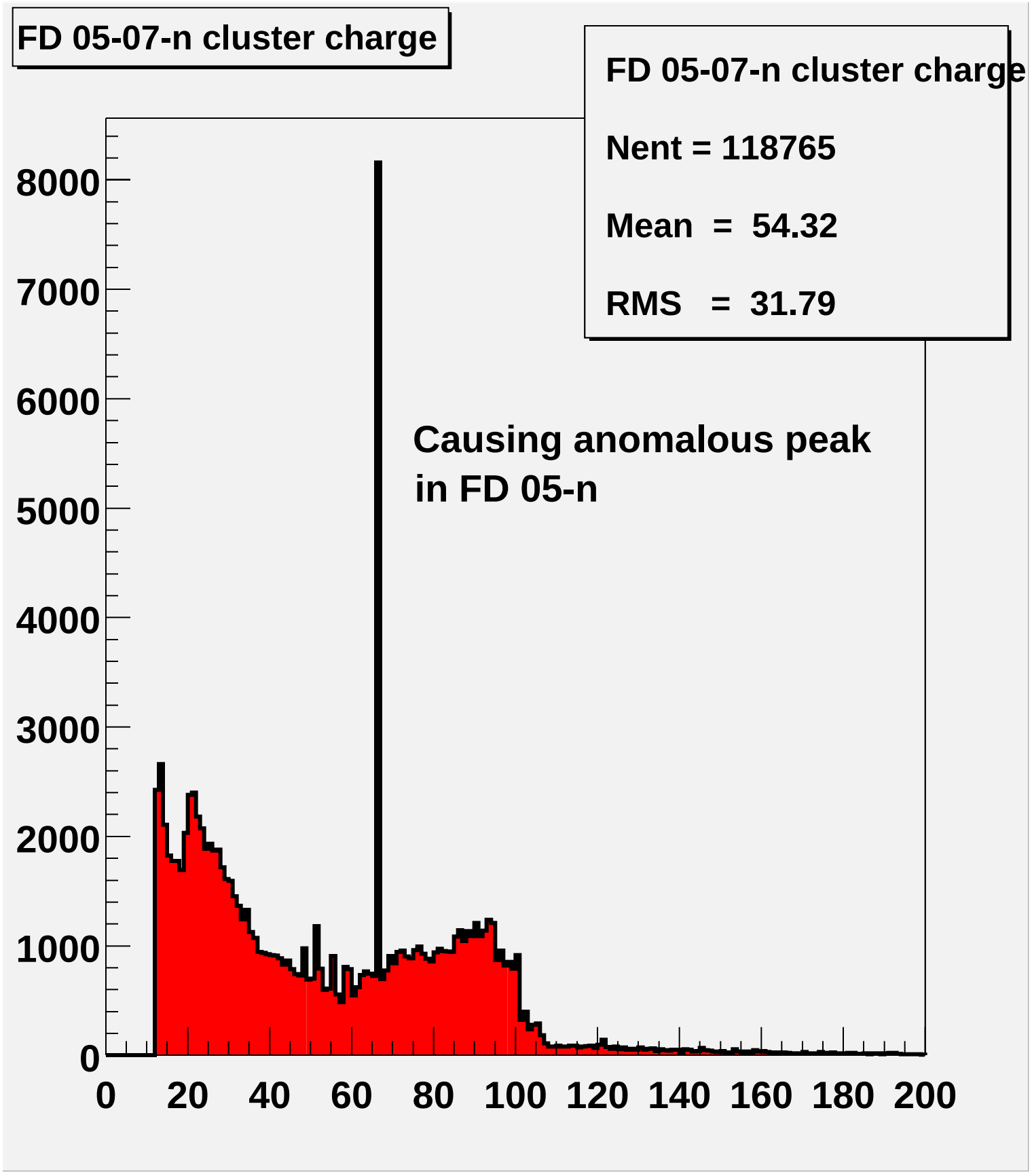

Bar 4-8-07-p cluster charge
Bar 4-8-07-p cluster charge
Nent = 21123
Mean = 55.74
RMS = 41.89


Bar 4-8-12-p cluster charge
Bar 4-8-12-p cluster charge
Nent = 18830
Mean = 57.86
RMS = 40.48


Bar 5-1-03-n cluster charge
Bar 5-1-03-n cluster charge
Nent = 52754
Mean = 61.91
RMS = 47.34
Causing anomalous spikes in Bar 5-n L6
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
120
140
160
180
200


Bar 5-1-03-p cluster charge
Bar 5-1-03-p cluster charge
Nent = 77940
Mean = 68.08
RMS = 57.04
Causing Anamolous spikes in Bar 5-1-03-p
0
200
400
600
800
1000
1200
1400
1600
1800
0
20
40
60
80
100
120
140
160
180
200


FD 03-07-n cluster charge
FD 03-07-n cluster charge
Nent = 47559
Mean = 30.6
RMS = 13.31
Causing anomalous spikes in
FD 03-n
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
120
140
160
180
200


FD 05-07-n cluster charge
FD 05-07-n cluster charge
Nent = 118765
Mean = 54.32
RMS = 31.79
Causing anomalous peak
in FD 05-n
8000
7000
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
120
140
160
180
200