

FCAL bad channels

GlueX data

Susan Schadmand, 25.Nov.2020

introduction

- FCAL bad channel maps needed for efficiency from simulations
 - main issue: HV stability
- NIM paper:
 - four acrylic panes each covering the upstream end of one quadrant
 - each pane is illuminated by forty LEDs, ten violet, ten blue, and twenty green
 - the different colors are used to study the wavelength dependence of the transmission
 - transmission of blue is sensitive to radiation damage which causes brownish color of lead glass
- WIKI:
 - during production running the FCAL LEDs are cycled through 6 configurations, each 10 minutes long and tied to the wall clock

Violet 12 V (00 to 09 minutes)

Blue 10 V (10 to 19 minutes)

Green 29 V (20 to 29 minutes)

Violet 22 V (30 to 39 minutes)

Blue 15 V (40 to 49 minutes)

No pulsing (50 to 59 minutes)

- goal: “efficiencies” per run per detector channel, based on Blue 15 V
 - with respect to HV status only

analysis of LED skims

- plugin for histograms (hd_root file) containing ADC integrals per detector channel
 - `/u/home/susansch/GlueX/hald_my/plugins/fcalbadchannels`
- scripts for analysis and hand over all sub-runs per run
 - `/u/home/susansch/GlueX/FCAL/badchannels/scripts`
- sum over ADC integrals shows distinct peaks for the different “LED Regions”
 - *Regions 0-4, Region 4 is ‘most intense color’*
- LEDs are cycled, LED trigger sometimes off (by choice)

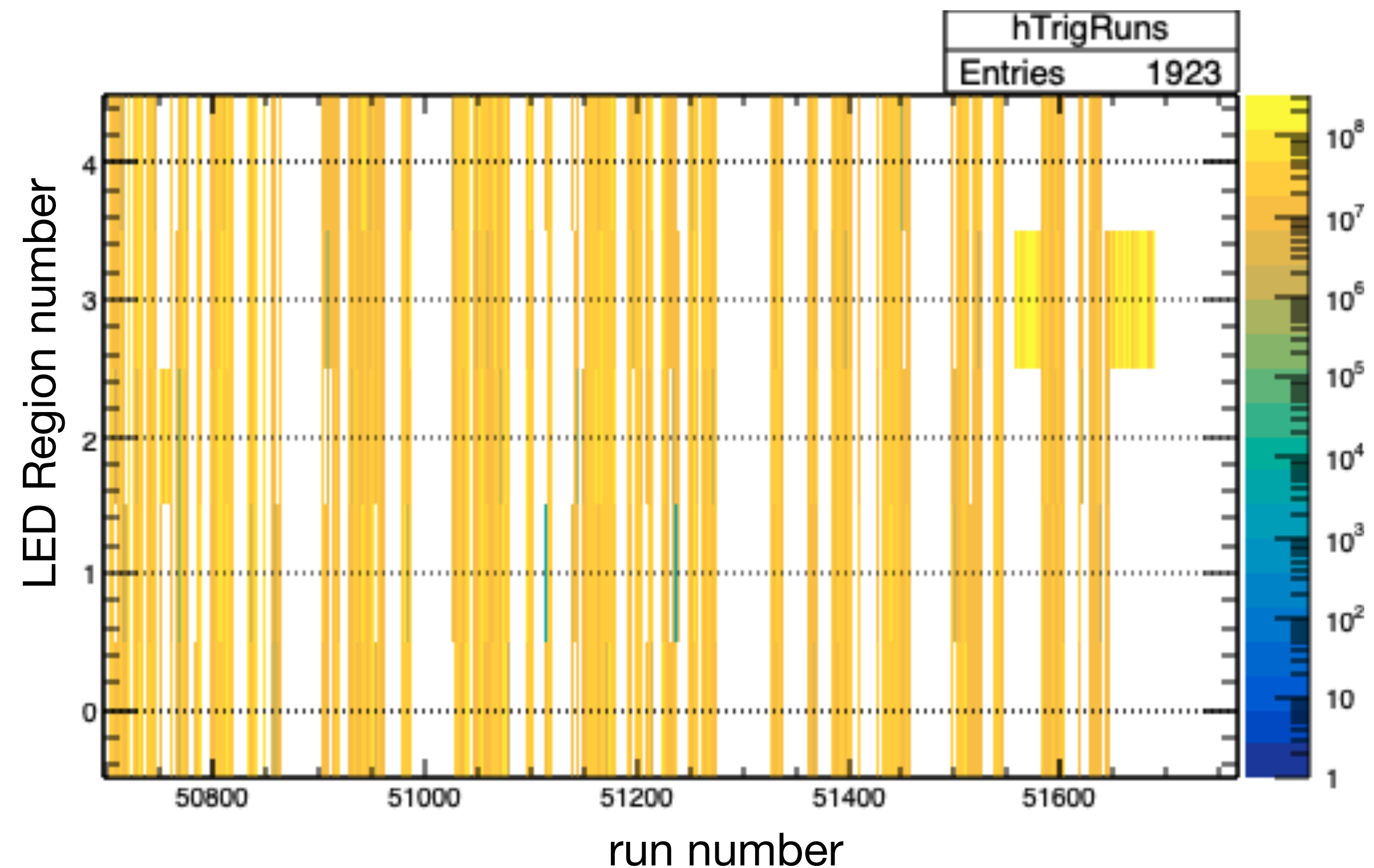
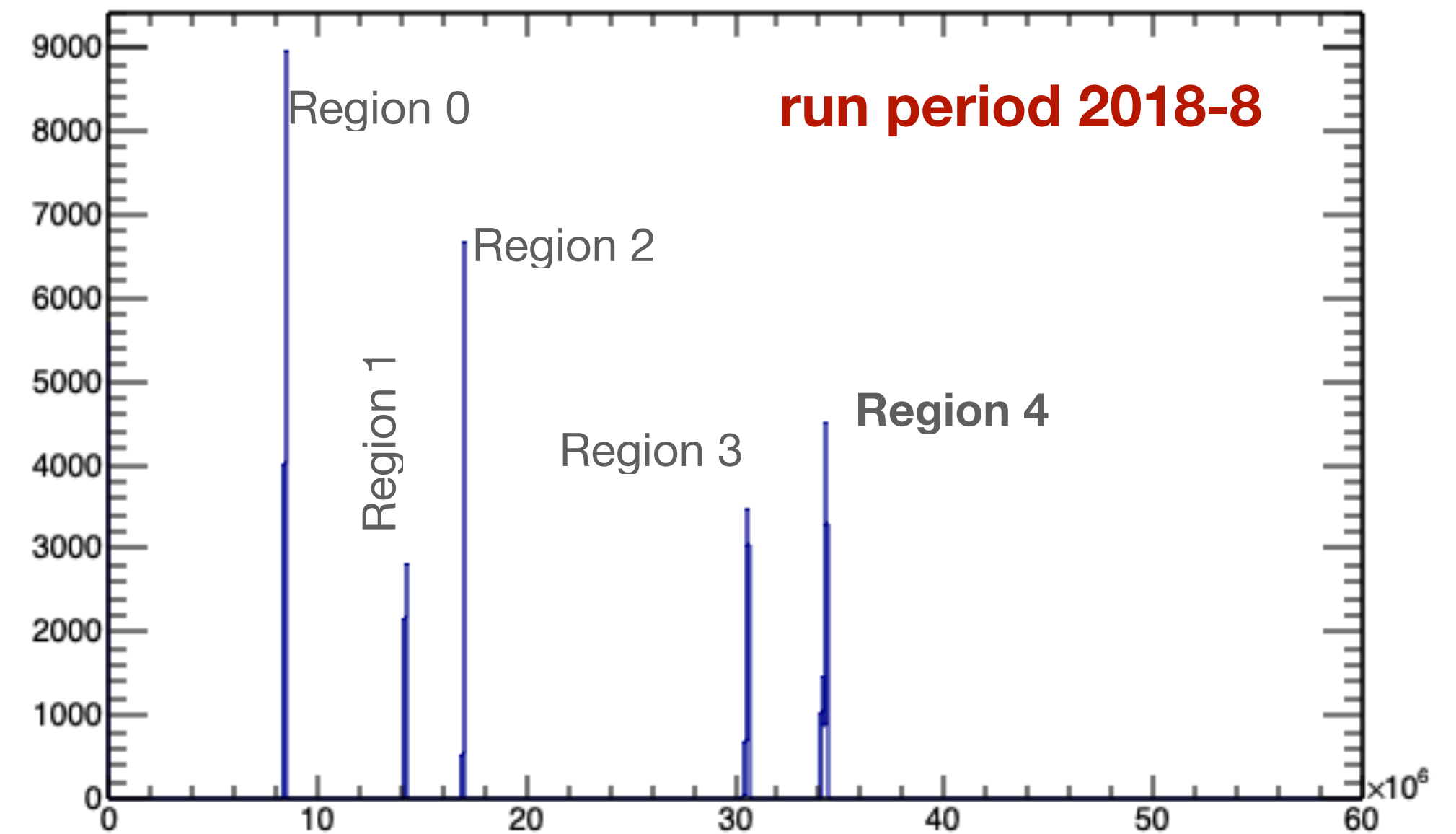
see 2D plot:

Entries in LED Regions

as a function of LED Region and run number

(shown: up to incl. Run_051599)

Total ADC Integral, Run_51768



evaluation of histograms

- scripts for running the macro
 - `/u/home/susansch/GlueX/FCAL/badchannels/macros/ChannelStatusGlueX.C`
- Entries: entries of histograms, ADC integrals per detector channel, normalized via entries in LED Region
 - just entries, no regard to number or quality of peaks in histograms
- txt output file: Entries>1 are set to 1 → “**efficiency**” (with respect to HV status)

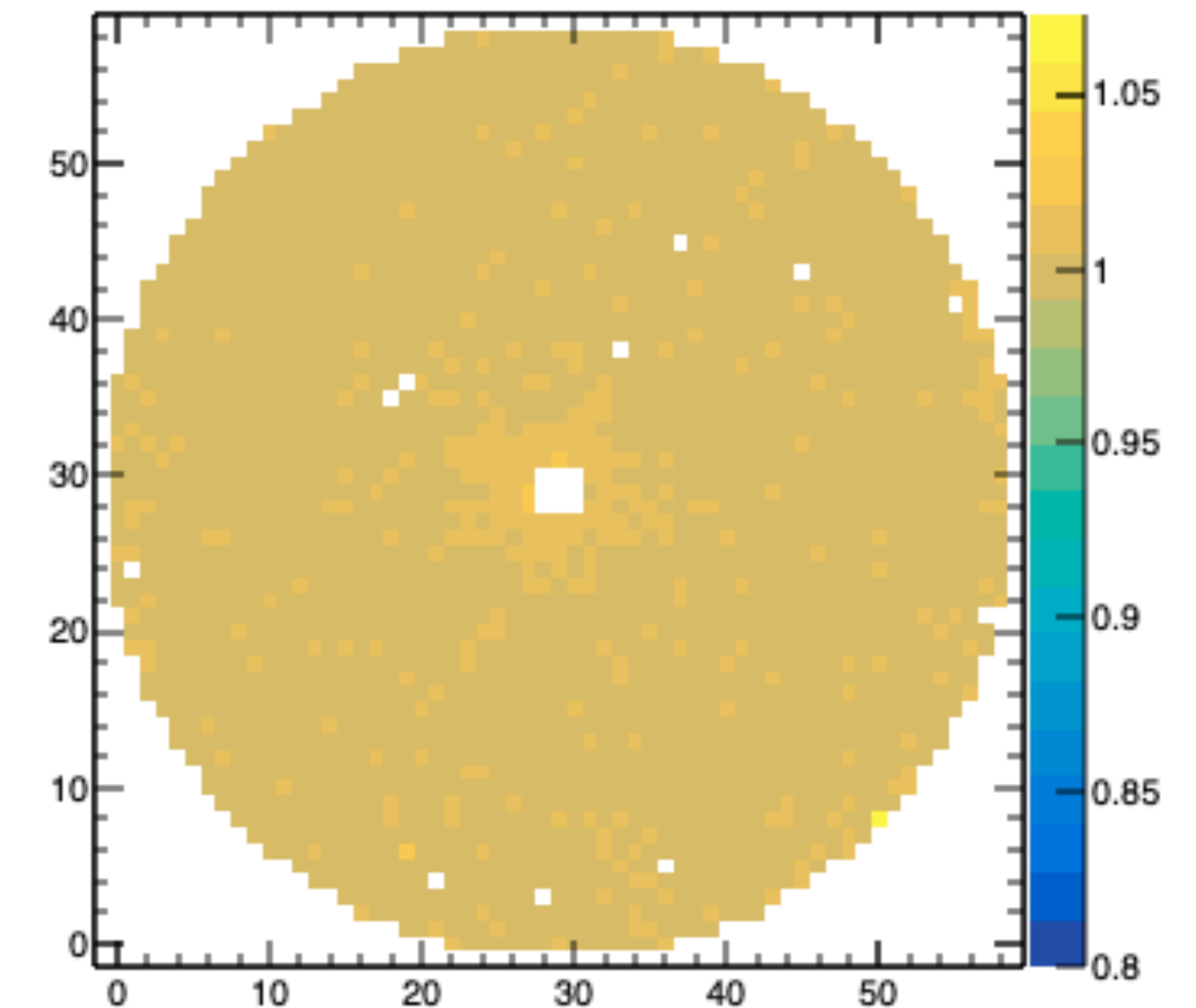
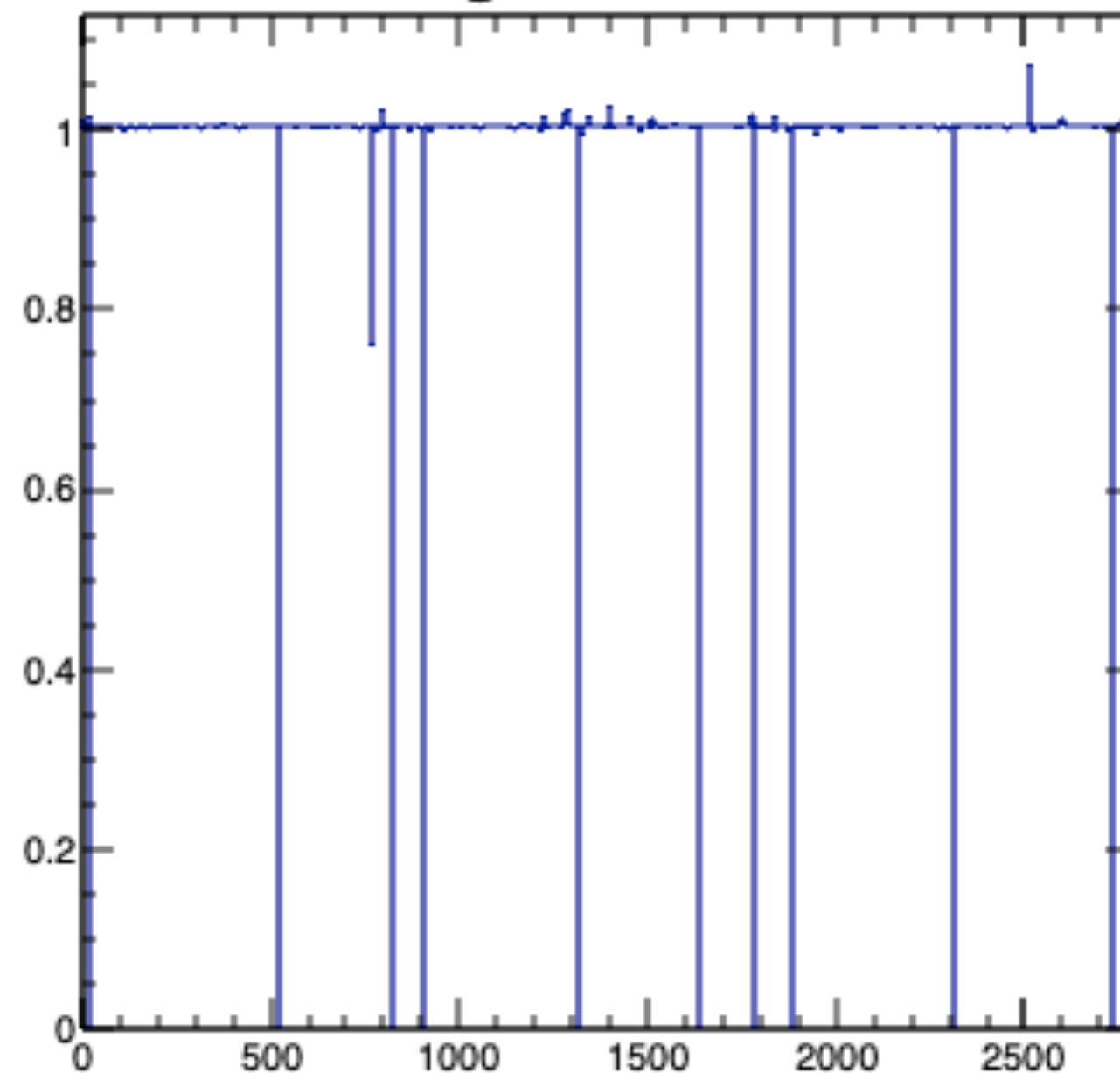
- Entries plot is using the translation
`int channel = fcalGeom.channel(digihit->row,digihit->column);`

- 2D plot is the occupancy
`hRowColOcc_[ireg]->Fill(digihit->row,digihit->column);`

normalized to the Entries plot

(Run_051768 is last physics production run)

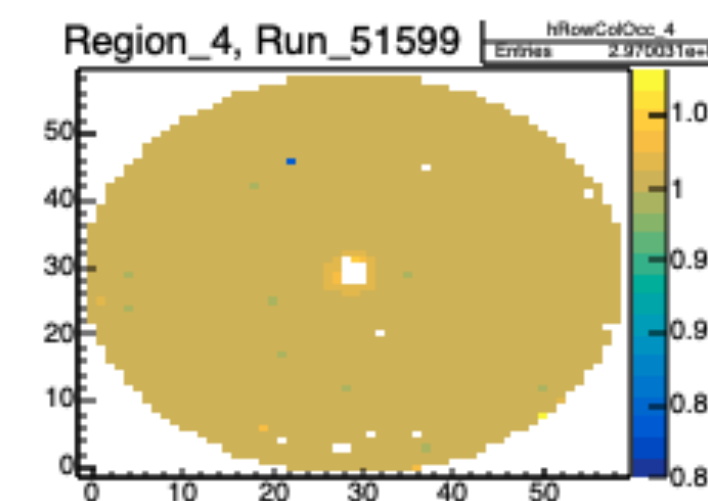
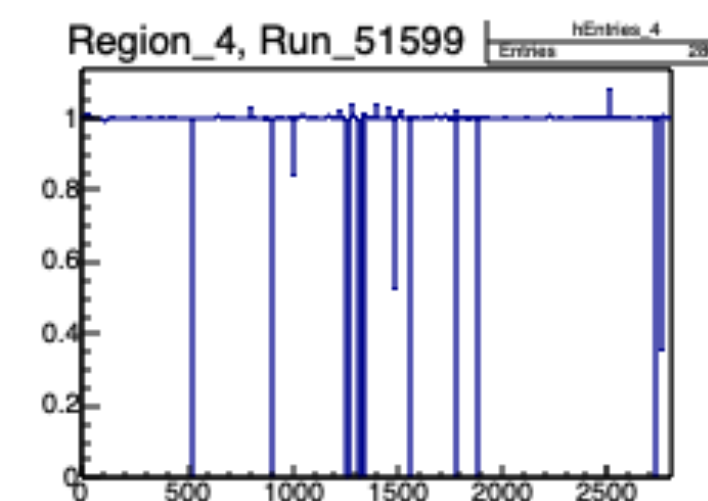
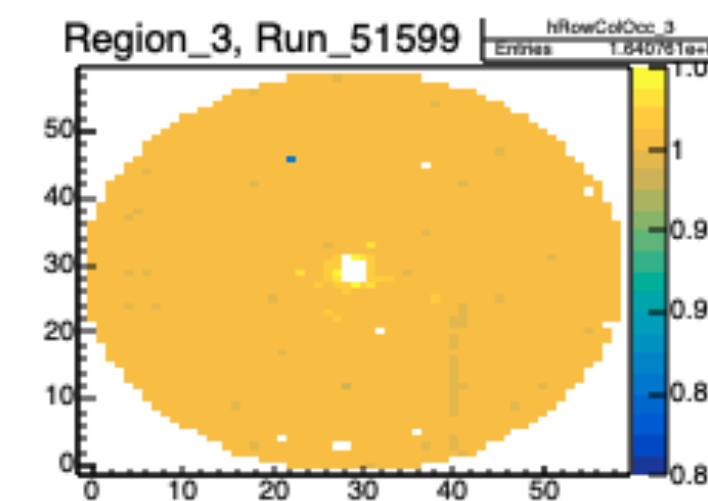
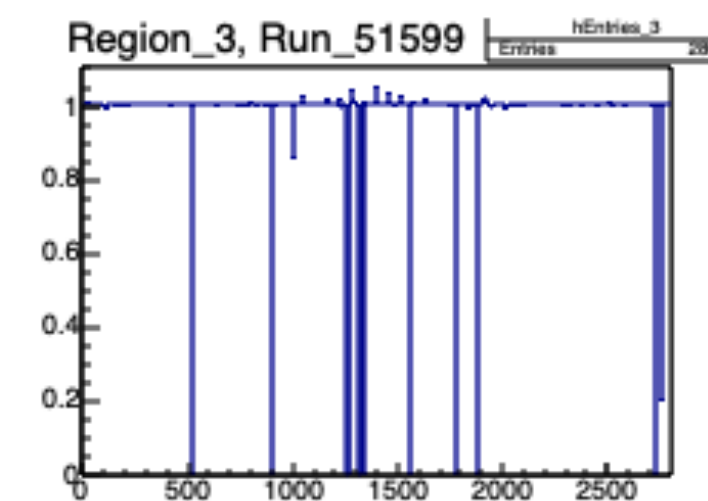
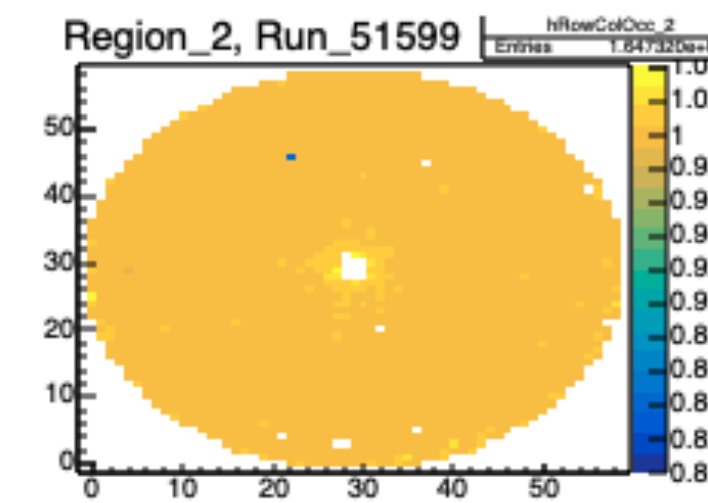
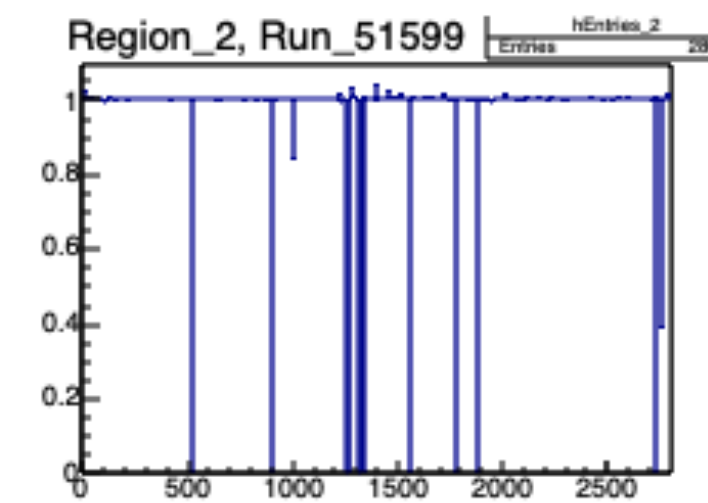
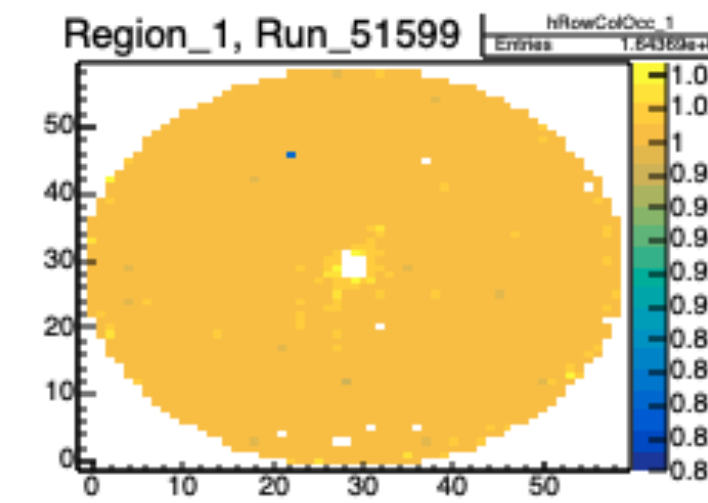
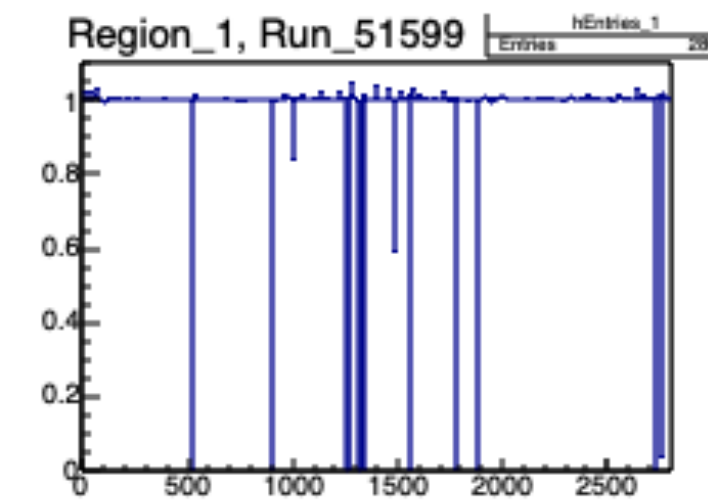
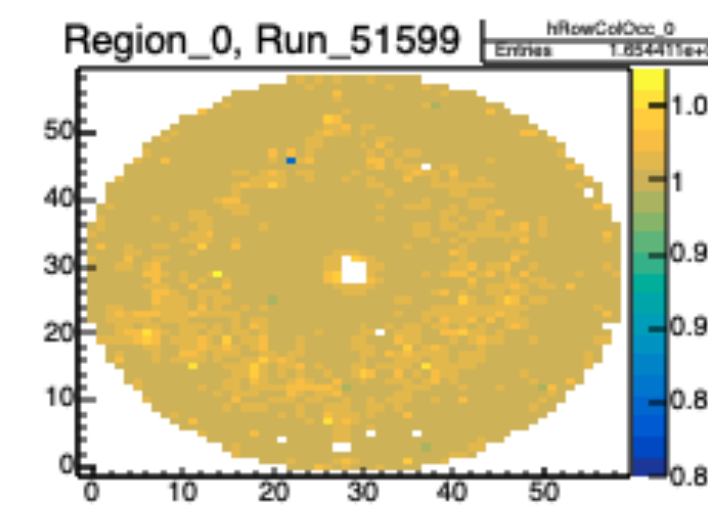
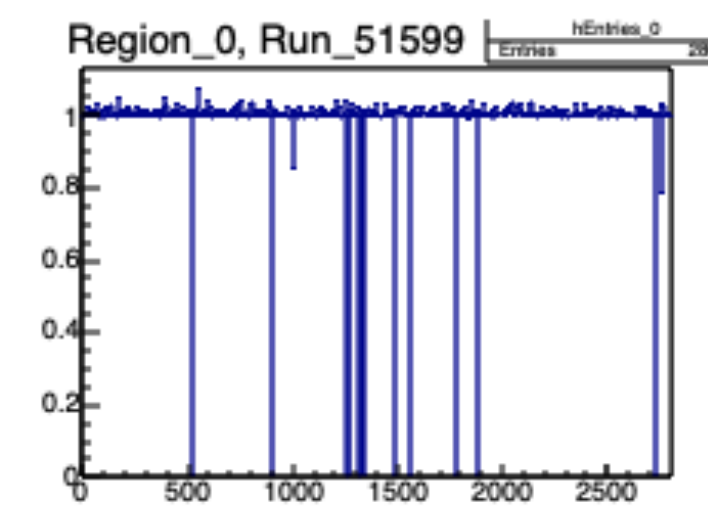
Entries, Region_4, Run_51768



output files for data base

- a root file with entry and occupancy plots
- txt files: “efficiencies”
 - with respect to HV status only
 - per run and per LED Region,
 - each file 2800 lines, 1 column

```
/w/hald-scifs17exp/home/susansch/FCALbadchannels  
Run_051599_Entries_plot.root  
Run_051599_Region0_Eff.txt  
Run_051599_Region1_Eff.txt  
Run_051599_Region2_Eff.txt  
Run_051599_Region3_Eff.txt  
Run_051599_Region4_Eff.txt
```



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Susan Schadmand, 11.Nov.2020

bad channel maps needed for efficiency from simulations

known issues:

FCAL Base Manual (JonZ)

- sudden HV failure
- loss of communication
- hot channels

method adapted from Chandra Akondi

(fcalbadchannels05aug2020presentation.pdf, see previous calorimeter meetings)

- LEDs are used to check the status of detector channels
- analyze **FCAL-LED event skims**

plugin for histograms (hd_root file) records ADC integrals per detector channel

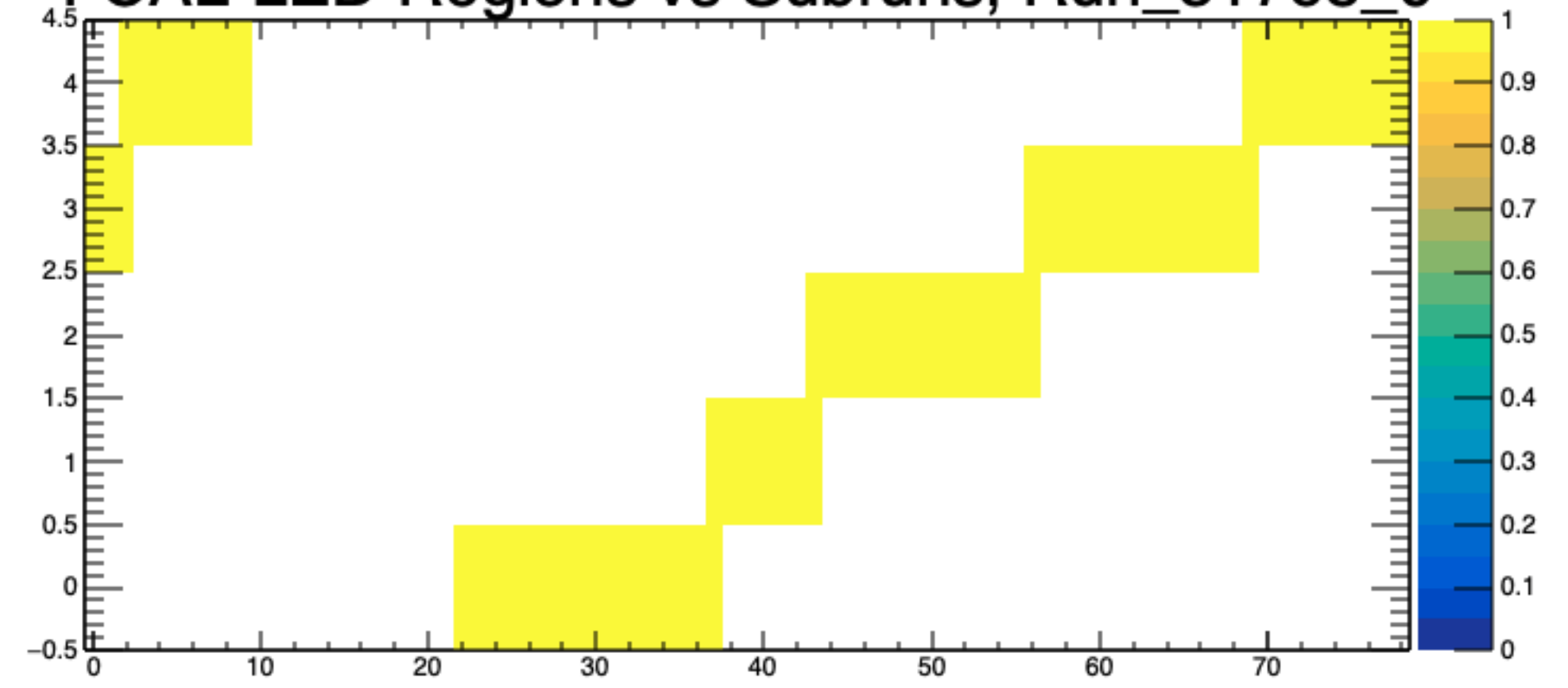
```
ADCintegral per detector channel  
= (digiHit->pulse_integral)  
- (((double)digiHit->pedestal/digiHit->nsamples_pedestal) * digiHit->nsamples_integral);
```


- 3 LED colors, run with different voltages, periodically switching voltages -> seen in ADC integrals

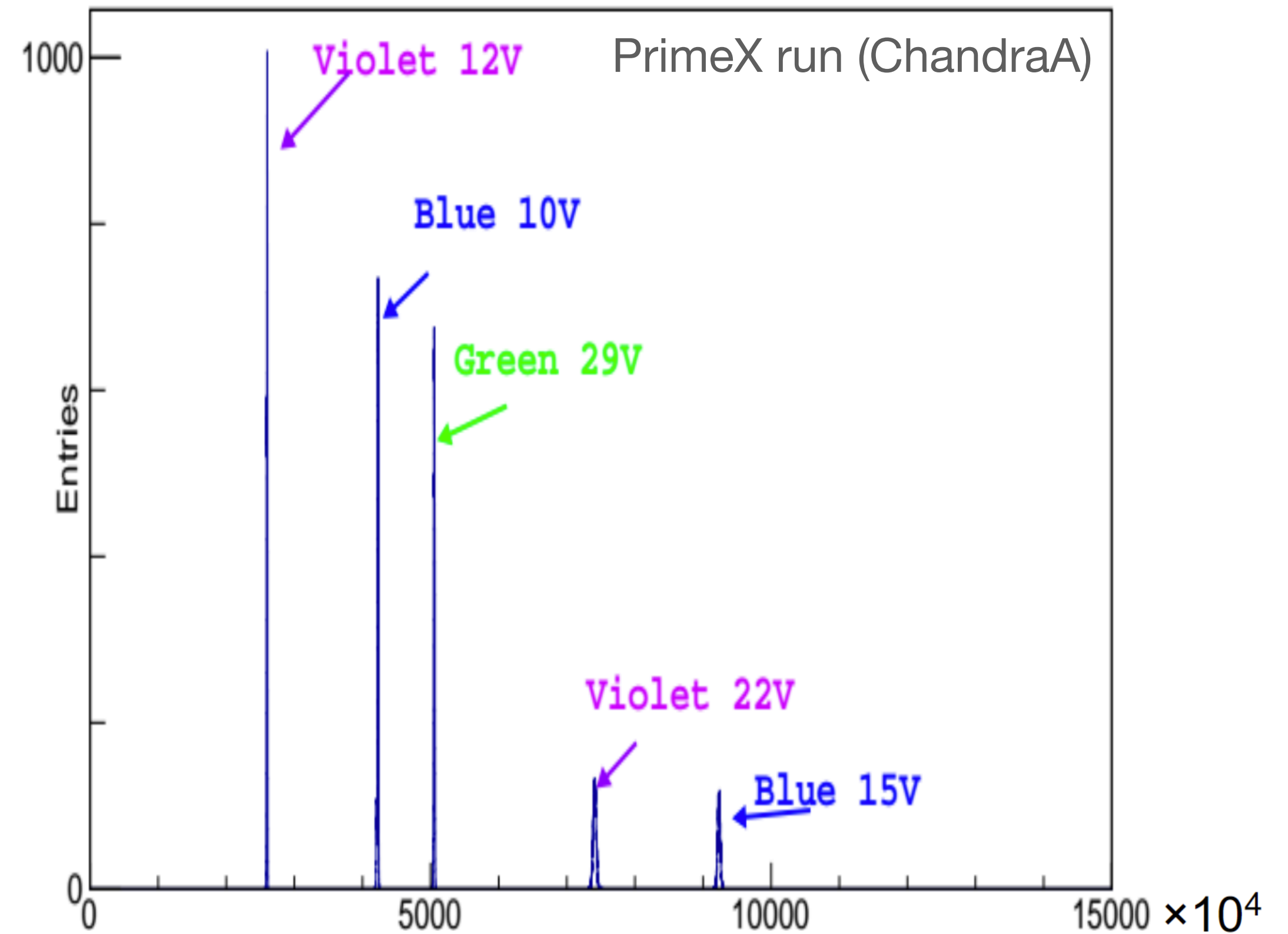
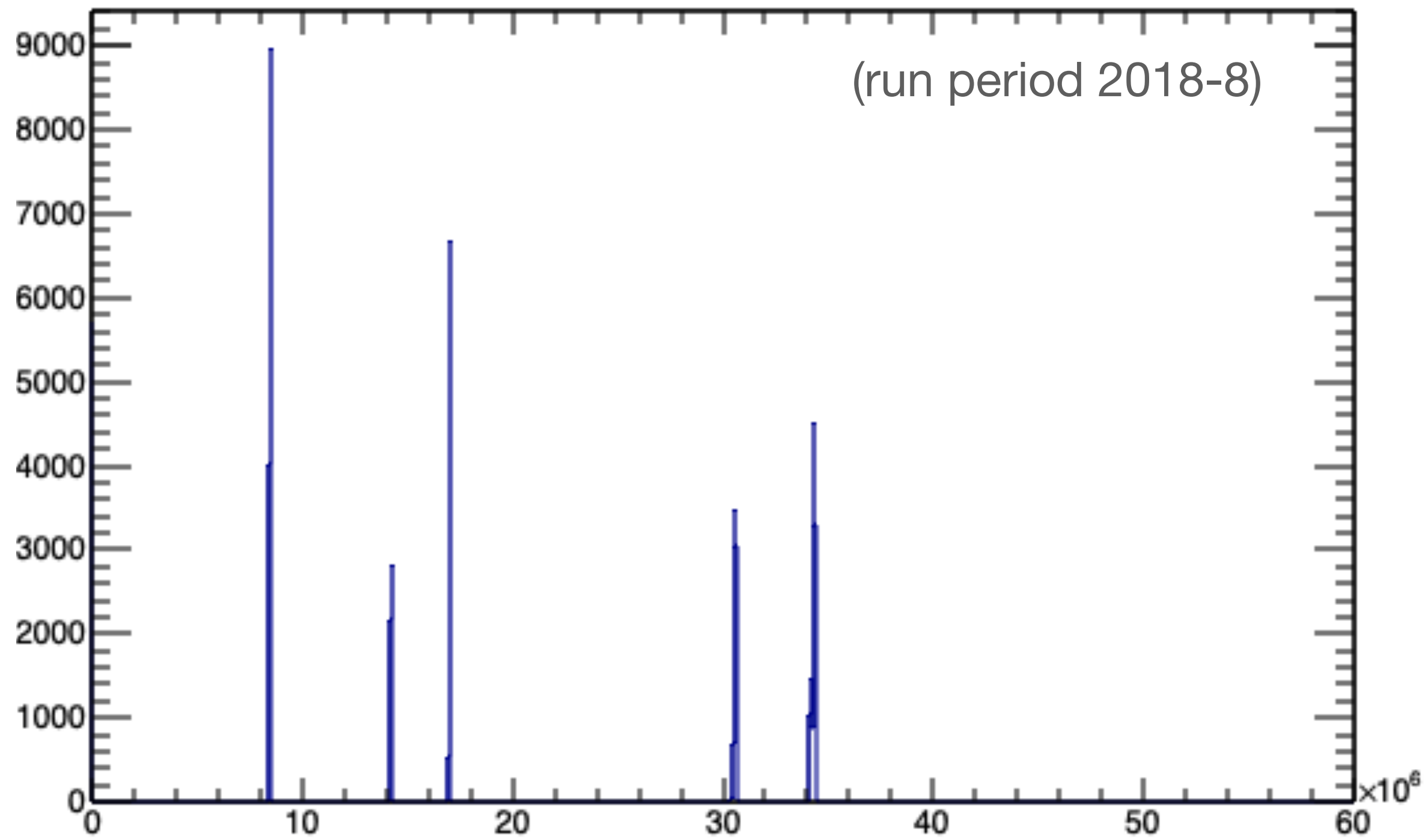
- ★ sub-runs without LED events
- ★ sub-runs with more than one LED region

- sum over ADC integrals shows distinct peaks for the different “LED Regions”

FCAL-LED Regions vs Subruns, Run_51768_0



Total ADC Integral, Run_51768



finding bad channels:

look at ADC integrals, per run and per region

status is bad if

- number of peaks in histogram > 2 (there may be a pedestal peak ??)
- or Gauß fit to the peak returns the status 4
- or averaged* histogram entries < 0.9
- or the averaged* area under the Gauß is < 0.9

these two types of spectra do not seem to have the same features

the overall bad status of the detector channels has to be a logic OR over the regions

the Gauß area seems more sensitive to inefficiencies?

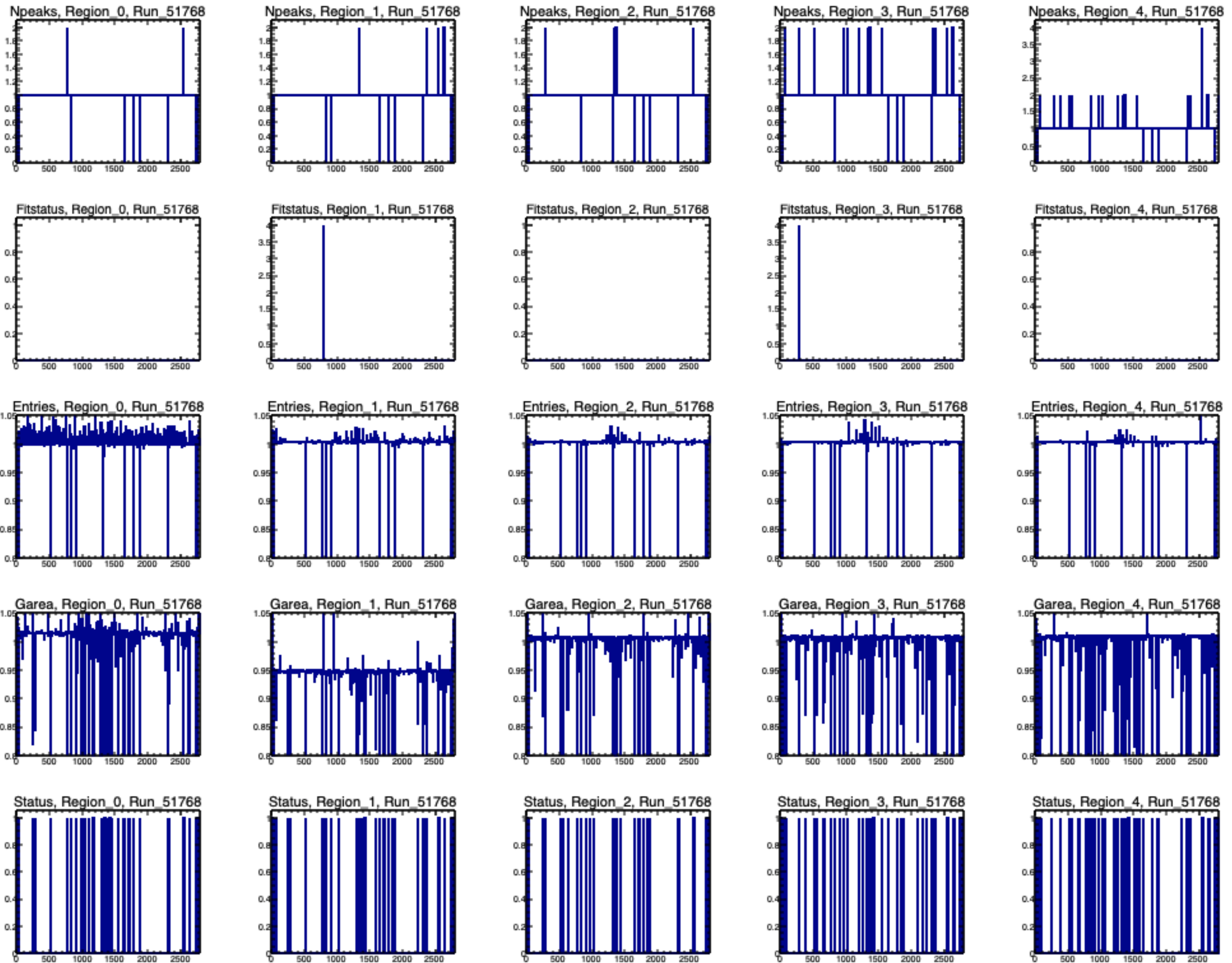
for the data base, need a txt file with numbers for the 2800 channels

- 1 for good ; 0 for bad
- or an efficiency

or simply preferable because it does not count additional peaks like pedestals?

(see next page)

* averaged to 1 over the channel numbers



for example:

there is ≥ 2 peaks in the ADC integral histograms

Gaussian fitstatus is good ($=0$), the peak with the highest x-position is fitted.

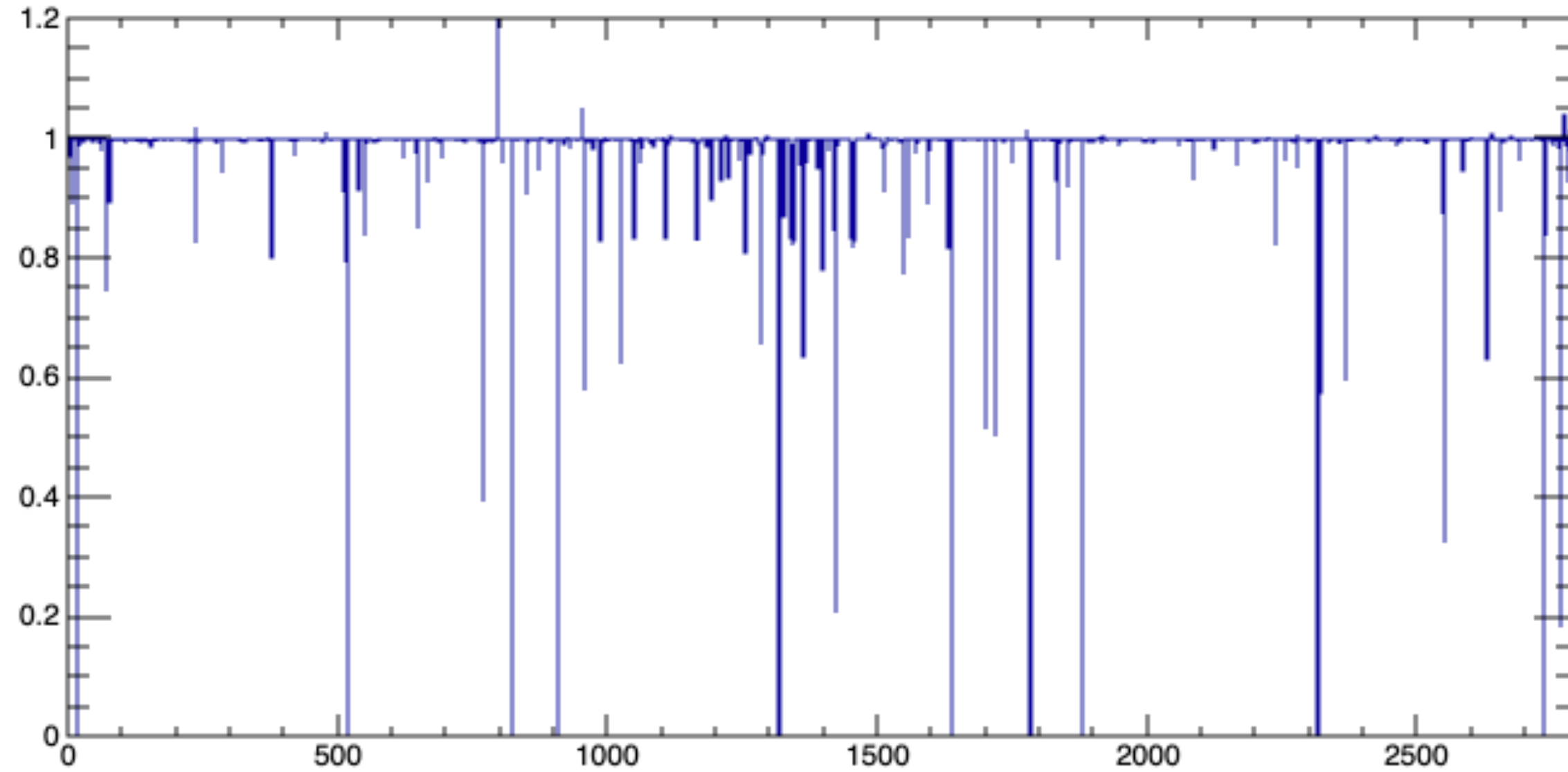
there is hot channels in the middle of the detector (beam).

this is not seen as extremely in the averaged Gauß areas ... because of counting in only one peak, the one with the highest x-position.
but the Gauß area seems more sensitive to inefficiencies?

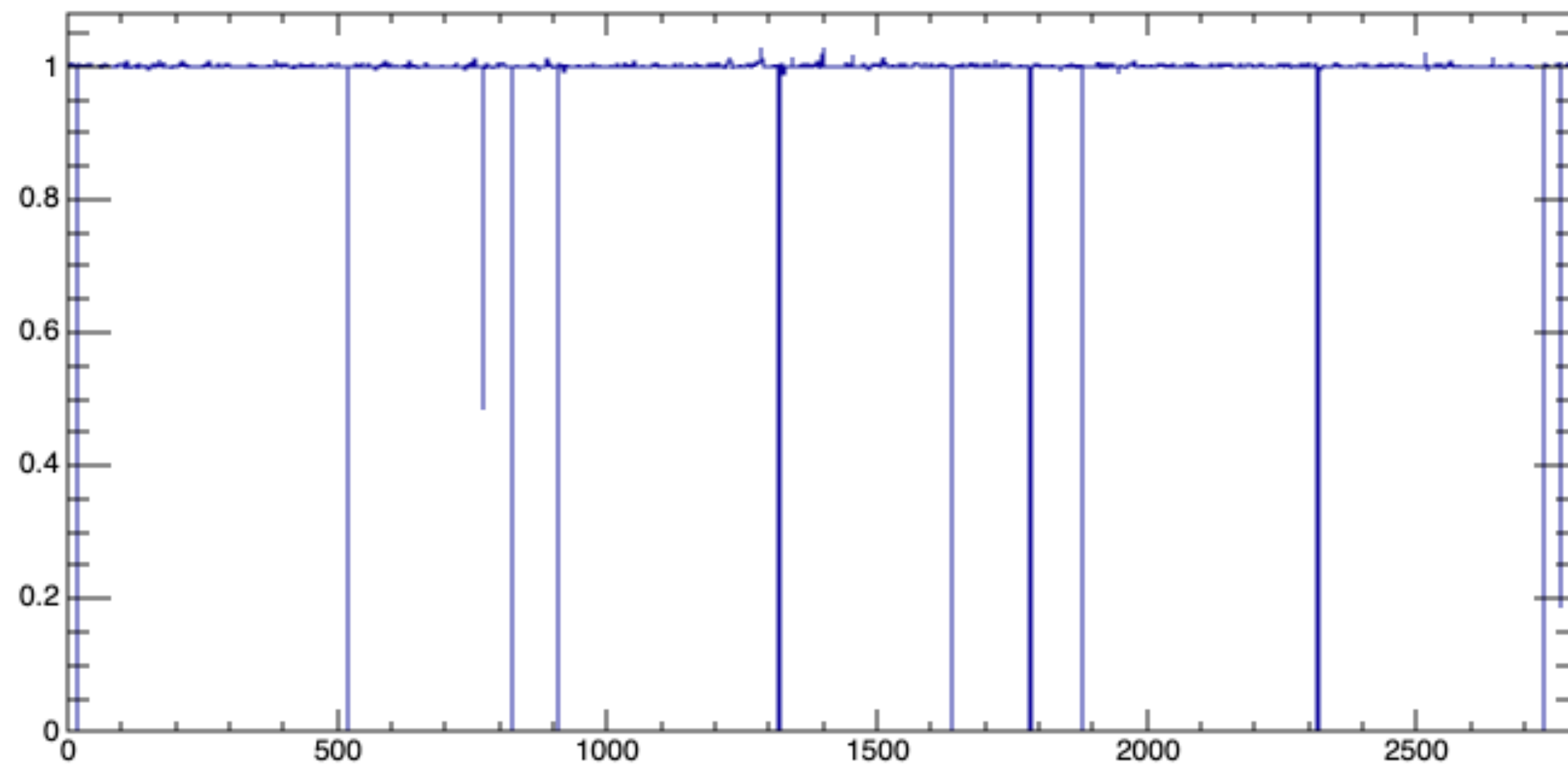
here, the bad channels (status=1) are based on the Gauß areas.

in total 57 channels would be bad

Efficiency from Gauss area, Run_51768



Efficiency from Entries, Run_51768



efficiencies

- ignoring LED Regions
- integrated over Run
 - including sub-runs without LED events
- normalized with FCAL-LED trigger count
- consider as inefficiency (set efficiency > 1 to 1)
- **suggestion:**
 - **provide per-run files with inefficiencies**
 - **from which**, Gauss areas or Entries or both?
 - by applying a **cut on the inefficiencies** this could easily be turned into a 0/1 decision