FCAL LED monitoring GlueX data

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introduction

- FCAL “bad block maps” needed for efficiency from simulations
  - main issue: HV stability

- setup:
  - 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

- usage:
  - 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 block

  - *detector channels are called blocks (ref to shape of the lead glass detectors :)*

bad block maps needed for efficiency from simulations

known issues:

- sudden HV failure
- loss of communication
- hot blocks

- LEDs are used to check the status of blocks
- analyze **FCAL-LED skims**

plugin for histograms (hd_root file) records ADC integrals per hit

```
ADCintegral per hit =
  (digihit->pulse_integral) -
  (((double)digihit->pedestal/digihit->nsamples_pedestal) * digihit>nsamples_integral);
```

Hit bank has associated block number, row, column.

analysis of LED skims

- plugin for histograms (hd_root file) containing ADC integrals per detector blocks
  - ***/u/home/susansch/GlueX/halld_my/plugins/fcalbadchannels***

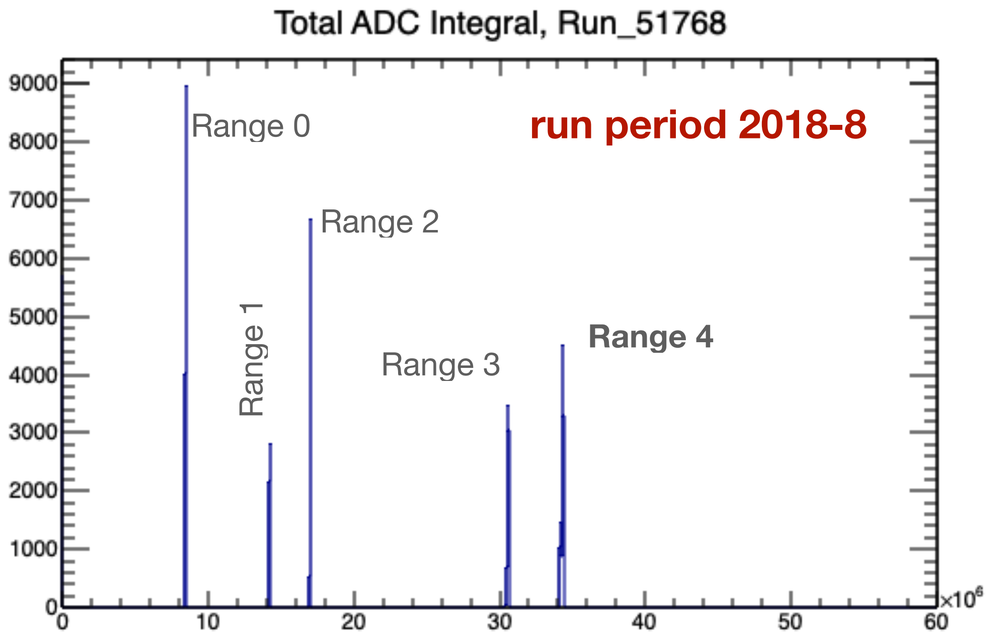
- scripts for analysis
  - *eg* ***/u/home/susansch/GlueX/FCAL/badchannels/*** *RunPeriod-2018-08*

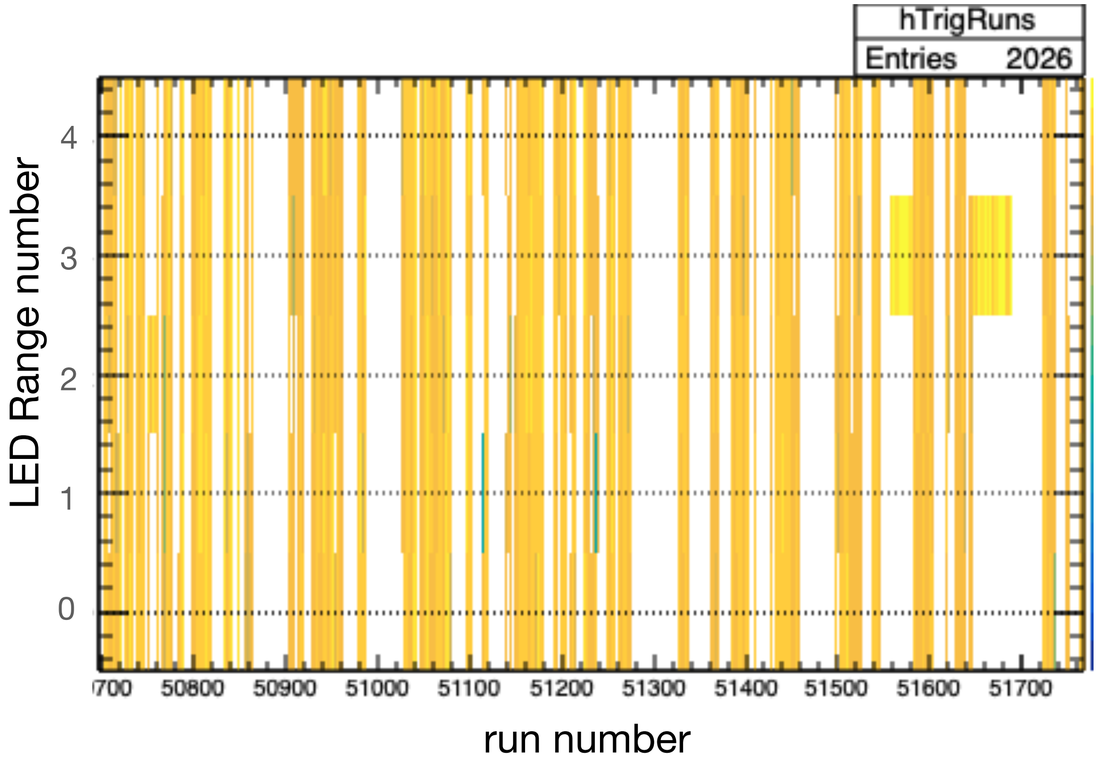
- **Total ADC Integral:**
  - sum over hit ADC integrals
  - distinct peaks for the different “LED ranges”
  - ***identify and normalize LED ranges***
  - *Range 0-4, Range 4 is ‘most intense color’*

- LEDs are cycled, LED trigger sometimes off (by choice)

  see 2D plot:
  Entries in LED Ranges
  as a function of LED range and run number

RunPeriod 2018-08 physics runs: 050697 - 051768





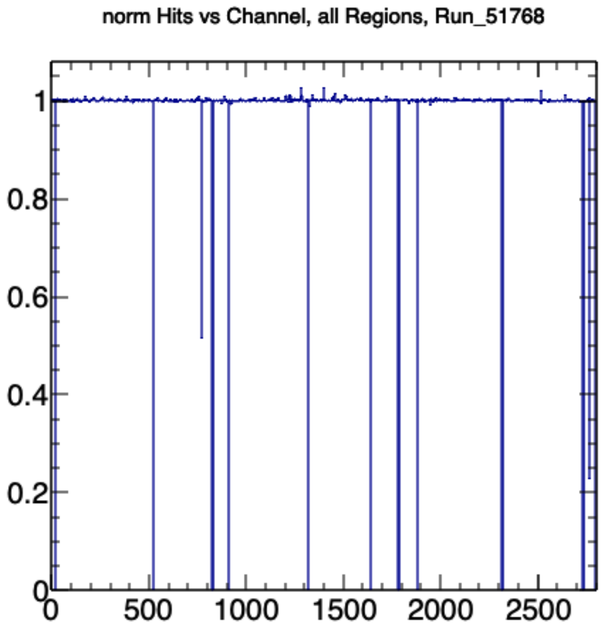
FCAL LED efficiency

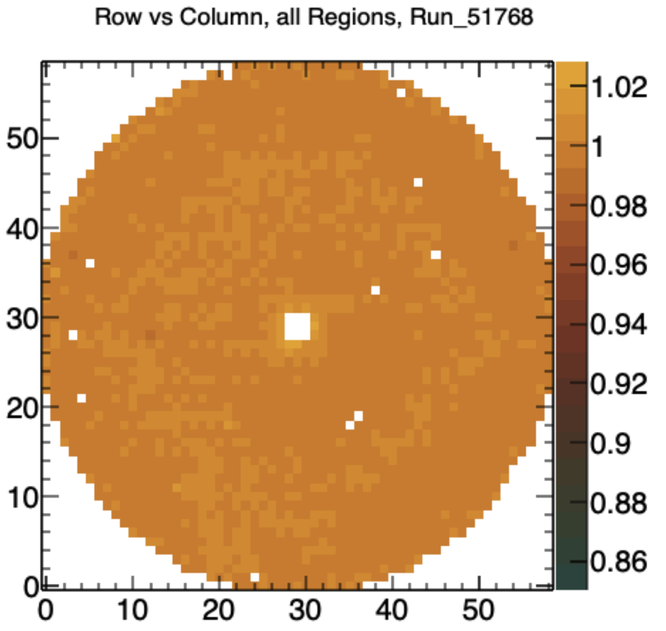
- old approach:
    - Entries of normalized histograms (ADC integrals (pulses), per block)
    - Entries >1 were later set to =1 —> “efficiency”
    - > 1 hits per block can result from double pulsing (at high rates) and switching noise
- **present approach**:
    - increment Entries only once for blocks with 1 or more hits

-> **no more efficiencies > 1**

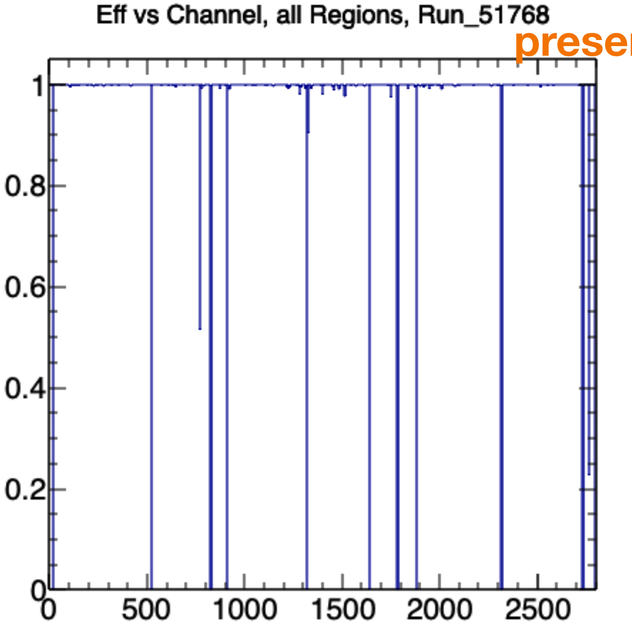
scripts for running the macro

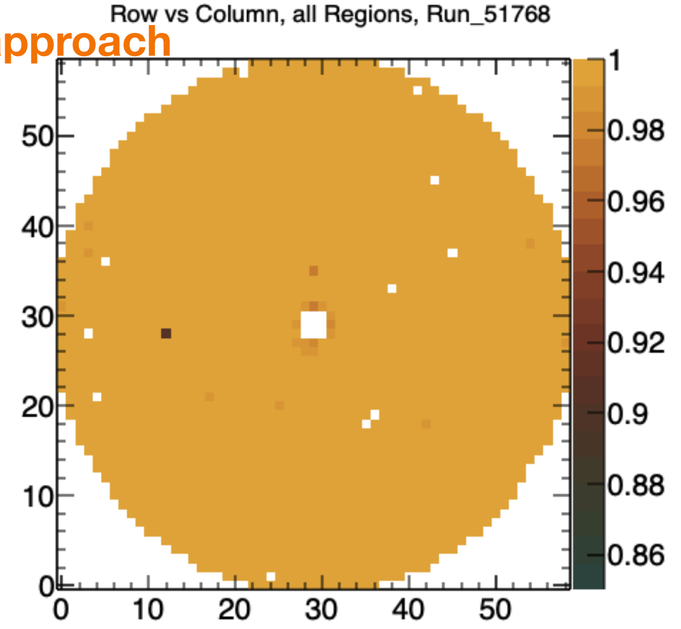
- ***/u/home/susansch/GlueX/FCAL/badchannels/macros/ChannelStatusGlueX.C***





present approach





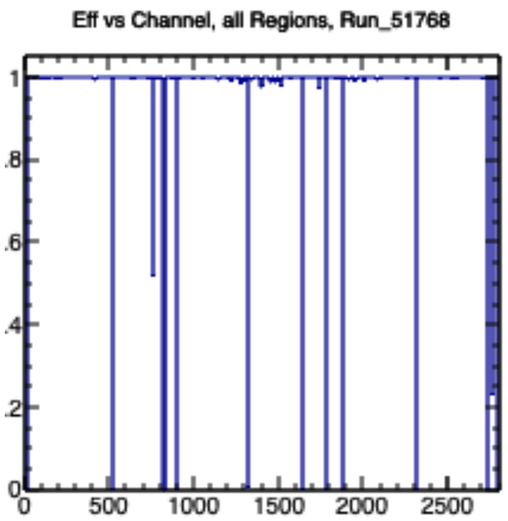
FCAL LED efficiency compare LED ranges

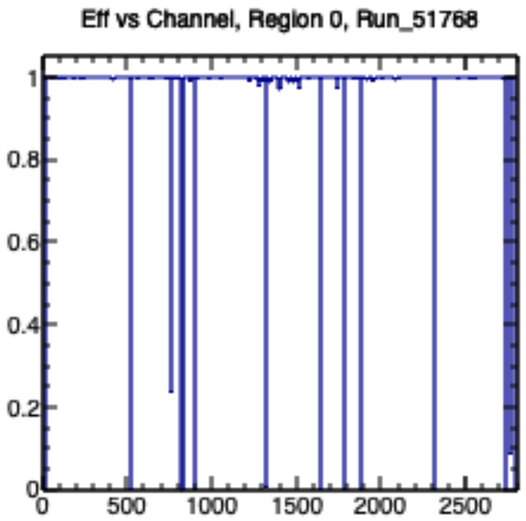
reminder:

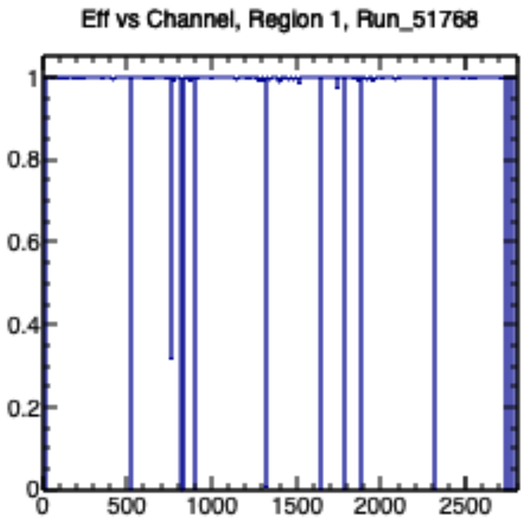
- HV situation changes rapidly
- LEDs cycle through 6 configurations
- -> using only one range provides info for only part of a run

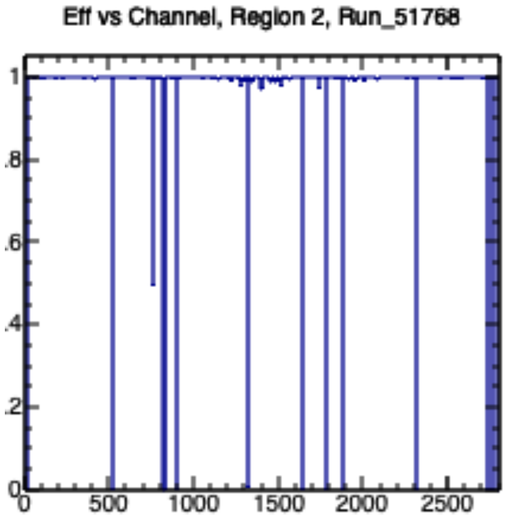
- the efficiencies for the various ranges are similar to **overall efficiency**
  (regardless of ranges,
  anything withTotal Inte >0)

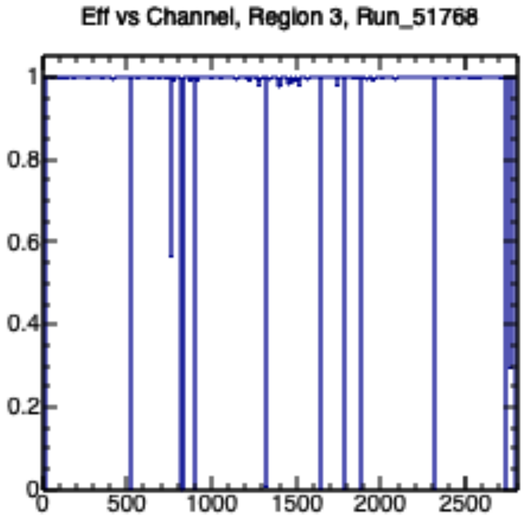
overall efficiency

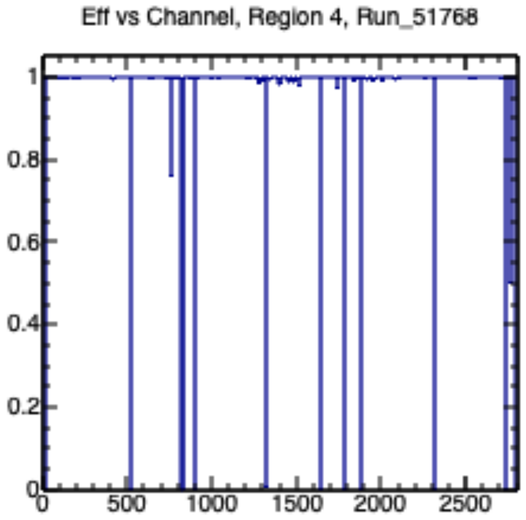












FCAL LED efficiency normalization

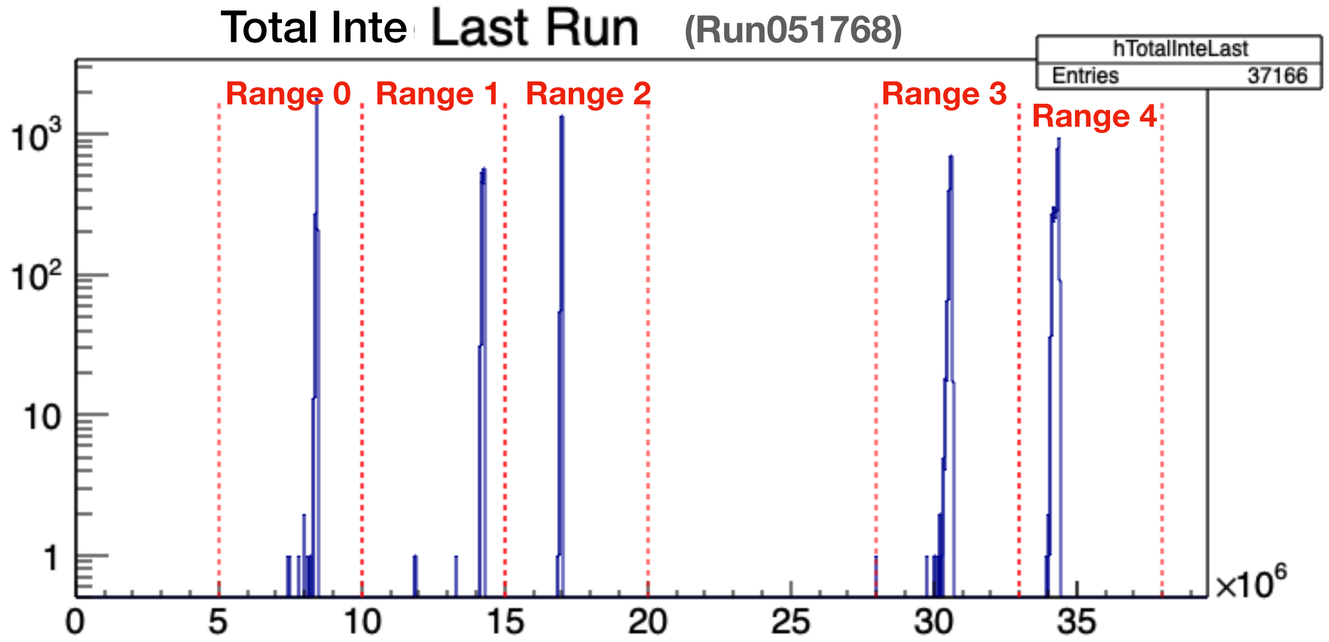
normalization and identification of LED ranges:

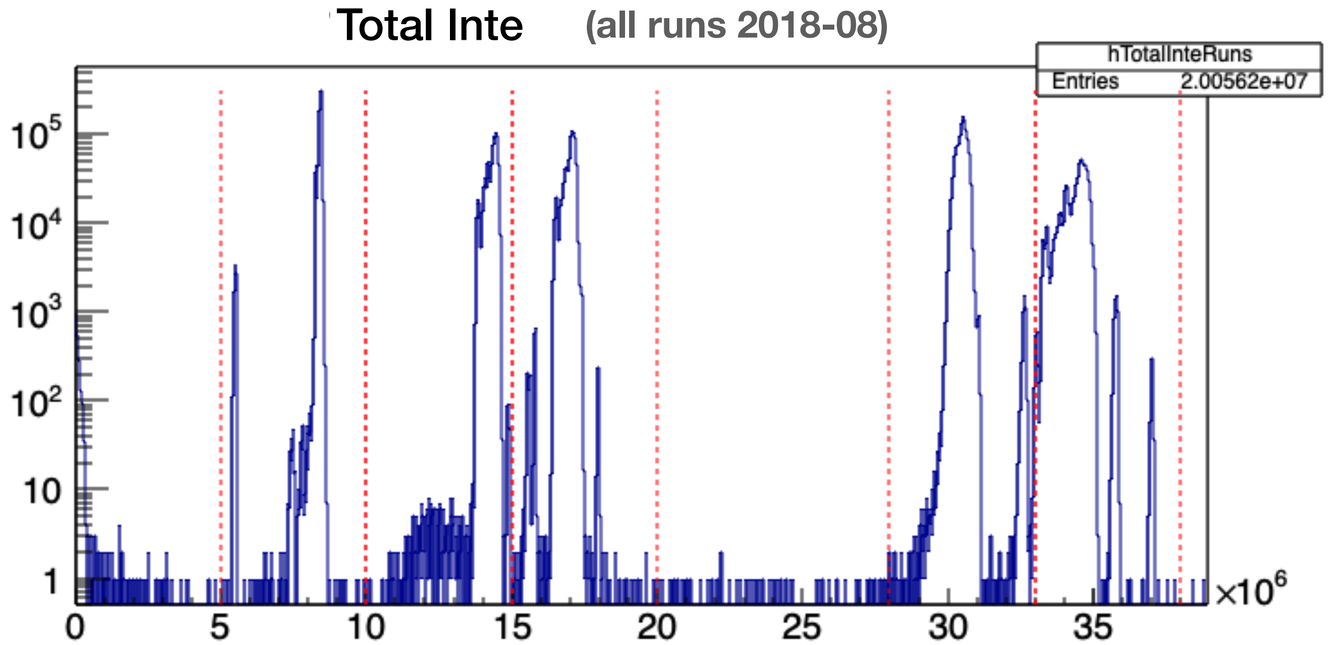
via histogram “Total Inte” which is
ADC integrals, summed over hits

red dashed lines:
definition of LED ranges

“Total Inte” for entire RunPeriod 2018-08

- counts outside the ranges
- the peak at 0
  - is not from pedestals
  - contains >1 hit events
  - indicates all hits have small ADC integral
  - -> area at 0 can be excluded





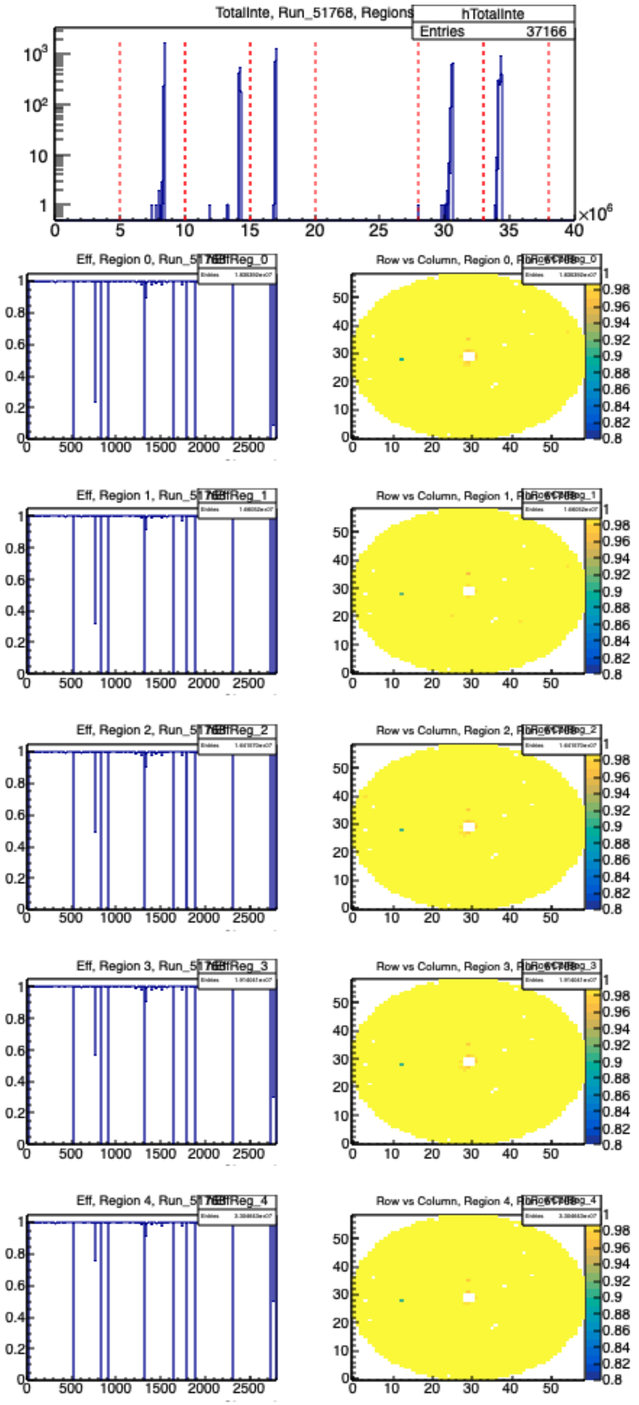
Results

- a root file
  - Total Inte with indications of LED range definitions
  - efficiency and occupancy plots

- txt files with efficiencies
  - per run and per LED range,
  - each file <u>2800 lines, 1 column</u>

e.g.
/w/halld-scifs17exp/home/susansch/FCALbadchannels/RunPeriod-2018-08
…

```
Run_051768_Eff.txt (“overall efficiency”)
Run_051768_Region0_Eff.txt
Run_051768_Region1_Eff.txt
Run_051768_Region2_Eff.txt
Run_051768_Region3_Eff.txt
Run_051768_Region4_Eff.txt
Run_051768_plot.root
```



output files for data base

only for RunPeriod-2018-08
/w/halld-scifs17exp/home/susansch/FCALbadchannels/RunPeriod-2018-08/**old**

- a root file with entries and occupancy plots
  - note that row and column axes are switched

- txt files: “efficiencies”
  - where Entries >1 to = 1 -> “efficiency”
  - per run and per LED range,
  - each file <u>2800 lines, 1 column</u>

eg

```
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
```