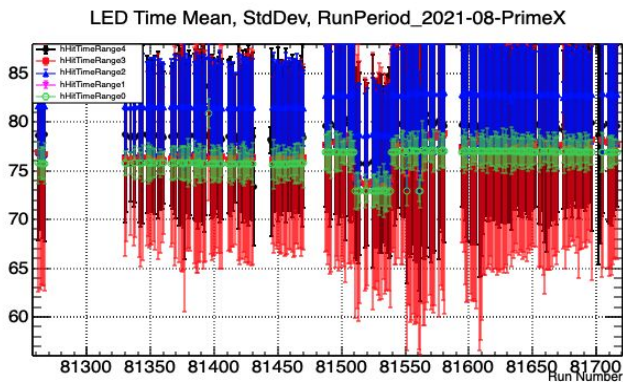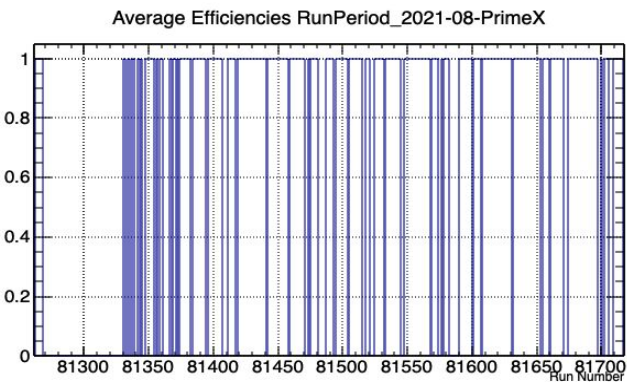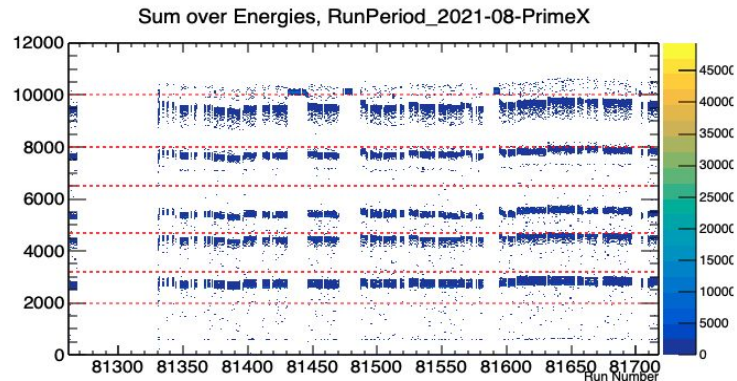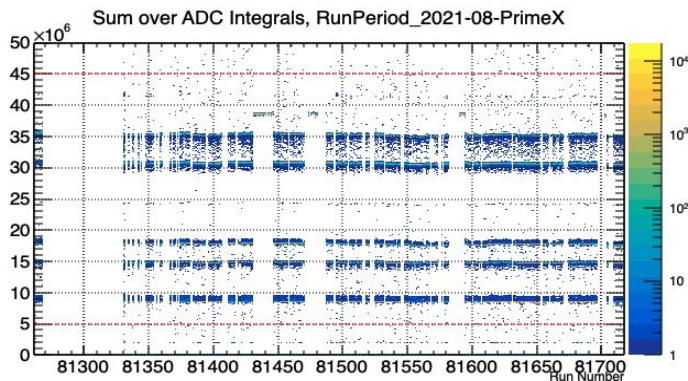# FCAL LED efficiencies and timing

- RunPeriod-2021-08 PrimeX
- RunPeriod-2021-11 SRC/CT

Susan Schadmand, Mar 16, 2022GlueX Calorimetry Working Group

Sum over ADC Integrals, RunPeriod_2021-08-PrimeX

Sum over Energies, RunPeriod_2021-08-PrimeX

Average Efficiencies RunPeriod_2021-08-PrimeX

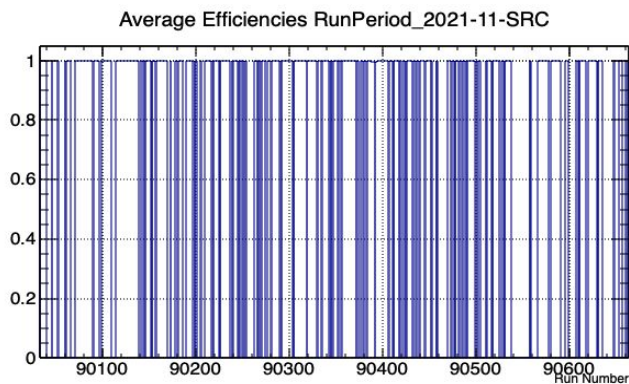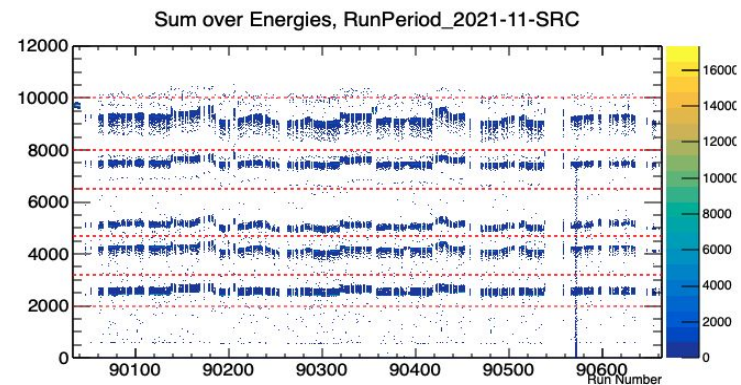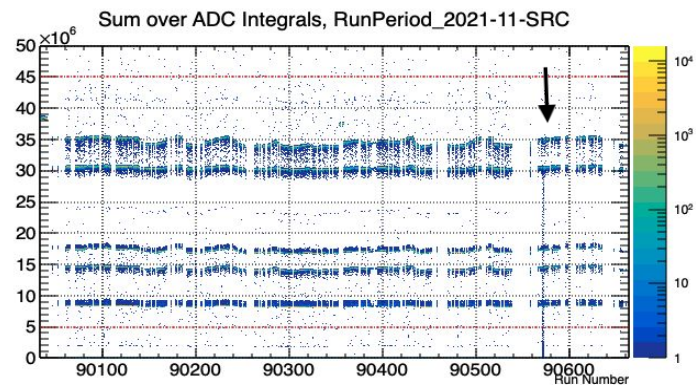LED Time Mean, StdDev, RunPeriod_2021-08-PrimeX

some runs have summed pulse integrals only at 48e6, they show up as "energies" of 10000, unfortunately cut out by energy ranges for time status
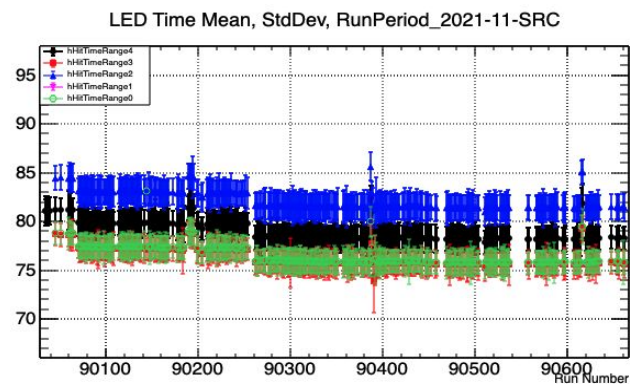
Validation excluded so far:
- 81330 FCAL crates (one at the beginning and two at the end) are off the scaler pattern, DAQ problem at the end of run
- 81533 empty target run with predominantly no beam (cosmics)
- 81672 raw mode while filling target, issue with ComCAL, junk run
- 81674 He cell full, production in raw mode
- 81700 junk, nothing in logbook, 10 hours long, essentially a cosmic run
- 81701 junk, nothing in logbook, low event count and ~0 beam current

=> rerun with improved energy range limits for time status

Sum over ADC Integrals, RunPeriod_2021-11-SRC

Sum over Energies, RunPeriod_2021-11-SRC

Average Efficiencies RunPeriod_2021-11-SRC

LED Time Mean, StdDev, RunPeriod_2021-11-SRC

runs 90571-90572: noise? logbook says beam (and target?) trouble

timing seems shifted in the beginning (probably not final calibration)

FCAL LED efficiencies and timing

RunPeriod-2021-08 PrimeX

Susan Schadmand, Feb 22, 2022 PrimEx-eta (informal) Calibration & Analysis Meeting

introduction FCAL LED efficiencies

- **FCAL efficiency maps needed for efficiency from simulations**
- known issue: HV stability
    - sudden HV failure
        - loss of communication
    - hot blocks
- 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
        1. Violet 12 V   (00 to 09 minutes)
        2. Blue   10 V   (10 to 19 minutes)
        3. Green 29 V   (20 to 29 minutes)
        4. Violet 22 V   (30 to 39 minutes)
        5. Blue   15 V   (40 to 49 minutes)
        6. No pulsing   (50 to 59 minutes)

- evaluate LED events, find "bad" blocks* (inconsistent response to LEDs)
- **goal: LED efficiencies per run per block**
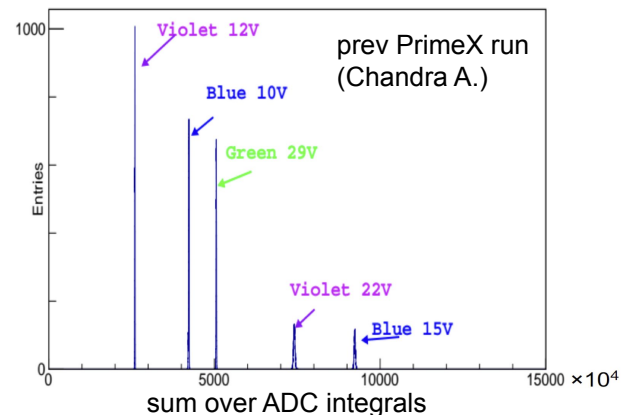
detector channels are called blocks (ref to shape of the lead glass detectors)
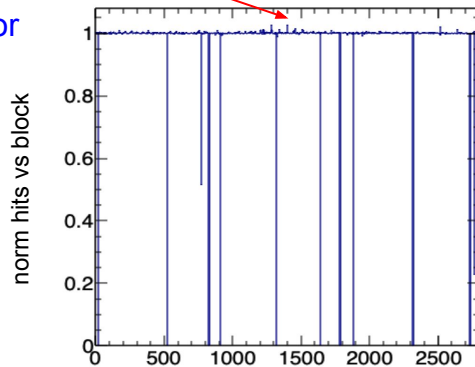
FCAL LED efficiencies

- analyze FCAL-LED skims
  - plugin* for histograms (hd_root file) records ADC integrals per hit
- step 1: **loop over hits** (using DFCALDigiHit)
  - sum over ADC integrals shows distinct peaks for the different "**LED Regions**" which **shift with time**
  - ➤ **consider entire LED region**
  - count # hits per block
    - ■ **> 1 hits per block** can result from double pulsing (at high rates) and switching noise
      - ● mostly at small angles
- ➤ step 2: **loop over blocks**
  - efficiency histogram
  - increment entries only once for blocks with 1 or more hits
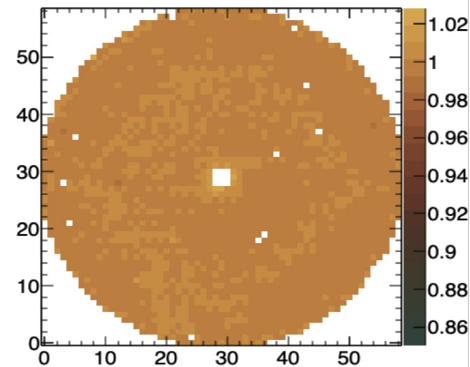
- ➤ **LED efficiencies per block**

*ifarm /u/home/susansch/GlueX/halld_my/plugins/fcalbadchannels

sum over ADC integrals Run051768

sum over ADC integrals all runs 2018-08)
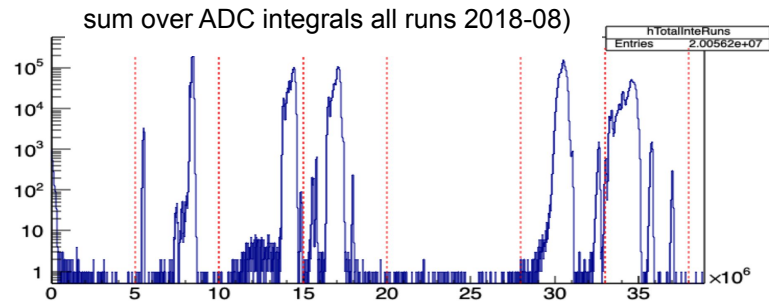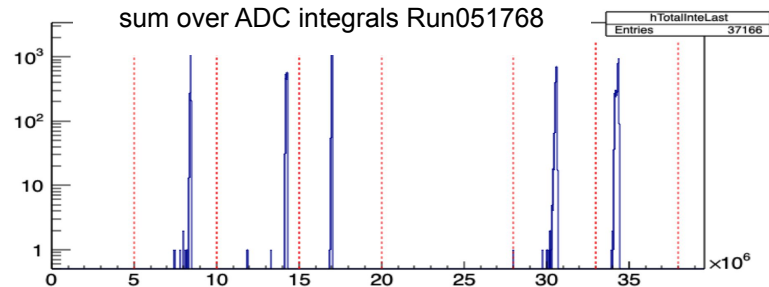
norm Hits vs Channel, all Regions, Run_51768

Row vs Column, all Regions, Run_51768

RunPeriod-2021-08 PrimeX

- consider entire LED region for sum over ADC integrals

- efficiency histogram
  - incremented entries only once for blocks with 1 or more hits
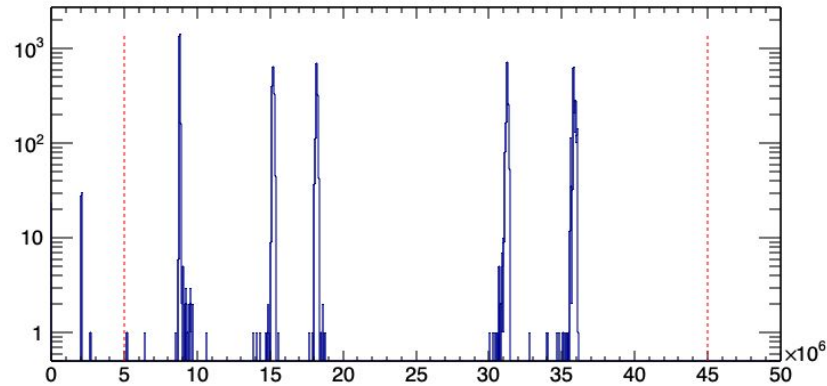
➔ **LED efficiencies per run per block**

/work/halld3/home/susansch/FCAL-LED/RunPeriod-2021-08-PrimeX
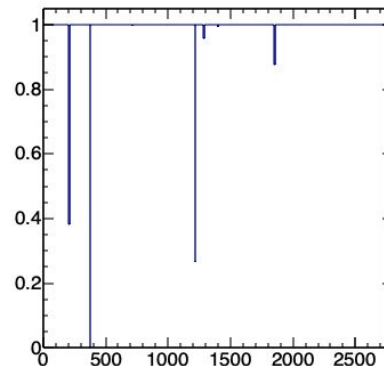Run_081262_Eff.txt
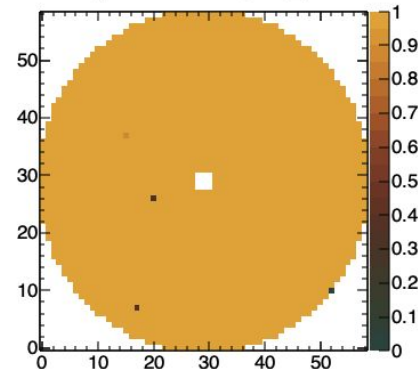Run_081262_plot.root
...

Sum over ADC Integrals, Run_81262

Eff vs Block, Run_81262

Eff, Row vs Column, Run_81262

FCAL LED efficiencies and timing

Run Periods 2021-08 (PrimeX) and 2021-11 (SRC/CT)

- LED efficiency maps
- LED time shifts

FCAL-LED time status

RunPeriod-2019-11 Batch 1 (runs 71345 - 71591) using DFCALHit objects

~2ns time shifts from synching to RF time, eg crate reboot then syncing to the RF signal

- 4 ns in phase with the previous choice (beam comes every ~4 ns)

- sometimes out of phase by 2 ns (RF signal is every ~2 ns)

Sum over Energies, RunPeriod_2019-11_Batch01

RunPeriod_2019-11_Batch01